



DOE/EIS-0380-SA-04  
April 2018

# **Supplement Analysis of the 2008 Site-Wide Environmental Impact Statement for the Continued Operation of Los Alamos National Laboratory**



U.S. Department of Energy  
National Nuclear Security Administration  
Los Alamos Field Office

Prepared by the Environmental Stewardship Group at Los Alamos National Laboratory

## **EXECUTIVE SUMMARY**

This supplement analysis for the 2008 “Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico,” (2008 SWEIS) reviews changes in operations at Los Alamos National Laboratory (LANL or the Laboratory) since the publication of the 2008 SWEIS (2008 through 2017) and evaluates the continued adequacy of the 2008 SWEIS for the future of LANL operations (2018 through 2022). The purpose of this supplement analysis is to provide a basis for understanding if there have been substantial changes in the LANL mission or operations or significant new circumstances or information relevant to environmental affects that are not bounded by the 2008 SWEIS analysis. The decision to be made by the U.S. Department of Energy (DOE) is to determine if the 2008 SWEIS is currently sufficient and will remain so through 2022, or if additional National Environmental Policy Act (NEPA) analysis and documentation (i.e., a supplemental or new SWEIS) is required.

The records of decision issued by the DOE for the 2008 SWEIS approved the No Action Alternative, with a continued decision to produce up to 20 pits per year, and some specific additional projects from the Expanded Operations Alternative. The status of the projects and site operations, and their associate impacts, approved in the records of decision are reported in the SWEIS yearbooks. To date, data collected from across the Laboratory and reported in the yearbooks indicate that LANL has consistently operated within the bounds of the 2008 SWEIS. Detailed information regarding Laboratory operations and related environmental impacts is available in the yearbooks and the Laboratory’s annual site environmental reports. These documents are available in the electronic public reading room (<http://epr.lanl.gov/oppie/service>).

This supplement analysis compares the potential impacts of proposed projects and operations from 2018 through 2022 with the alternatives analyzed in the 2008 SWEIS and included in the subsequent records of decision. In some cases, projects or programs analyzed in the 2008 SWEIS have been undertaken in different locations at LANL for programmatic reasons; those changes are also summarized in this supplement analysis. This document includes a summary of major projects and programs including the Technical Area 55 Reinvestment Project; modifications to the Radioactive Liquid Waste Treatment Facility; decommissioning and demolition of facilities across LANL (including Technical Areas 18 and 21); and various projects that have been initiated, implemented, and/or completed since issuance of the 2008 SWEIS pursuant to a Compliance Order on Consent with the New Mexico Environment Department. Proposed projects that have been cancelled or deferred are also included. Finally, proposed projects that would be implemented through 2022 for which planning is sufficiently developed to support a meaningful NEPA evaluation are included in this supplement analysis.

This supplement analysis indicates that the environmental impacts for the periods from 2008 through 2017 and those projected for 2018 through 2022 have not substantially changed from those projected for the projects and operations selected in the records of decision and do not differ significantly from the impacts analyzed in the 2008 SWEIS. Based on this analysis, additional supplementation of the 2008 SWEIS or a new SWEIS is not required at this time, and the 2008 SWEIS provides a bounding NEPA analysis for a majority of projects planned in the next 5 years. Projects that do not fall into this category will be subject to additional NEPA analyses.

This page intentionally left blank.



# CONTENTS

<b>ACRONYMS AND TERMS.....</b>	<b>XI</b>
<b>1.0 INTRODUCTION.....</b>	<b>1</b>
1.1 Purpose and Need.....	4
1.2 Scope of this Document .....	4
1.2.1 Determining Projects, Operations, and Information Considered in this Supplement Analysis.....	5
1.2.2 Initial Screening.....	5
1.2.3 Environmental Consequence .....	6
1.3 Applicable NEPA Documents .....	10
1.3.1 2008 SWEIS and Records of Decision .....	10
1.3.2 Other Relevant NEPA Documents.....	12
1.4 LANL Functions and Key Facilities.....	13
1.5 The Plutonium Mission .....	16
1.6 Copy of Supplement Analysis.....	16
<b>2.0 NEW AND UPDATED PROJECTS AND OPERATIONS ANALYZED IN THIS SUPPLEMENT ANALYSIS (2018 THROUGH 2022).....</b>	<b>18</b>
2.1 Proposed Projects for 2018 through 2022.....	18
2.1.1 LANL Functions and Key Facilities .....	20
2.1.2 Non-Key Facility Proposed Projects.....	33
2.2 2008 SWEIS Projects Implemented .....	42
2.2.1 Nuclear Materials Safeguards and Security Upgrades Project.....	42
2.2.2 Transuranic Waste Facility .....	43
2.2.3 TA-55 Reinvestment Project .....	43
2.2.4 Radioactive Liquid Waste Treatment Facility Upgrade .....	44
2.2.5 March 2005 Compliance Order on Consent.....	44
2.2.6 Decommissioning, Decontamination, and Demolition of TA-21.....	45
2.2.7 Decommissioning, Decontamination, and Demolition of TA-18.....	45
2.3 Projects Analyzed in a 2008 SWEIS Alternative but not Included in a Record of Decision .....	45
2.4 Future Projects not Analyzed in this Supplement Analysis .....	46
2.4.1 Future Upgrades to Supercomputing Platforms.....	46
2.4.2 Matter and Radiation Interactions in Extremes .....	47
2.4.3 Plutonium Modular Approach.....	48
2.4.4 New Transmission Line .....	48
2.4.5 Access and Related Fencing for Sites in the Manhattan Project National Historical Park.....	48
2.5 Projects with Separate NEPA Analyses .....	49
2.5.1 Categorical Exclusions Issued .....	49
2.5.2 LANL NEPA Documents Published since 2008.....	51
2.6 Project Cancellations and Deferrals .....	53
<b>3.0 AFFECTED ENVIRONMENT AND POTENTIAL IMPACTS TO RESOURCE AREAS.....</b>	<b>55</b>
3.1 Overview of the Affected Environment .....	55
3.1.1 Potential Impacts to Resource Areas.....	59
3.2 Land Resources and Visual Environment .....	59
3.2.1 Land Use .....	59

3.2.2	Visual Environment .....	64
3.3	Geology and Soils.....	66
3.3.1	2008 SWEIS Analysis .....	66
3.3.2	Changes since the 2008 SWEIS (2008 through 2017) .....	70
3.3.3	Analysis of Projected Changes (2018 through 2022) .....	70
3.3.4	Conclusion.....	71
3.4	Water Resources .....	71
3.4.1	2008 SWEIS Analysis .....	71
3.4.2	Changes since 2008 SWEIS (2008 through 2017) .....	74
3.4.3	Analysis of Projected Changes (2018 through 2022) .....	78
3.4.4	Conclusion.....	80
3.5	Air Quality .....	80
3.5.1	2008 SWEIS Analysis .....	80
3.5.2	Changes since the 2008 SWEIS (2008 through 2017) .....	81
3.5.3	Analysis of Projected Changes (2018 through 2022) .....	86
3.5.4	Conclusion.....	89
3.6	Noise.....	89
3.6.1	2008 SWEIS Analysis .....	89
3.6.2	Changes since the 2008 SWEIS (2008 through 2017) .....	89
3.6.3	Analysis of Projected Changes (2018 through 2022) .....	90
3.6.4	Conclusion.....	90
3.7	Ecological Resources .....	90
3.7.1	2008 SWEIS Analysis .....	90
3.7.2	Changes since the 2008 SWEIS (2008 through 2017) .....	91
3.7.3	Analysis of Projected Changes (2018 through 2022) .....	92
3.7.4	Conclusion.....	92
3.8	Human Health and Worker Health/Safety .....	93
3.8.1	2008 SWEIS Analysis .....	93
3.8.2	Changes since the 2008 SWEIS (2008 through 2017) .....	94
3.8.3	Analysis of Projected Changes (2018 through 2022) .....	96
3.8.4	Conclusion.....	97
3.9	Cultural Resources .....	97
3.9.1	2008 SWEIS Analysis .....	97
3.9.2	Changes since the 2008 SWEIS (2008 through 2017) .....	98
3.9.3	Analysis of Projected Changes (2018 through 2022) .....	100
3.9.4	Conclusion.....	101
3.10	Socioeconomics.....	101
3.10.1	2008 SWEIS Analysis .....	101
3.10.2	Changes since the 2008 SWEIS (2008 through 2017) .....	101
3.10.3	Analysis of Projected Changes (2018 through 2022) .....	102
3.10.4	Conclusion.....	102
3.11	Infrastructure.....	102
3.11.1	2008 SWEIS Analysis .....	102
3.11.2	Changes since the 2008 SWEIS (2008 through 2017) .....	104
3.11.3	Analysis of Projected Changes (2018 through 2022) .....	107
3.11.4	Conclusion.....	110
3.12	Waste Management.....	110
3.12.1	2008 SWEIS Waste Management Scope .....	110

3.12.2	Changes since the 2008 SWEIS (2008 through 2017)	111
3.12.3	Analysis of Projected Changes 2018 through 2022	122
3.12.4	Conclusion	123
3.13	Traffic and Transportation	123
3.13.1	2008 SWEIS Analysis	123
3.13.2	Changes since the 2008 SWEIS (2008 through 2017)	124
3.13.3	Analysis of Projected Changes (2018 through 2022)	124
3.13.4	Conclusion	125
3.14	Environmental Justice	125
3.14.1	2008 SWEIS Analysis	125
3.14.2	Changes since the 2008 SWEIS (2008 through 2017)	125
3.14.3	Analysis of Proposed Changes (2018 through 2022)	126
3.14.4	Conclusion	126
3.15	Environmental Remediation	126
3.15.1	2008 SWEIS Analysis	126
3.15.2	Changes since the 2008 SWEIS (2008 through 2017)	127
3.15.3	Analysis of Projected Changes (2018 through 2022)	130
3.15.4	Conclusion	130
3.16	Facility Accidents	131
3.16.1	2008 SWEIS Analysis	131
3.16.2	Changes since the 2008 SWEIS (2008 through 2017)	139
3.16.3	Analysis of Projected Changes (2018 through 2022)	139
3.16.4	Conclusion	141
3.17	Climate Trends and Greenhouse Gases	141
3.17.1	2008 SWEIS Analysis	142
3.17.2	Changes since the 2008 SWEIS (2008 through 2017)	142
3.17.3	Analysis of Projected Changes (2018 through 2022)	144
3.17.4	Conclusion	145
3.18	Forest Health and Wildland Fire Preparedness	145
3.18.1	2008 SWEIS Analysis	146
3.18.2	Changes since the 2008 SWEIS (2008 through 2017)	146
3.18.3	Analysis of Projected Changes (2018 through 2022)	147
3.18.4	Conclusion	148
<b>4.0</b>	<b>CUMULATIVE IMPACTS</b>	<b>149</b>
4.1	Reasonably Foreseeable Actions in the Region of Influence	150
4.1.1	CMR	150
4.1.2	Conveyances and Transfers of DOE Land and Properties	150
4.1.3	National Park Service Lands	150
4.1.4	Los Alamos County	151
4.1.5	U.S. Department of Agriculture	151
4.1.6	NNSA Complex Transformation	151
4.1.7	Santa Fe National Forest Lands	152
4.2	Continued Operation of LANL from 2018 through 2022	152
4.2.1	Land Resources and Visual Environment	152
4.2.2	Geology and Soils	153
4.2.3	Water Resources	153
4.2.4	Air Quality	154

4.2.5	Noise .....	154
4.2.6	Ecological Resources.....	154
4.2.7	Human Health and Worker Health/Safety .....	155
4.2.8	Cultural Resources.....	155
4.2.9	Socioeconomics .....	155
4.2.10	Infrastructure .....	155
4.2.11	Waste Management .....	156
4.2.12	Environmental Remediation .....	157
4.2.13	Traffic and Transportation .....	157
4.2.14	Environmental Justice .....	157
4.2.15	Facility Accidents.....	158
4.2.16	Climate Trends and Greenhouse Gases.....	158
4.2.17	Forest Health and Wildland Fire Preparation .....	158
4.3	Mitigations.....	159
4.4	Conclusion .....	160
<b>5.0</b>	<b>CONCLUSIONS AND DETERMINATION .....</b>	<b>161</b>
	<b>REFERENCES.....</b>	<b>162</b>

## Appendixes

APPENDIX A. CATEGORICAL EXCLUSION CROSSWALK.....	A-1
APPENDIX B. LOS ALAMOS PLUTONIUM HISTORY .....	B-1
APPENDIX C. LIST OF NEPA REVIEWS CONDUCTED SINCE THE 2008 SWEIS .....	C-1
APPENDIX D. PRESCRIPTIONS FOR DESIRED FINAL CONDITIONS BY FOREST COVER TYPE ..	D-1
APPENDIX E. LANL FLOODPLAIN AND WETLAND ASSESSMENTS SINCE THE 2008 SWEIS .....	E-1
APPENDIX F. LANL BIOLOGICAL ASSESSMENTS SINCE THE 2008 SWEIS.....	F-1

## Figures

Figure 1-1.	Location of Los Alamos National Laboratory .....	2
Figure 1-2.	Projects and Key Facilities at LANL .....	3
Figure 2-1.	PF-4 and RLUOB at TA-55 .....	21
Figure 2-2.	The CMR Building at TA-3 .....	23
Figure 2-3.	LANL technical areas .....	24
Figure 2-4.	High-explosives testing at LANL TA-39 .....	25
Figure 2-5.	The DARHT Facility .....	26
Figure 2-6.	LANSCe Accelerator Complex, west view.....	27
Figure 2-7.	TA-54 waste management areas.....	30
Figure 2-8.	The Proposed Nuclear Counterproliferation Building .....	34
Figure 2-9.	Omega Bridge in 1963 (top) and 2013 (bottom) .....	37
Figure 2-10.	Chromium and RDX Groundwater Plumes at LANL .....	41
Figure 2-11.	Fenton Hill site at TA-57 .....	41
Figure 2-12.	Location of Fenton Hill at TA-57 .....	42

Figure 2-13.	Transuranic Waste Facility at LANL.....	43
Figure 2-14.	The Trinity advanced technology system computing platform.....	47
Figure 2-15.	Rendition of MaRIE laboratory office building at LANSCE .....	48
Figure 2-16.	The RLUOB Facility .....	53
Figure 3-1.	Las Conchas Fire near TA-3 at LANL.....	56
Figure 3-2.	Land conveyance and transfer map.....	58
Figure 3-3.	Pajarito Plateau around LANL .....	67
Figure 3-4.	Española Basin .....	68
Figure 3-5.	Seismic faults around LANL.....	69
Figure 3-6.	National Pollutant Discharge Elimination System total discharge from 2008 through 2016 .....	75
Figure 3-7.	National Pollutant Discharge Elimination System discharge by LANL facilities from 2008 through 2016 .....	75
Figure 3-8.	LANL total reportable cases and days away, restricted, or transferred annual rates.....	96
Figure 3-9.	Electrical peak load at LANL from 2008 through 2016 .....	105
Figure 3-10.	Electricity consumption at LANL from 2008 through 2017.....	105
Figure 3-11.	Water consumption at LANL from 2008 through 2017 .....	106
Figure 3-12.	Natural gas consumption at LANL from 2008 through 2016 .....	106
Figure 3-13.	Peak demand projection from 2018 through 2022.....	108
Figure 3-14.	Projected energy use from 2018 through 2022 .....	108
Figure 3-15.	Water consumption projections at LANL from 2018 through 2022.....	109
Figure 3-16.	Total LANL annual chemical waste generation (2008 through 2016).....	115
Figure 3-17.	Environmental Management annual chemical waste generation (2008 through 2016) ..	115
Figure 3-18.	NNSA annual chemical waste generation (2008 through 2016).....	116
Figure 3-19.	Total LANL annual low-level waste generation (2008 through 2016).....	116
Figure 3-20.	Environmental Management annual low-level waste generation (2008 through 2016)..	117
Figure 3-21.	NNSA annual low-level waste generation (2008 through 2016).....	117
Figure 3-22.	Total LANL annual mixed low-level waste generation (2008 through 2016) .....	118
Figure 3-23.	Environmental Management annual mixed low-level waste generation (2008 through 2016) .....	119
Figure 3-24.	NNSA annual mixed low-level waste generation (2008 through 2016) .....	119
Figure 3-25.	Total LANL annual transuranic and mixed transuranic waste generation (2008 through 2016) .....	120
Figure 3-26.	Environmental Management transuranic and mixed transuranic waste generation (2008 through 2016).....	120
Figure 3-27.	NNSA transuranic and mixed transuranic waste generation (2008 through 2016) .....	121
Figure 3-28.	LANL greenhouse gas emissions .....	143
Figure 3-29.	LANL greenhouse gas emissions and projections.....	145
Figure 3-30.	Land cover types in current LANL boundary, 2001 and 2014 .....	147
Figure 4-1.	Buckman Water Diversion Project map .....	152

## **Tables**

Table 1-1. Comparison of Environmental Factors in the 2008 SWEIS and this Supplement Analysis .....	7
Table 2-1. Proposed Key Facility Projects to be Initiated in the Next 5 Years .....	18
Table 2-2. Proposed Non-Key Facility Projects to be Initiated in the Next 5 Years.....	19
Table 2-3. Difficult Waste Streams and Possible Disposition Pathways Under Consideration .....	31
Table 2-4. Forest and Vegetation Management Prescriptions .....	39
Table 2-5. Categorical Exclusions Issued by DOE since September 2008.....	49
Table 3-1. Environmental Factors Summary for LANL Projects .....	60
Table 3-2. Reduction in Gross Square Feet at LANL since 2008.....	63
Table 3-3. Tracts Analyzed in the Land Conveyance and Transfer EIS that Remain to be Conveyed.....	63
Table 3-4. Radiological Air Emissions from Point Sources.....	82
Table 3-5. Tritium Emissions from Key Facilities .....	82
Table 3-6. Non-Radioactive Regulated Air Emissions, Based on Annual Emissions Inventory Report <sup>a</sup> ....	85
Table 3-7. Non-Radioactive Regulated Air Emissions, Based on Title V Operating Permit Emissions Report <sup>a</sup> .....	85
Table 3-8. Hazardous Air Pollutants and Volatile Organic Compounds .....	86
Table 3-9. Occupational Injury and Illness Rates at LANL <sup>a</sup> .....	94
Table 3-10. Individual Dose to the Public from LANL Radioactive Air Emissions .....	95
Table 3-11. Manhattan Project National Historical Park Properties at LANL .....	99
Table 3-12. LANL Site Total Projected Utility Use from the 2008 SWEIS .....	103
Table 3-13. Projected LANL Cumulative Waste Generation—2008 through 2016 .....	113
Table 3-14. Waste Volumes from the Sanitary Effluent Reclamation Facility .....	113
Table 3-15. Projects with Contributions to Waste Volumes.....	122
Table 3-16. Consent Order Actions Initiated since the 2008 SWEIS .....	127
Table 3-17. Chemicals of Concern <sup>a</sup> at LANL Facilities and their Potential Impacts .....	134

## **ACRONYMS AND TERMS**

ALARA	as low as reasonably achievable
CFR	Code of Federal Regulations
CMR	Chemistry and Metallurgy Research (Building)
CMRR	Chemistry and Metallurgy Research Replacement (facility or project)
Consent Order	Compliance Order on Consent
DARHT	Dual-Axis Radiographic Hydrodynamic Test
DOE	U.S. Department of Energy
DP	Delta Prime
EIS	environmental impact statement
GeV	giga electron volt
HEPA	high-efficiency particulate air
Laboratory	Los Alamos National Laboratory
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Science Center
MaRIE	Matter and Radiation Interactions in Extremes
Metropolis Center	Nicholas C. Metropolis Center (TA-3)
MeV	million electron volt
NEPA	National Environmental Policy Act, 1969
NMSSUP	Nuclear Materials Safeguards and Security Upgrades Project
NNSA	National Nuclear Security Administration
PF-4	Plutonium Facility building 4 (TA-55)
RDX	royal demolition explosive (1,3,5-trinitro-1,3,5-triazacyclohexane)
RLUOB	Radiological Laboratory/Utilities/Office Building (TA-55, building 400)
SEIS	supplemental environmental impact statement
SPEIS	supplemental programmatic environmental impact statement
SWEIS	Site-Wide Environmental Impact Statement
TA	Technical Area
U.S.	United States

This page intentionally left blank.



## **1.0 INTRODUCTION**

Los Alamos National Laboratory (LANL or the Laboratory), is a multidisciplinary, multipurpose research institution in north-central New Mexico about 60 miles (97 kilometers) north-northeast of Albuquerque and about 25 miles (40 kilometers) northwest of Santa Fe. LANL extends over approximately 40 square miles (25,600 acres [10,360 hectares]) (Figure 1-1). There are about 2,000 structures that house LANL operations and activities. The combined footprint of these structures totals approximately 8 million square feet (743,000 square meters); about half the square footage is used for laboratory or production space and the remainder for administration and offices, storage, service, and other purposes. The U.S. Department of Energy (DOE) Los Alamos Field Offices include the National Nuclear Security Administration (NNSA) and the Office of Environmental Management. NNSA was established by Congress in 2000 as a separately organized agency within DOE. NNSA has responsibility for the management and security of the nation's nuclear weapons, nuclear nonproliferation, and naval reactor programs. DOE implements the strategic plan for the nation, which includes nuclear security, intelligence, defense, emergency response, nonproliferation, counterterrorism, energy security, and emerging threats. Created at the headquarters level in 1989, the Office of Environmental Management's mission is to address the legacy contamination at DOE sites resulting from decades of nuclear weapons production and government-sponsored nuclear energy research. While environmental management activities have been ongoing at LANL, a separate DOE Field Office was established in 2015 and will continue operating beyond the 2022 evaluation period of this supplement analysis.

This supplement analysis for the 2008 "Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico" [2008 SWEIS (DOE 2008a)] reviews changes in projects, programs, and operations at the Laboratory (Figure 1-2) since the publication of the 2008 SWEIS and the associated records of decision (DOE 2008b, 2009a, 2011a). This supplement analysis also evaluates the continued adequacy of the 2008 SWEIS analyses for the next 5 years of LANL operations (2018 through 2022).

The Council on Environmental Quality regulations that implement the National Environmental Policy Act of 1969 (NEPA) stipulate that a federal agency shall prepare a supplement to a final environmental impact statement (EIS) if "(i) the agency makes substantial changes in the Proposed Action that are relevant to environmental concerns; or (ii) there are significant new circumstances or information relevant to environmental concerns and bearing on the Proposed Action or its impacts" [40 Code of Federal Regulations (CFR) 1502.9(c)(1)]. DOE regulations implementing NEPA require that "[when] it is unclear whether or not an EIS supplement is required, DOE shall prepare a Supplement Analysis [that] shall discuss the circumstances that are pertinent to deciding whether to prepare a supplemental EIS pursuant to 40 CFR 1502.9(c)" (10 CFR 1021.314).

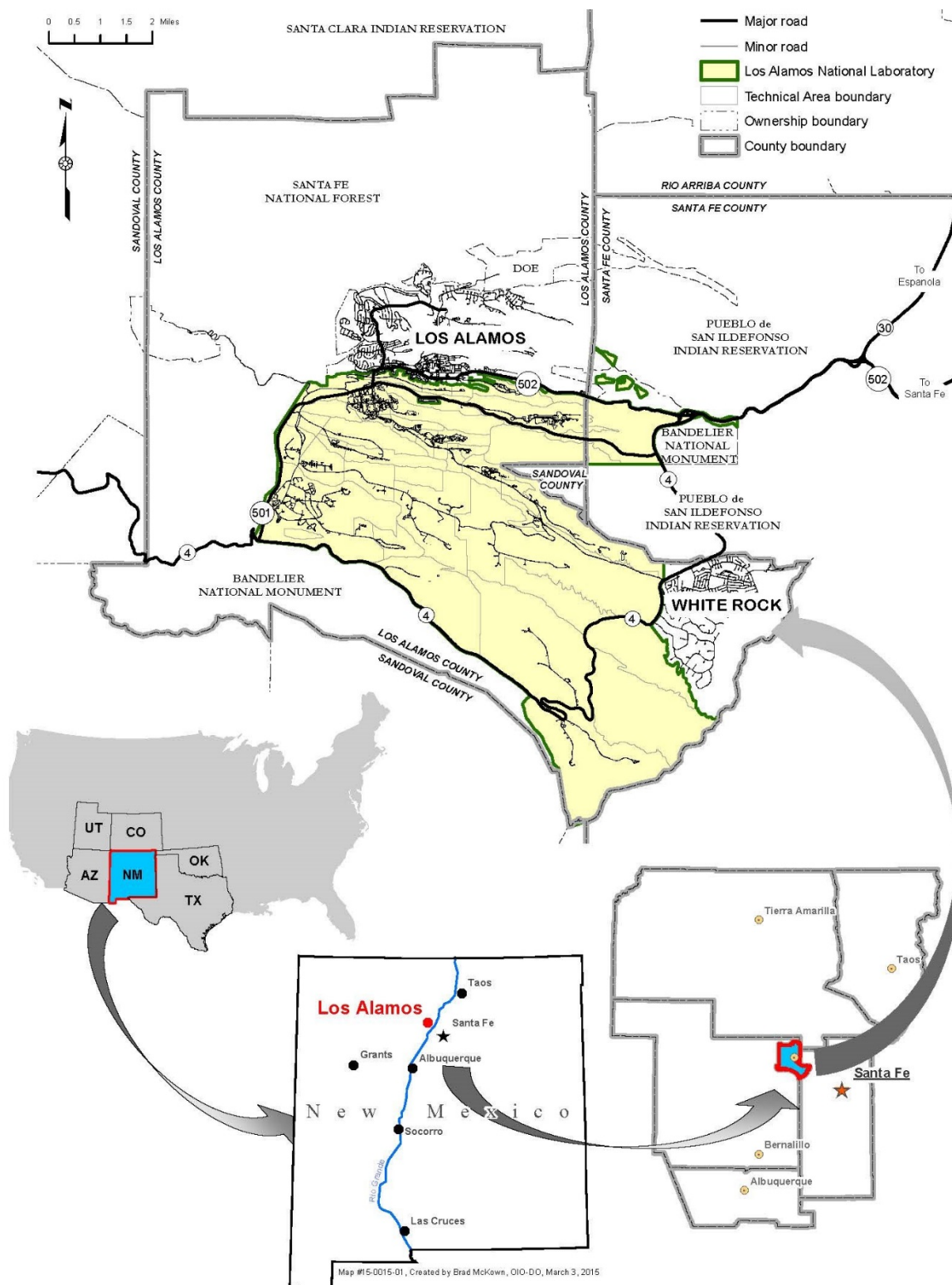


Figure 1-1. Location of Los Alamos National Laboratory

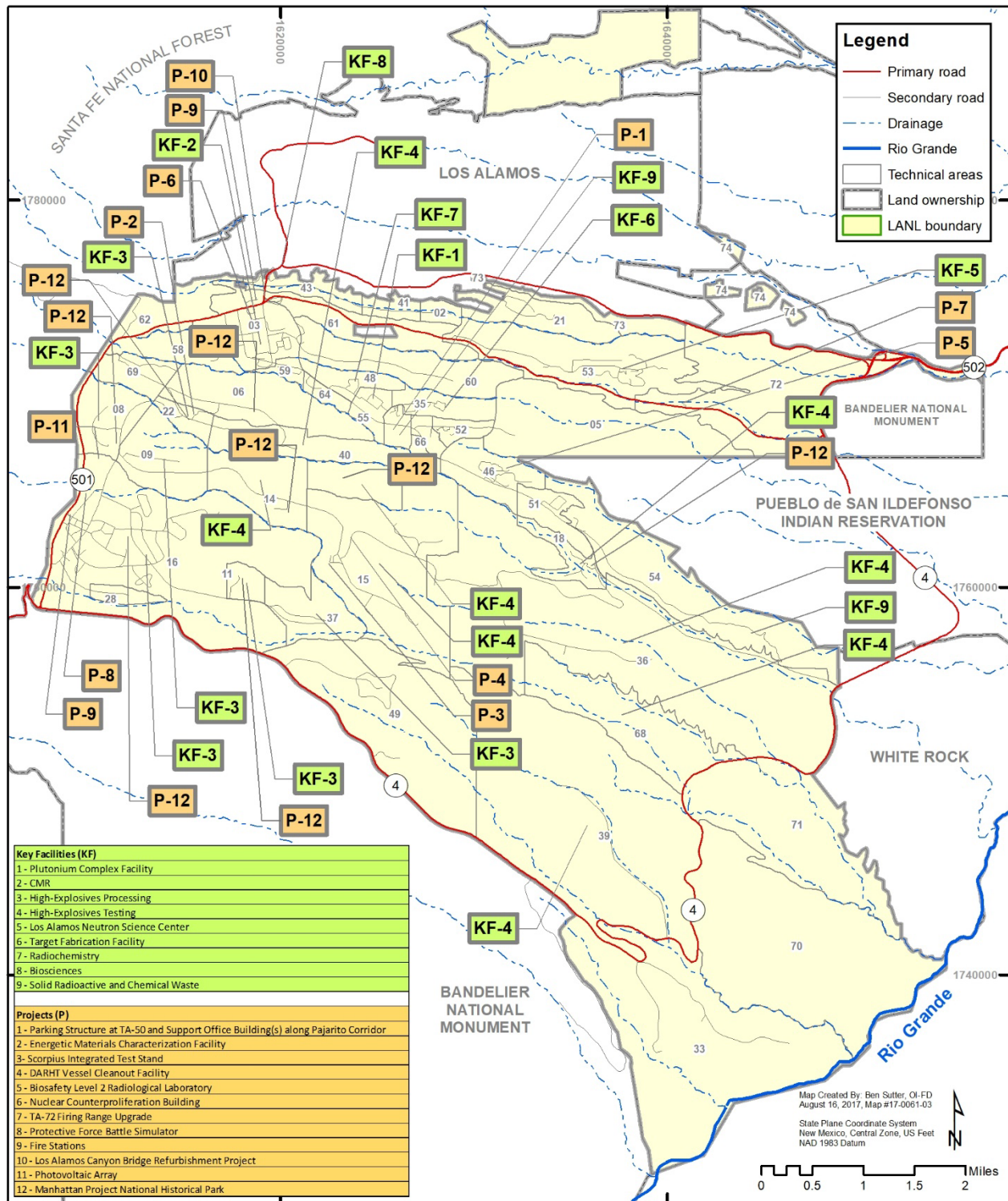


Figure 1-2. Projects and Key Facilities at LANL

DOE has promulgated a specific regulation, 10 CFR 1021.330(d), regarding site-wide EISs for its large, multiple-programmatic facilities such as LANL. This regulation stipulates that DOE “shall evaluate site-wide NEPA documents prepared under 10 CFR 1021.330(c) at least every five years. DOE shall evaluate site-wide EISs by means of a supplement analysis, as provided in 10 CFR 1021.314.” Based on the supplement analysis, “DOE shall determine whether the existing EIS remains adequate or whether to prepare a new site-wide EIS or supplement the existing EIS, as appropriate.” This 2017 supplement analysis provides a basis to determine whether the 2008 SWEIS remains adequate.

LANL projects are evaluated by Laboratory subject matter experts to identify whether a project is bounded by activities previously analyzed in a NEPA document. LANL uses an internal automated process that can involve subject matter experts from over 40 technical disciplines to ensure all aspects are considered by project staff and receive a thorough review. The DOE/NNSA Los Alamos Field Office is often involved as these projects are developed and reviews a monthly report identifying the Laboratory NEPA actions. The DOE/NNSA Los Alamos Field Office may direct the Laboratory to prepare a NEPA Review, an internal document used to support decisions on NEPA requirements. Using the NEPA Review as a basis for decision making, DOE/NNSA will make a determination of whether a project is bounded by an existing NEPA document or if further action is required. This process allows the opportunity to identify potential issues and to reduce potential impacts early in the life of a project.

DOE uses incorporation by reference and tiers from previous DOE NEPA documents to more succinctly present the analyses. Descriptive text from the 2008 SWEIS regarding detailed settings, programs, and operations that have not changed are incorporated by reference. The 2008 SWEIS and associated documents are available for viewing and download at <https://energy.gov/nepa/listings/eis-0380-documents-available-download>. Tiering from the 2015 “Final Surplus Plutonium Disposition Supplemental Environmental Impact Statement” (SEIS) (DOE 2015a) and previous decision documents are used to support analysis. The series of surplus plutonium disposition documents are available for viewing and download at <https://energy.gov/nepa/eis-0283-s2-surplus-plutonium-disposition-supplemental-environmental-impact-statement> and <https://energy.gov/nepa/listings/eis-0283-documents-available-download>.

## **1.1 Purpose and Need**

The purpose of this supplement analysis is to provide a basis for understanding if there have been substantial changes in the LANL mission or operations or significant new circumstances or information relevant to environmental affects that are not bounded by the 2008 SWEIS analysis. The decision to be made by the DOE is to determine if the 2008 SWEIS is currently sufficient and will remain so through 2022, or if additional NEPA analysis and documentation (i.e., a supplemental or new SWEIS) is required. Additionally, the supplement analysis is a tool that provides valuable planning information regarding situational awareness of potential competition for use of limited resources (e.g., water and power) and changing conditions (i.e., variability in global climate) that could affect future LANL programs and operations.

## **1.2 Scope of this Document**

The projects that this supplement analysis addresses underwent the screening process described in this section to determine whether they were appropriate for inclusion.

### **1.2.1 Determining Projects, Operations, and Information Considered in this Supplement Analysis**

In preparing this supplement analysis, DOE considered multiple sources of information. Published environmental data are not yet available for calendar year 2017 and, therefore, are not included in this supplement analysis. However, to the extent possible, projects and operations data from calendar year 2017 are included.

A number of sources and approaches were used to evaluate which projects and programs would be incorporated into this supplement analysis including:

- A review of NEPA documentation prepared after issuance of the 2008 SWEIS
- An evaluation of institutional and other plans to identify major new plans, proposals, or projects that would be implemented within the 2018 through 2022 timeframe
- Identification and consideration of any changes in applicable federal, state, and local regulations
- Consultations with project and program managers
- Identification of evolving information on the natural and human environment at LANL

### **1.2.2 Initial Screening**

The projects or operations at LANL analyzed in this supplement analysis generally fall into one or more of the following categories:

- New or modified projects or operations likely or reasonably foreseeable to go forward in the future (2018 through 2022) that have no other NEPA analysis/documentation
- Projects or operations that were analyzed in the 2008 SWEIS and are in the process of being implemented
- Projects analyzed in a 2008 SWEIS alternative but not included in a record of decision
- Future projects that are not analyzed in this supplement analysis and may require separate NEPA documentation
- New or modified projects or operations that have been reviewed and approved through the DOE/NNSA NEPA process (EISs, environmental assessments, and categorical exclusions) since the 2008 SWEIS (2008 through 2017)
- Projects or operations included in the 2008 SWEIS that have since been cancelled or deferred beyond the 2018 through 2022 timeframe

Projects or operations included in the 2008 SWEIS that are in progress, largely completed, or are ready to be executed without major modifications are summarized in Chapter 2 and are not given further consideration in this supplement analysis.

Routine maintenance, support activities, safety and environmental improvements, and footprint reduction are ongoing at LANL. These types of activities at LANL are routinely performed and have previously been included in a DOE categorical exclusion. They are described in the 2008 SWEIS, Appendix L (DOE 2008a) and were included in the No Action Alternative.



DOE categorical exclusion criteria at 10 CFR 1021 Subpart D were updated in 2011 to add 20 categorical exclusions (primarily for renewable energy activities) and other substantive changes to existing categorical exclusion descriptions (DOE 2011b). The NEPA 10 CFR 1021 implementing procedures were also amended. The 2011 revision of 10 CFR 1022 Subpart D included a new requirement that all categorical exclusion determinations be posted online. The implementing procedures also note that recurring activities occurring in a given time period could be addressed in a single categorical exclusion (DOE 2011c).

Many of the sections in Appendix L cover activities included in multiple DOE categorical exclusions; however, all actions listed in Appendix L remain bounded by one of the updated DOE categorical exclusions (Appendix A). A provision in DOE categorical exclusion B1.15 *Support Buildings*, now excludes “facilities for nuclear weapons activities.” All new or modified projects at LANL are subject to screening by NEPA subject matter experts to evaluate the activity against the criteria for applicability of the Appendix L categorical exclusion summary, or to determine if an additional NEPA review is necessary. Nuclear weapons activities, such as those occurring at PF-4 would be subject to NEPA review.

Planning for reuse or remodeling of aging facilities, construction of new facilities, infrastructure improvements, and implementation of new or modified missions at LANL are also continuing processes. Numerous projects are proposed annually. Only new or modified projects or operations that have sufficient information to evaluate their environmental impacts are included in this supplement analysis [10 CFR 1021.314(a)]. DOE/NNSA will review and determine the appropriate level of environmental analysis and NEPA documentation necessary when sufficient information is available for projects or operations that currently lack sufficient maturity for analysis.

### **1.2.3 Environmental Consequence**

The potential impacts of all the new and modified projects and modifications to ongoing operations are discussed in this supplement analysis. Specific impacts associated with land resources, geology and soils, water resources, air quality, noise, ecological resources, human health and worker health/safety, cultural resources, socioeconomic, infrastructure, waste management, traffic and transportation, environmental justice<sup>1</sup>, environmental remediation, facility accidents, climate trends and greenhouse gases, forest health and wildland fire preparedness, and mitigations are discussed in Chapter 3. Table 1-1 provides an overview of new information and changed circumstances since the 2008 SWEIS was published.

Intentional destructive acts were analyzed in the 2008 SWEIS (DOE 2008a). This analysis was also considered in the Complex Transformation SPEIS (DOE 2008c) and is addressed in Chapter 3, *Facility Accidents*. In addition, a classified appendix to the 2008 SWEIS was

---

<sup>1</sup> 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.

completed, this is not addressed in this supplement analysis. Cumulative impacts are discussed in Chapter 4.

**Table 1-1. Comparison of Environmental Factors in the 2008 SWEIS and this Supplement Analysis**

Environmental Factors	2008 SWEIS	2018 Supplement Analysis
Land Resources and Visual Environment <sup>a</sup>	<ul style="list-style-type: none"> <li>• LANL occupied about 40 square miles.</li> <li>• Visual impacts from the Cerro Grande fire, drought, and tree thinning.</li> </ul>	<ul style="list-style-type: none"> <li>• No significant changes in land use resources are anticipated.</li> <li>• Over 1 million square feet of building footprint reduction.</li> <li>• Proposed photovoltaic array site selection in TA-16 (brownfield).</li> <li>• Visual improvements from remediation.</li> </ul>
Geology and Soils <sup>a</sup>	<ul style="list-style-type: none"> <li>• The 2008 SWEIS projected 3.2 million cubic yards of soil and rock disturbance.</li> <li>• 2007 seismic hazard analysis integrated.</li> <li>• The 2008 SWEIS projected 2.2 million cubic yards of backfill and surface materials would be required.</li> </ul>	<ul style="list-style-type: none"> <li>• No significant changes in geology and soils are anticipated.</li> </ul>
Water Resources	<ul style="list-style-type: none"> <li>• LANL operated 21 permitted outfalls, prepared 15 storm water pollution prevention plans for 26 facilities, and conducted sampled storm water at 75 monitoring stations.</li> <li>• The Cerro Grande fire increased surface water runoff and erosion.</li> </ul>	<ul style="list-style-type: none"> <li>• No significant changes in water resources are anticipated.</li> <li>• Vegetation growth has slowed erosion from the 2011 fire and 2013 flood.</li> <li>• Outfalls reduced from 21 to 11.</li> <li>• Implementation of the Consent Order will improve water quality as canyon cleanup work continues.</li> </ul>
Air Quality	<ul style="list-style-type: none"> <li>• The 2008 SWEIS projected non-radiological and radiological air emissions (34,000 curies<sup>b</sup> per year).</li> </ul>	<ul style="list-style-type: none"> <li>• No significant changes in non-radioactive emissions.</li> <li>• Significant reductions in radiological air emissions.</li> </ul>
Noise	<ul style="list-style-type: none"> <li>• The 2008 SWEIS projected temporary noise impacts would be generated by LANL operations and construction.</li> </ul>	<ul style="list-style-type: none"> <li>• No significant changes in noise generated are anticipated.</li> </ul>

Environmental Factors	2008 SWEIS	2018 Supplement Analysis
Ecological Resources	<ul style="list-style-type: none"> <li>• 95 percent mortality of piñon pine trees due to Cerro Grande fire and bark beetle.</li> <li>• 100 percent of Douglas firs on north-facing slopes killed by drought.</li> </ul>	<ul style="list-style-type: none"> <li>• Threatened and Endangered Species Habitat Management Plan updated to include the federal listings of the Jemez Mountains salamander, New Mexico meadow jumping mouse, and yellow-billed cuckoo.</li> <li>• No significant changes to ecological resources are anticipated.</li> </ul>
Human Health	<ul style="list-style-type: none"> <li>• The 2008 SWEIS projected worker health and safety to include maximally exposed individuals (8.2 millirem) and latent cancer fatalities (<math>5 \times 10^{-6}</math>).</li> </ul>	<ul style="list-style-type: none"> <li>• No significant changes to human health are anticipated.</li> <li>• Decreases in worker accidents and dose<sup>c</sup>. Decreases in dose to maximally exposed individuals<sup>d</sup> and the public.</li> </ul>
Cultural Resources	<ul style="list-style-type: none"> <li>• 1,915 archaeological sites and 657 historic buildings.</li> <li>• Impacts to cultural resources, including archaeological sites, historic buildings and structures, and traditional cultural properties.</li> </ul>	<ul style="list-style-type: none"> <li>• Manhattan Project National Historical Park established. DOE is working with the Department of Interior to restore Park buildings and enhance public access to Park properties.</li> <li>• Updated 2017 Cultural Resources Management Plan.</li> <li>• New Programmatic Agreement among DOE/NNSA Los Alamos Field Office, the New Mexico State Historic Preservation Office, and the Advisory Council on Historic Preservation Concerning Management of the Historic Properties of Los Alamos National Laboratory</li> <li>• No significant changes to cultural resources are anticipated.</li> </ul>
Socioeconomics	<ul style="list-style-type: none"> <li>• 2008 SWEIS analyzed 13,500 employees including regional economic and demographic characteristics, income, employment, housing, and local government finance and services.</li> </ul>	<ul style="list-style-type: none"> <li>• Direct LANL employment as of 2017 is 11,200.</li> <li>• No significant changes to socioeconomics are anticipated.</li> </ul>



Environmental Factors	2008 SWEIS	2018 Supplement Analysis
Infrastructure <sup>a</sup>	<ul style="list-style-type: none"> <li>The 2008 SWEIS projected electricity peak load 103,200 kilowatts, 417.8 million gallons of water per year.</li> <li>The 2008 SWEIS projected average natural gas consumption projection was 1,197,000 decatherms.</li> </ul>	<ul style="list-style-type: none"> <li>Electrical consumption is projected to exceed the 2008 bounding limit of 120 megawatts by 2021. It is anticipated that additional electrical infrastructure will be required after 2022.</li> <li>Increases are forecasted in water and gas consumption.</li> </ul>
Waste Management <sup>a</sup>	<ul style="list-style-type: none"> <li>Waste management volumes projected in the 2008 SWEIS: radioactive (low level [885,306], mixed low level [137,774], transuranic [20,887] in cubic meters per year), and chemical wastes (46,774 10<sup>3</sup> kilograms per year).</li> </ul>	<ul style="list-style-type: none"> <li>Cumulative waste generated through 2016 is well under 2008 SWEIS projection.</li> <li>Waste generated through 2022 projected to remain under 2008 SWEIS projection, except for chemical waste where filter cake from Sanitary Effluent Reclamation Facility caused an exceedance of total volume.</li> </ul>
Traffic and Transportation	<ul style="list-style-type: none"> <li>The 2008 SWEIS projected LANL traffic and wear on local roads to increase by up to 18 percent.</li> <li>Radioactive shipments over a 10-year period were projected at 122,445.</li> </ul>	<ul style="list-style-type: none"> <li>Total shipments from 2008 through mid-2017 are 26,409—well under the 2008 SWEIS projections.</li> <li>No significant changes to traffic and transportation are anticipated.</li> </ul>
Environmental Justice	<ul style="list-style-type: none"> <li>The 2008 SWEIS anticipated no adverse impacts from continued operation of LANL under any alternatives.</li> </ul>	<ul style="list-style-type: none"> <li>No significant changes to environmental justice are anticipated.</li> </ul>
Environmental Remediation	<ul style="list-style-type: none"> <li>All remediation activities are projected to be completed by the 2005 Consent Order deadline (December 2015).</li> </ul>	<ul style="list-style-type: none"> <li>Impacts will generally be less than 2008 SWEIS projections.</li> <li>DOE will continue to implement the 2016 Consent Order, which supersedes the 2005 Consent Order.</li> </ul>
Facility Accidents	<ul style="list-style-type: none"> <li>Facility accident scenarios in the 2008 SWEIS were analyzed and grouped into the following categories: radiological releases, chemical releases, seismic impacts, and wildfire accidents.</li> </ul>	<ul style="list-style-type: none"> <li>No significant changes to potential consequences in the event of an accident are anticipated.</li> </ul>
Climate Trends and Greenhouse Gases	<ul style="list-style-type: none"> <li>Not specifically analyzed in the 2008 SWEIS, although effects of regional drought and local catastrophic wildfires were analyzed.</li> </ul>	<ul style="list-style-type: none"> <li>Climate trends and impacts are anticipated to continue. Greenhouse gas emissions from proposed LANL activities are anticipated to increase as missions change.</li> </ul>

Environmental Factors	2008 SWEIS	2018 Supplement Analysis
Forest Health and Wildland Fire Preparedness	<ul style="list-style-type: none"> <li>Drought and wildland fire were identified in the 2008 SWEIS as impacting large forested areas at LANL.</li> </ul>	<ul style="list-style-type: none"> <li>Continued risks of severe wildfire and higher soil erosion rates require the need for a continued active wildland fire and forest health program.</li> </ul>

<sup>a</sup> Multiply square miles by 2.59 to get square kilometers; multiply square feet by 0.092903 to get square meters; multiply cubic yards by 0.76456 to get cubic meters; multiply gallons by 3.78533 to get liters; and multiply cubic meters by 35.314 to get cubic feet.

<sup>b</sup> Curie—a unit of radioactivity equal to 37 billion disintegrations per second (i.e., 37 billion becquerels); also, a quantity of any radionuclide or mixture of radionuclides having 1 curie of radioactivity.  
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.

<sup>c</sup> Dose—a generic term meaning absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or committed equivalent dose. For ionizing radiation, the energy imparted to matter by ionizing radiation per unit mass of the irradiated material (e.g., biological tissue). The units of absorbed dose are the rad and the gray. In many publications, the rem is used as an approximation of the rad.

<sup>d</sup> Maximally exposed individual—a hypothetical individual whose location and habits result in the highest total radiological or chemical exposure (and thus dose) from a particular source for all exposure routes (i.e., inhalation, ingestion, direct exposure, resuspension).

### 1.3 Applicable NEPA Documents

Chapter 1 of the 2008 SWEIS describes NEPA documents associated with the operation of LANL. Most of these NEPA documents continue to be relevant to the operation of LANL. Additional relevant NEPA documents (e.g., EISs, environmental assessments, SEISs, supplement analyses, records of decision, and categorical exclusions) that have been completed or published since issuance of the 2008 SWEIS are briefly discussed in this section.

#### 1.3.1 2008 SWEIS and Records of Decision

On May 16, 2008, DOE/NNSA issued the 2008 SWEIS (DOE 2008a). In its initial record of decision<sup>2</sup> (DOE 2008b), DOE/NNSA selected the No Action Alternative to continue operation of the Laboratory with the addition of two types of elements from the Expanded Operations Alternative: 1) changes in the level of operations for ongoing activities within existing facilities, and 2) new facility projects.

(1) Changes in operational level in existing facilities:

- Support for the Global Threat Reduction Initiative and Off-Site Source Recovery Project

<sup>2</sup> Record of decision—a concise public document that records a Federal agency's decision(s) concerning a proposed action for which the agency has prepared an EIS. The record of decision is prepared in accordance with the requirements of the Council on Environmental Quality National Environmental Policy Act regulations (40 CFR 1505.2). A record of decision 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.

- Expansion of supercomputing capabilities at the Nicholas C. Metropolis Center (Metropolis Center)
- Research to improve beryllium detection and developing mitigation methods for beryllium dispersion to support industrial health and safety initiatives for beryllium workers
- Retrieval and disposal of legacy transuranic waste

(2) New specific facility projects:

- Plan, design, construct, and operate the Waste Management Facilities Transition projects required by the Compliance Order on Consent<sup>3</sup> (Consent Order)
- Repair and replace mission-critical cooling system components for buildings in Technical Area (TA) 55
- Complete final design of a new Radioactive Liquid Waste Treatment Facility and design of the Zero Liquid Discharge Facility

On July 10, 2009, DOE/NNSA issued a second record of decision (DOE 2009a). In this record of decision, DOE/NNSA continued to select the No Action Alternative from the 2008 SWEIS but decided to implement additional elements of the Expanded Operations Alternative specifying operational changes. In this supplement analysis, the actions selected by DOE/NNSA are referred to as the 2008 SWEIS regardless if it was from the No Action Alternative or Expanded Operations Alternative, unless otherwise specified. The following six projects were selected in the second record of decision.

- Complete environmental remediation and closure of the Pajarito Site at TA-18
- Complete environmental remediation and closure of the Delta Prime or DP<sup>4</sup> Site at TA-21
- Refurbish the Plutonium Facility Complex at TA-55
- Construct and operate a new Radioactive Liquid Waste Treatment Facility at TA-50 and operate the Zero Liquid Discharge Facility at TA-52
- Continue to expand supercomputing capabilities and operations at the Metropolis Center at TA-3
- Construct and operate a new Science and Engineering Complex at TA-62

In October 2009, DOE issued the first supplement analysis to the 2008 SWEIS to determine if the 2008 SWEIS adequately bounded the proposed shipping of an estimated 15,000 cubic yards (11,500 cubic meters) of low-specific-activity and low-level waste from the North Ancho Canyon Aggregate Area to EnergySolutions in Clive, Utah, using a combination of truck and

---

<sup>3</sup> The Consent Order is an agreement between the New Mexico Environment Department and DOE to remediate contaminated sites at LANL. The Consent Order is issued pursuant to the New Mexico's Hazardous Waste Act and Solid Waste Acts. The original Consent Order was issued in 2005 and superseded by a new Consent Order in 2016.

<sup>4</sup> When originally constructed at LANL, DP was a designation for Delta Prime. It has since just used the name DP as its formal name.

rail. DOE/NNSA concluded that the proposed shipment of waste by truck and rail was bounded by the 2008 SWEIS transportation analysis (DOE 2009b).

On July 8, 2011, DOE/NNSA issued an amended record of decision (DOE 2011a) which determined that certain actions would be expected to take place as part of the Global Threat Reduction Initiative Off-Site Source Recovery Program.

### **1.3.2 Other Relevant NEPA Documents**

**The LANL Dual-Axis Radiographic Hydrodynamic Test (DARHT) EIS** (DOE 1995) addressed DOE's need to improve its radiographic hydrodynamic testing capability in order to ensure continued confidence in the safety and reliability of the United States nuclear weapons stockpile. Uncertainty in the behavior of the aging weapons in the enduring stockpile increases with the passage of time. Results of testing at the DARHT Facility assist in the assessment of the safety, performance, and reliability of the weapons primaries. The DARHT EIS also evaluated a vessel cleanout facility for use in connection with the DARHT testing activity.

**The Complex Transformation Supplemental Programmatic Environmental Impact Statement (SPEIS)** (DOE 2008c) was issued on October 24, 2008. The SPEIS analyzed the environmental impacts of alternatives for transforming the nuclear weapons complex into a smaller, more-efficient enterprise that could respond to changing national security challenges and ensure the long-term safety, security, and reliability of the nuclear weapons stockpile. Programmatic alternatives considered in the Complex Transformation SPEIS specifically addressed facilities that use or store significant (Security Category I/II) quantities of special nuclear material. In the associated 2008 record of decision (DOE 2008d) for the programmatic alternatives, NNSA announced its decision to transform the plutonium and uranium manufacturing aspects of the complex into smaller and more efficient operations while maintaining the capabilities NNSA needs to perform its national security missions. The record of decision also stated that manufacturing, research, and development involving plutonium would remain at LANL. To support these activities, the Complex Transformation SPEIS record of decision stated that NNSA would construct and operate the Chemistry and Metallurgy Research Replacement (CMRR) Nuclear Facility at LANL as a replacement for portions of the Chemistry and Metallurgy Research (CMR) Building. The CMR building is a structure that faces significant seismic challenges from a new understanding of the seismic threat and issues of contamination because of its long-term operation and deteriorating condition.

**The Sanitary Effluent Reclamation Facility Environmental Assessment** (DOE 2010a) analyzed potential environmental impacts from the expansion of the Sanitary Effluent Reclamation Facility and environmental restoration of Reach S-2 of Sandia Canyon at LANL. DOE selected the Proposed Action Alternative for the Sanitary Effluent Reclamation Facility expansion project.

**The CMRR Nuclear Facility SEIS** (DOE 2011d) is related to the LANL CMRR EIS (DOE 2003a), which examined the potential environmental impacts associated with the Proposed Action of consolidating and relocating the mission-critical chemistry and metallurgy research capabilities from an aging building to a modern building (or buildings) at LANL. The selected alternative, Modified CMRR Nuclear Facility Alternative, included constructing and operating a new CMRR Nuclear Facility at TA-55 with design and construction modifications to address

seismic safety, nuclear-safety-basis requirements, infrastructure enhancements, and sustainable design principles. This would have entailed replacement of the existing CMR Building and relocating certain CMR capabilities from the aging building to the new facility. On February 13, 2012, DOE deferred the construction of the CMRR Nuclear Facility for at least 5 years. In August 2014 DOE cancelled construction of the CMRR Nuclear Facility. DOE has since developed a plutonium infrastructure strategy that maintains continuity in analytical chemistry and materials characterization capabilities using existing facilities within LANL at TA-55.

**The Surplus Plutonium Disposition SEIS** (DOE 2015a) analyzed the potential environmental impacts of alternatives for the disposition of 14.4 tons (13.1 metric tons) of surplus plutonium for which a disposition path was not assigned, including 7.8 tons (7.1 metric tons) of weapons-usable plutonium from pits<sup>5</sup> and 6.6 tons (6 metric tons) of non-pit plutonium. These pits were declared surplus to national defense needs in 2007, and therefore, were not included in DOE's prior decisions. A record of decision has not been issued for pit plutonium.

**The Environmental Assessment for Chromium Plume Control Interim Measure and Plume-Center Characterization at LANL** (DOE 2015b) analyzed an interim measure to control a chromium plume that exceeded the New Mexico groundwater 50-parts per billion standard in TA-5. The environmental assessment presents a detailed evaluation of potential environmental impacts associated with the plume control interim measures and plume center characterization. The environmental assessment does not include analysis of the final remedy. A mitigated finding of no significant impact was issued in 2015.

## **1.4 LANL Functions and Key Facilities**

This 2017 supplement analysis addresses capabilities and operations using the concept of "Key Facilities" described in the 2008 SWEIS (DOE 2008a). The definition of each Key Facility hinges upon operations (research, production, services, and environmental impacts) and capabilities; a Key Facility is not necessarily confined to a single structure, building, or technical area. The 2008 SWEIS identified 15 Key Facilities, which represent the majority of environmental risks associated with operations at LANL.

Certain non-Key facilities and operations are described in the 2008 SWEIS, Appendix D (DOE 2008a) and are also included in this supplement analysis. Discussions of non-Key Facilities in this supplement analysis will be limited to those with actions that have a potential environmental impact (utilities and construction for both physical security and global security efforts in counter- and non-proliferation). The non-Key Facilities excluded from this supplement analysis were determined not to have potential environmental impacts in the 2008 SWEIS and include the Health Physics Instrument Calibration facilities, Source Storage Building used for storage of materials and test kits, the sample management laboratory activities, and the Sewage Treatment Plants. Environmental remediation is also discussed in this supplement analysis. In order to reduce or eliminate the impacts of past operations, DOE remediates contaminated areas in accordance with the Consent Order and other regulatory requirements. There are no Key Facilities associated with this capability except in supporting roles such as the Solid Radioactive and Chemical Waste facilities.

---

<sup>5</sup> A pit is the central core of a nuclear weapon, principally made of plutonium or enriched uranium.

Because of the importance of the nuclear weapons mission at LANL, this supplement analysis groups Key Facilities and operations in non-Key Facilities into seven functions to show the relationship of LANL operations to the DOE/NNSA nuclear weapons mission.

The following seven capabilities encompass DOE operations that could have substantial environmental effects.

1. **Plutonium Science:** LANL is the designated center for plutonium work in support of the nation's nuclear stockpile as defined in the Complex Transformation SPEIS (DOE 2008c). The plutonium science mission includes
  - Production of war reserve pits
  - Research on plutonium properties to support DOE's nuclear weapon certification program
  - Pit surveillance
  - Use of plutonium for heat sources and similar applications

The Key Facilities that have a primary role in support of the Plutonium Science Capability include the Plutonium Facility Complex (TA-55) and the CMR Building (TA-3). Construction of the Radiological Laboratory/Utilities/Office Building (RLUOB) at TA-55 was completed in 2011 and operations conducted at this facility directly support the plutonium science capability. RLUOB is considered to be part of the Plutonium Facility Complex and is included in that Key Facility. Some of the operations currently being conducted at the CMR Building are scheduled to be relocated to RLUOB and the Plutonium Facility (TA-55, building 4 or PF-4).

2. **High Explosives:** DOE conducts research, development, and testing of high explosives and explosive components of conventional and nuclear weapons and the fabrication of weapons components for the Nation's Stockpile Stewardship Program. Hydrodynamic testing at the DARHT Facility in TA-15 supports DOE's weapons certification mission. Work for other federal agencies may also be conducted at firing sites. DOE continues to provide supporting explosives research, development, and testing and weapons component surveillance (detonator and valve surveillance) for both conventional and nuclear weapon components. The 2008 SWEIS (DOE 2008a) defined two categories of high-explosives Key Facilities: 1) high-explosives processing facilities (TAs 8, 9, 11, 16, 22, and 37) and 2) high-explosives testing facilities (TAs 14, 15, 36, 39, and 40). Work in these Key Facilities is interrelated and involves transfers of material among various technical areas associated with high-explosives research.
3. **Supercomputing:** DOE's supercomputing facilities support warhead design, certification, surveillance, and assessment. Computing capabilities, including platforms and simulation codes, are upgraded on a continuing cycle to provide weapons evaluations that are necessary as a substitute for discontinued above- and below-ground tests of nuclear weapons. Computing capabilities also support non-weapons simulations and modeling. The Metropolis Center at TA-3 is a Key Facility for simulating characteristics of the stockpile to support DOE's weapons certification mission. The Laboratory Data

Communications Center, the Central Computing Facility, and the Advanced Computing Laboratory also support high-performance computing.

4. **Materials Science:** Materials science contributes knowledge of the properties of materials to support studies of nuclear and conventional weapons and non-defense applications in other federal agencies, educational institutions, and commercial entities. Extensive research in materials properties is conducted at Key Facilities and smaller laboratories at LANL. Key Facilities include the Materials Science Laboratory (TA-3), the Los Alamos Neutron Science Center (TA-53), and the Target Fabrication Facility (TA-35).
5. **Non-Plutonium Weapons Research:** LANL does not have a principal role in the uranium and tritium production mission; yet, research and fabrication are conducted at LANL using uranium, beryllium, tritium, and other materials used in weapons components. Some of this research may also be applicable to other programs, such as nonproliferation. The Sigma Complex (TA-3) and the Tritium Facilities (TA-16) are Key Facilities that support weapons research at LANL. However, plutonium research is not conducted at these facilities, nor is it present at these facilities. The Sigma Complex consists of several research facilities used to study uranium, beryllium, and other metals used in nuclear and conventional weapons. Several facilities that were part of the Tritium Key Facilities have been demolished. These include the Tritium Science and Fabrication Facility (TA-21, building 209) and the Tritium Systems Test Assembly (TA-21, building 155). Decommissioning, decontamination, and demolition of these facilities and remediation of the sites began in 2009. Demolition of both the Tritium Science and Fabrication Facility and the Tritium Systems Test Assembly was completed in 2010. The Weapons Engineering Tritium Facility at TA-16 houses tritium research and development.
6. **Supporting and Ancillary Research:** In addition to materials science research, fundamental and applied research is conducted at LANL. While much of the experimental work at LANL is in support of the DOE nuclear weapons mission, it also includes counterproliferation and many non-nuclear applications and work for other federal agencies, private industry, and academic institutions. Research at LANL includes bioscience, chemistry, geology, high-energy physics, particle physics, nanotechnology and development of new materials, laser development and applications, communications, energy efficiency, electronics, medical radioisotope production, and other areas to assist other organizations within DOE, other federal agencies, non-government organizations, and commercial entities. This research supports homeland security, threat reduction and response, nonproliferation, energy efficiency and alternative energy sources, space science, conventional weapons research, medical isotope production, and environmental studies. Two Key Facilities, the Bioscience Facilities (TA-43 and TA-46) and the Radiochemistry Facility (TA-48) contribute extensively to this capability. LANL's Bioscience Facilities are limited to biosafety levels 1 and 2 laboratories.
7. **Mission and Facility Support Operations:** Maintaining infrastructure and providing services (e.g., assembly, machining, shaping, coating, security, radioactive and chemical waste management, etc.) are essential to implementing the DOE mission. Fundamental facility-related services include maintenance, repair, water treatment, lighting, heating,

ventilation, recycling and non-hazardous waste management, and traffic control and access. Three LANL Key Facilities fall in this category: Machine Shops (TA-3), which provide customized parts for the non-plutonium weapons research capability, and the two waste management facilities: 1) the Radioactive Liquid Waste Treatment Facility (TA-50) and 2) the Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54), which each provide waste management services for both facility and mission needs.

The Pajarito Site at TA-18, which is undergoing decommissioning, decontamination, and demolition, is no longer a Key Facility and is not part of this analysis.

## **1.5 The Plutonium Mission**

The Laboratory has been in the forefront of plutonium research and development and production of plutonium components for nearly 75 years. Currently, LANL operates the nation's newest and only full-service plutonium facility, the TA-55 Plutonium Facility. The facility is capable of handling all normally used isotopes of plutonium in their usual chemical and physical forms, and has the demonstrated capability for fabricating plutonium pits suitable for use in the stockpile. The Plutonium Facility has also developed processes to support the disposition of excess plutonium, developed processes for production of plutonium-238 components for defense and civilian applications, and maintained a comprehensive suite of capabilities and personnel to characterize and analyze plutonium materials. In addition, the flexibility afforded by the inherent design of the Plutonium Facility laboratory spaces can accommodate equipment relocations and replacements as programmatic needs change.

The nation has established a number of plutonium research and development and production facilities over the years. Many of these facilities have either been closed or have had their active plutonium operations terminated, including the Hanford Site and the Rocky Flats Plant, the only facilities other than LANL where plutonium pits for the stockpile have been fabricated. Since the cessation of operations at Rocky Flats in 1989, numerous attempts to re-establish the nation's large-scale pit production capability have all led to the same outcome, the decision to continue this important work at Los Alamos. Similarly, as other facilities were closed, their programmatic activities were transferred to LANL. Specifically, pit surveillance and pit fabrication process development were transferred to LANL from Rocky Flats, and plutonium-238 heat source production was transferred from the Mound Plant in Ohio.

The most recent affirmation of the Laboratory as a comprehensive resource for plutonium-related research and development and component fabrication came in 2008, when the NNSA decided to designate LANL as the center of excellence for plutonium research and development and manufacturing, primarily based on the fact that LANL has the existing facilities, infrastructure, and trained personnel necessary for this mission (DOE 2008d). With these components of the plutonium research and development and manufacturing system, the Laboratory is able to support the vast majority of defense and civilian programs that need plutonium components and related expertise. See Appendix B for a full description of LANL's plutonium mission.

## **1.6 Copy of Supplement Analysis**

DOE requires that each supplement analysis and the resulting determination be made available to the public [10 CFR 1021.314(c)]. Copies are in the public reading room located at 94 Cities of Gold Road, Pojoaque, New Mexico, and posted on the DOE NEPA website at



<https://energy.gov/nepa/public-comment-opportunities>, and  
<https://nnsa.energy.gov/aboutus/ouoperations/generalcounsel/nepaoverview/nepa/lafo>. A hard  
[copy of this supplement analysis will be](#) provided upon written request.

Written requests can be submitted to:

**Jane Summerson**  
**NEPA Compliance Officer**  
**c/o Los Alamos National Laboratory**  
**PO Box 1663**  
**MS J978**  
**Los Alamos, NM 87545**

Document requests can be submitted by e-mail to: [nepa@lanl.gov](mailto:nepa@lanl.gov)

## 2.0 NEW AND UPDATED PROJECTS AND OPERATIONS ANALYZED IN THIS SUPPLEMENT ANALYSIS (2018 THROUGH 2022)

This chapter includes a discussion of current and proposed operations and projects at LANL. Section 2.1 identifies new projects and project updates anticipated in the next 5 years. Section 2.2 summarizes the status of projects analyzed in the 2008 SWEIS (DOE 2008a) that were selected in a record of decision (DOE 2008b). Section 2.3 identifies projects analyzed in the 2008 SWEIS but not included in a record of decision. Section 2.4 summarizes future projects that are not ripe for NEPA analysis. Section 2.5 identifies projects with separate NEPA analyses. Section 2.6 lists cancelled and deferred projects analyzed in the 2008 SWEIS.

### 2.1 Proposed Projects for 2018 through 2022

This section summarizes proposed new projects and project updates anticipated for 2018 through 2022. Summaries of projects involving Key Facilities are presented first, followed by summaries of projects involving non-Key Facilities.

Some Key Facilities did not have projects of significance that required evaluation in this supplement analysis or new projects were covered under separate NEPA. Appendix C summarizes the reviews conducted by DOE/NNSA of proposed projects that have been implemented at the following six Key Facilities since the issuance of the 2008 SWEIS.

- Metropolis Center
- Material Science Laboratory Complex
- Sigma Complex
- Tritium Facilities
- Machine Shops
- Radioactive Liquid Waste Facility

Table 2-1 summarizes projects involving Key Facilities at LANL and Table 2-2 summarizes projects involving non-Key Facilities at LANL for 2018 through 2022. New or modified projects requiring further consideration are described in more detail in this section.

**Table 2-1. Proposed Key Facility Projects to be Initiated in the Next 5 Years**

LANL Function	Key Facility	Proposed Projects 2018 through 2022
Plutonium Science	Plutonium Facility Complex	<ul style="list-style-type: none"> <li>• Increased Pit Disassembly/Conversion and Disposition</li> <li>• Construction of a Parking Structure at TA-50 and Support Office Building(s) along Pajarito Corridor</li> </ul>
	CMR	<ul style="list-style-type: none"> <li>• Relocation of some Wing 9 Hot Cell capabilities</li> <li>• Relocation, remediation, and disposal of Large-Vessel Handling</li> </ul>
High-Explosives Program	High-Explosives Processing	<ul style="list-style-type: none"> <li>• Consolidation of high-explosives processing facilities at the Energetic Materials Characterization Facility</li> </ul>

LANL Function	Key Facility	Proposed Projects 2018 through 2022
	High-Explosives Testing	<ul style="list-style-type: none"> <li>• Installation and Operation of a prototype Scorpius Integrated Test Stand*</li> <li>• Construction of a new DARHT Vessel Cleanout Facility</li> </ul>
Materials Science	Los Alamos Neutron Science Center	<ul style="list-style-type: none"> <li>• Resumption of High-Power Beam Delivery at Area A</li> <li>• Modernization and resumption of Hot-Cell Work</li> <li>• Shockwave Experiments at the Proton Radiography Facility using up to 50 grams of plutonium</li> <li>• Install Electron Beam Test Facility for research and development</li> </ul>
	Target Fabrication Facility	<ul style="list-style-type: none"> <li>• Renovation of the Materials Science and Technology Fuel Fabrication Facility</li> </ul>
Supporting and Ancillary Research	Radiochemistry	<ul style="list-style-type: none"> <li>• New Radiochemistry Laboratory Alpha Hot-Cell Facility for research and development</li> <li>• Expand Clean-Room Activities at Radiochemistry Facility for bioassay program</li> </ul>
	Biosciences	<ul style="list-style-type: none"> <li>• Biosafety Level 2 Radiological Laboratory for research and development using alpha-emitting radioisotopes</li> </ul>
Mission and Facility Support Operations	Solid Radioactive and Chemical Waste	<ul style="list-style-type: none"> <li>• Alternatives Analysis and Strategy for Certain Shafts at TA-54 Area G</li> <li>• Low-level and mixed low-level Difficult Waste Streams are evaluated for transport, treatment, and disposal</li> </ul>

\* An integrated test stand, in general, involves a facility used to develop, characterize, and test components or an entire system. Testing involves hardware and software, providing a comprehensive performance check of the desired system.

**Table 2-2. Proposed Non-Key Facility Projects to be Initiated in the Next 5 Years**

Non-Key Facility	Proposed Projects 2018 through 2022
Global Security	<ul style="list-style-type: none"> <li>• Construct the Nuclear Counterproliferation Building to consolidate existing activities</li> </ul>
Physical Security	<ul style="list-style-type: none"> <li>• Upgrade the TA-72 Firing Range</li> <li>• Construct a Protective Force Training Facility to consolidate existing training simulators</li> </ul>
Infrastructure Refurbishment, Replacement, Removal	<ul style="list-style-type: none"> <li>• Upgrade electrical transmission and distribution system</li> <li>• Re-conductor<sup>a</sup> Norton and Reeves transmission lines</li> <li>• Construct two new fire stations</li> <li>• Reduce building footprint</li> <li>• Refurbish Los Alamos Canyon Bridge</li> <li>• Re-purpose and modernize existing facilities</li> <li>• Replace office buildings and light laboratories</li> <li>• Implement Supplemental Environmental Projects<sup>b</sup></li> <li>• Install a 10-megawatt photovoltaic array</li> </ul>

Non-Key Facility	Proposed Projects 2018 through 2022
Manhattan Project National Historical Park	<ul style="list-style-type: none"> <li>• Establish the Manhattan Project National Historical Park</li> </ul>
Forest Health and Wildland Fire Preparedness	<ul style="list-style-type: none"> <li>• Forest and vegetation management</li> </ul>
Environmental Remediation	<ul style="list-style-type: none"> <li>• Environmental Management legacy contaminant program activities</li> </ul>

<sup>a</sup> Re-conductoring means to replace a cable or wire on an electric circuit, typically a high-voltage transmission line, to maintain transmission efficiency and afford a greater electric-current-carrying capability.

<sup>b</sup> The New Mexico Environmental Department issued a compliance order for violations of the New Mexico Hazardous Waste Act. These violations stemmed from improper packaging of transuranic waste from LANL. Supplemental Environmental Projects were established in an agreement between the state and LANL in lieu of fines. These projects address improvements for local roads and watersheds.

## 2.1.1 LANL Functions and Key Facilities

This section summarizes proposed new and updated projects for Key Facilities associated with each of the following LANL functions:

- plutonium science,
- high-explosives program,
- computing,
- materials science,
- non-plutonium weapons research,
- supporting and ancillary research, and
- mission and facility support operations.

### 2.1.1.1 Plutonium Science

The Complex Transformation SPEIS (DOE 2008c) identifies LANL as the plutonium center of excellence for the DOE complex where research, design, development, testing, surveillance, and assessment activities are performed. Certification capabilities in support of the Stockpile Stewardship Program are maintained at LANL.

Plutonium-processing programs at TA-55 provide chemical and metallurgical processes for recovering, purifying, and converting plutonium and other actinides into compounds and forms. Safeguarding design and certification capabilities are critical for enabling continued support of the nation's nuclear stockpile stewardship. DOE's plutonium science mission is defined in the Complex Transformation SPEIS (DOE 2008c) and updated in the annual Stockpile Stewardship and Management Plan (DOE 2016a). The plutonium science mission includes:

- Production of war reserve pits
- Research on plutonium properties to support the nuclear weapon certification program
- Pit surveillance
- Use of plutonium as heat and power sources for spacecraft and similar applications

#### **2.1.1.1.1 Plutonium Facility Complex**

Plutonium pits are produced at LANL pursuant to a programmatic decision based on the Stockpile Stewardship and Management programmatic EIS record of decision (DOE 1996a) and a site-specific decision based on the 1999 SWEIS record of decision (DOE 1999a) to establish an interim production capability of up to 20 pits per year. The production level of 20 pits per year was the No Action Alternative for the 2008 SWEIS (DOE 2008a) and was selected in the record of decision (DOE 2008b). Pit disassembly and conversion, surveillance, and non-nuclear components manufacturing (e.g., detonators) were also analyzed in the 2008 SWEIS.

The Plutonium Facility Complex (TA-55) and the CMR Building (TA-3) are Key Facilities that have a primary role in supporting the plutonium science capability. Construction of RLUOB, part of the Plutonium Facility Complex at TA-55, was completed in 2011; radiological operations began in 2014. Some of the operations currently conducted at the CMR Building are being relocated to RLUOB and the TA-55 Plutonium Facility (PF-4) (Figure 2-1) in support of the plutonium science capability. These efforts are part of the RLUOB Equipment Installation and PF-4 Equipment Installation projects (DOE 2003a, 2015c).



**Figure 2-1. PF-4 and RLUOB at TA-55**

#### **Increased Pit Disassembly/Conversion and Disposition**

The 2008 SWEIS evaluated pit disassembly and conversion. In 2015, DOE updated its analysis for disassembly, conversion, and disposition to consider additional inventory in the “Final Surplus Plutonium Disposition Supplemental Environmental Impact Statement” (DOE 2015a), namely the disposition of 13.1 metric tons (14.4 tons) of plutonium; 7.1 metric tons (7.8 tons) of plutonium is in pit form. DOE has not issued a record of decision for the supplemental EIS, but that analysis considered expanding the capability for pit disassembly and subsequent plutonium oxide and/or metal conversion at LANL up to approximately 2.5 metric tons (2.8 tons) per year

and 35 metric tons (38.6 tons) for the total program for all alternatives except the No Action alternative, which examined a level of 0.3 metric tons (0.33 tons) per year and 2 metric tons (2.2 tons) for the total program. In its analysis, DOE considered disposition of materials at the Waste Isolation Pilot Plant. Up to 0.3 metric tons (0.33 tons) per year, 7.1 metric tons (7.8 tons) for the total program, would be prepared at LANL if a record of decision selecting that alternative is issued.

### ***Parking Structure at TA-50 and Support Office Building(s) along the Pajarito Corridor***

DOE proposes to construct a parking structure at TA-50 and support office building(s) along the Pajarito Corridor in the next 5 years to support plutonium operations at TA-55. The 2015 supplement analysis (DOE 2015c) analyzed an office building at TA-50 and a graded parking lot instead of a multilevel parking structure. DOE currently projects a need for approximately 600 parking spaces, which was not specifically analyzed. The multilevel parking structure will likely cause some additional land disturbance adjacent to the graded parking lot. The support office buildings are being considered for several locations along the Pajarito Corridor in TA-48, TA-52, TA-55, and TA-63.

#### ***2.1.1.1.2 CMR***

Actinide chemistry and metallurgy research has been conducted at the CMR Building (Figure 2-2) for decades. Capabilities include special nuclear material analytical chemistry, materials characterization, and actinide research and development. Operations at the CMR Building include plutonium property studies. At the time that the 2008 SWEIS was issued (DOE 2008a), DOE planned to relocate CMR activities to the CMRR Nuclear Facility, RLUOB, and the Radiological Sciences Institute. In August 2015, DOE cancelled construction of the CMRR Nuclear Facility (DOE 2015d). The Radiological Sciences Institute was not included in a record of decision and is not in future DOE planning. As a result, DOE now intends to relocate CMR capabilities to RLUOB and PF-4 at TA-55 (Figure 2-3 and Section 2.5.2). Relocation of CMR operations to TA-59-1, PF-4, and RLUOB are considered in this supplement analysis.

#### ***Wing 9 Hot Cell***

The 2008 SWEIS projected the CMR Wing 9 hot-cell capabilities would be reconstructed in the proposed Radiological Sciences Institute in TA-48. The Radiological Sciences Institute has not been implemented, so related projects (e.g., relocation of the CMR Building Wing 9 hot cell to the Radiological Sciences Institute) have not occurred. Some of the Wing 9 hot-cell capabilities may move to TA-53-3 Area A at the Los Alamos Neutron Science Center (LANSCE) (Section 2.1.1.3.1).

#### ***Large-Vessel Handling***

Containment vessels would be relocated from TA-55 to CMR to be remediated and disposed of. In 2003, modifications to the CMR Building Wing 9 began in order to accommodate disposition of large vessels used to contain experimental explosives shots involving actinides. This project was analyzed in a supplement analysis to the 1999 SWEIS (DOE 2003b). The 2008 SWEIS evaluated processing of two large vessels per year. In 2014, the first vessel was processed. Six vessels remain to be processed. DOE proposes to process three vessels per year in order to finish ahead of the planned CMR termination of program operations and potential decontamination and decommissioning. The Containment Vessel Disposition Project is expected to be complete in 2019.





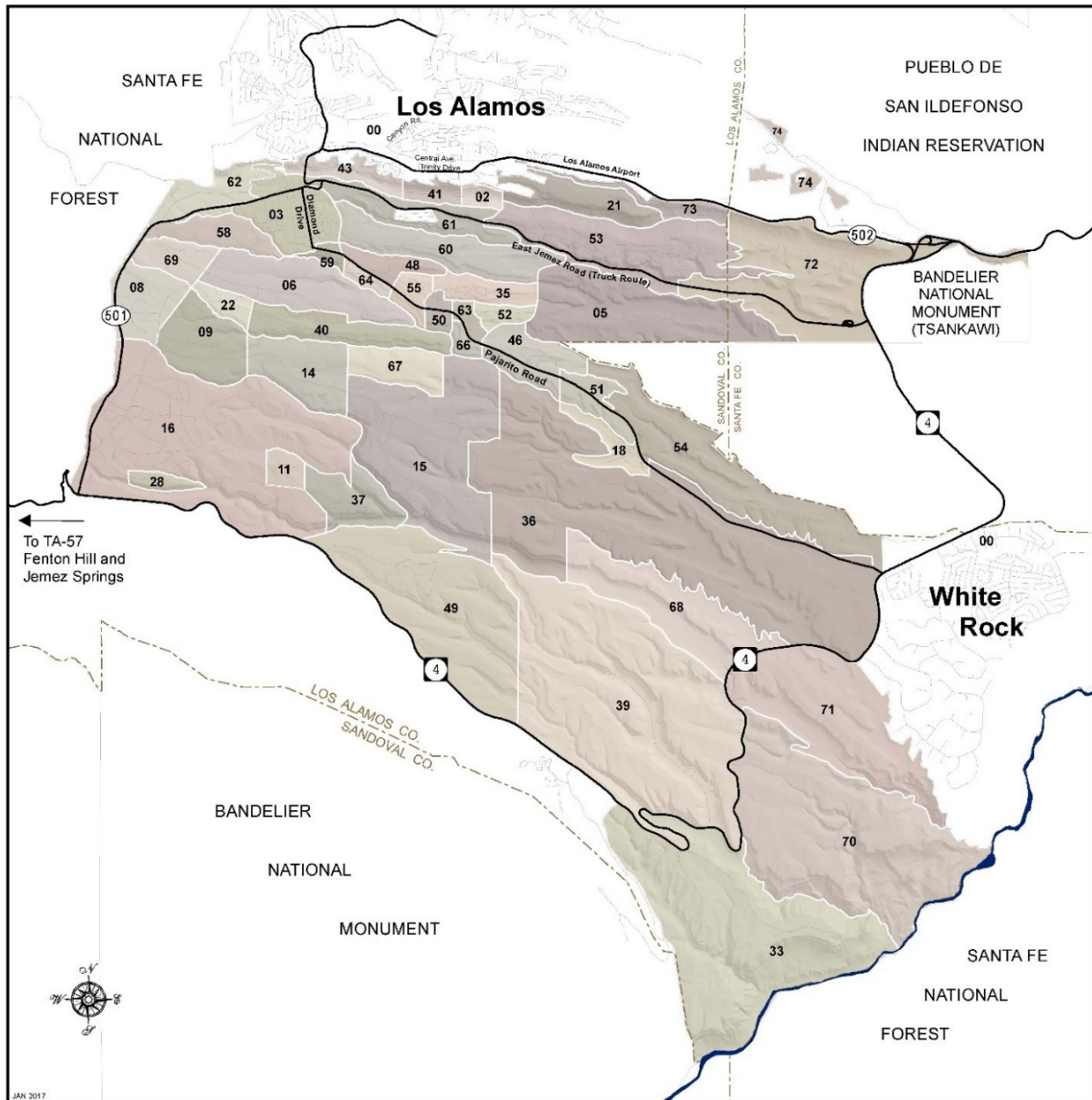
**Figure 2-2. The CMR Building at TA-3**

### **2.1.1.2 High-Explosives Program**

High-explosives research, development, and testing and weapons-component surveillance (detonator and valve surveillance) are conducted at LANL for both conventional and nuclear weapons components. These capabilities include outdoor high-explosives firing, proton radiography, large-charge high-explosives pressing, detonator fabrication, engineering testing of high-explosives assemblies, high-explosives manufacturing research and development, experiments on explosives using experimental guns, and high-explosives driven by pulsed power. High-explosives processing and testing occurs in approximately 20 square miles (52 square kilometers) of the LANL footprint (TAs 8, 9, 11, 14, 15, 16, 22, 36, 37, 39, and 40) (see technical area locations in Figure 2-3). Over the past 5 years, the high-explosives processing and testing areas have been modernized through upgrades of existing older structures (Figure 2-4).

#### **2.1.1.2.1 High-Explosives Processing**

Since the 2008 SWEIS analysis, high-explosives processing operations have been consolidated in existing facilities and modernized to facilitate high-explosives synthesis, formulation, pressing, and machining. The analysis in the 2008 SWEIS (DOE 2008a) is still applicable because the capabilities remain the same, thus, operational impacts are considered to be bounded by the 2008 SWEIS. These capabilities will remain the same for the next 5 years. Proposed actions at LANL for high-explosives processing focus on consolidation and modernization of facilities as discussed below.



**Figure 2-3. LANL technical areas**

### ***Energetic Materials Characterization Facility***

The Energetic Materials Characterization Facility Project would consolidate the performance of activities occurring in 18 separate 1950s-era buildings. The critical functions of this facility include explosive development, insensitive high-explosives characterization, detonator materials production, and stockpile explosives surveillance. The 2008 SWEIS analyzed the consolidation of new replacement dynamic experimentation facilities within portions of TA-6, TA-22, and TA-40. Fifteen to 25 new structures were planned over a 10-year timeframe to replace 59 structures.





**Figure 2-4. High-explosives testing at LANL TA-39**

#### **2.1.1.2.2 High-Explosives Testing**

High-explosives testing operations involve assembly of test devices, radiography, testing at engineering mechanical or thermal test facilities, and experiments at firing sites and at the DARHT Facility. As with the high-explosives processing capabilities, the 2008 SWEIS evaluates high-explosives testing capabilities that are currently required to meet mission requirements. The tests include hydrodynamic tests, dynamic experiments, explosives research, munitions experiments, and high-explosives pulsed-power experiments. DOE actions that are currently underway or proposed will involve consolidation of these capabilities.

#### ***Scorpius Integrated Test Stand***

A small, prototype integrated test stand would be installed within the Radiographic Support Laboratory (TA-15-313). The Scorpius Integrated Test Stand is a prototype for the fully designed Scorpius linear accelerator that will support dynamic plutonium experiments<sup>6</sup> at the Nevada Nuclear Security Site (DOE 2013a). Currently, similar experiments are being conducted at the DARHT Facility using surrogate materials in place of plutonium. This full-scale accelerator will be analyzed in a separate NEPA document. The beam energy of this Integrated Test Stand would be approximately 6 million electron volts (MeV). To accommodate its installation, a small addition would be added to the east side of the Radiographic Support Laboratory. Safety systems and shielding would be installed. The Radiographic Support Laboratory was designed and built for the development of accelerator technology and was analyzed in the DARHT EIS (DOE 1995). DOE determined, under all alternatives, that the Radiographic Support Facility would continue to be used to perform accelerator research, such as the proposed Scorpius Integrated Test Stand.

---

<sup>6</sup> Dynamic plutonium experiments are designed to improve knowledge of plutonium material properties. None of these experiments reaches nuclear criticality nor involves a self-sustaining nuclear reaction.

### **DARHT Vessel Cleanout Facility**

DOE will increase the number of hydrodynamic shots conducted at the DARHT Facility (Figure 2-5) to approximately 10 shots per year; four hydrodynamic shots were conducted in calendar year 2015 and six were conducted in calendar year 2016. Vessels are used to contain shots conducted at the DARHT Facility. These vessels are reused so they require decontamination, repair, and inspection after each shot to allow reuse. To accommodate this increase, a new vessel cleanout facility will be constructed across from building 15-534. The new facility will house two repair bays with duplicate equipment, thereby allowing two vessels to be repaired in parallel. Inspections will continue to be conducted at building 15-285. This will double the amount of vessels that can be rehabilitated.



**Figure 2-5. The DARHT Facility**

The 1995 DARHT EIS analyzed a 12,000-square-foot (1,100-square-meter) vessel building with cleanout capability to support 20 shots per year (DOE 1995). A new or expanded facility would include a high bay area to house vessel cleanout and staging, treatment process equipment, storage, and mechanical and electrical equipment. The new facility would be used in addition to the existing cleanout facility, providing more than 12,000 square feet for vessel services. Additional construction impacts are anticipated but operational impacts remain bounded by the DARHT EIS. The facility would be designed and constructed to include all necessary safety and environmental protection features.

#### **2.1.1.3 Materials Science**

Materials Science research conducted at LANL includes materials characterization and qualification experiments conducted at LANSCE; materials processing, characterization, and development at the Materials Science Laboratory Complex; and materials effects testing, characterization, technology development, and fabrication at the Target Fabrication Facility.



### 2.1.1.3.1 Los Alamos Neutron Science Center

The LANSCE accelerator complex is a unique NNSA resource that provides physics and engineering support to LANL, Lawrence Livermore National Laboratory, and Sandia National Laboratories. LANSCE provides the capability to measure cross sections of materials in order to characterize and qualify high explosives and other materials, and to support stockpile certification. The heart of the LANSCE facility is a linear accelerator located within TA-53-3 that is more than 0.5 miles (0.8 kilometers) long, with 316,000 square feet (29,400 square meters) of floor space (Figure 2-6). The facility contains equipment to form hydrogen ion beams (protons and negative hydrogen ions) and to accelerate them to 84 percent of the speed of light (DOE 2008a). Tests conducted at LANSCE involve explosives, radioactive material, and beryllium under extreme temperature and pressure. The following four projects are proposed to take place at LANSCE.



Figure 2-6. LANSCE Accelerator Complex, west view

### ***High-Power Beam Delivery at Area A***

Area A is the eastern end of the LANSCE accelerator where targets are positioned for experiments using the high-power beam. In the 1990s, DOE ceased operations in Area A (Figure 2-6). DOE proposes to resume high-energy, low-current proton beam operations in Area A.

### ***Hot-Cell Work***

Hot cells are heavily shielded concrete containments used for irradiation experiments. Work with hot cells in Area A of LANSCE has not been conducted since the 1990s. DOE proposes to modernize Area A to allow radiochemical processing of irradiated targets for actinium-225 and other alpha emitters to resume hot-cell work in Area A. The CMR Wing 9 hot cell capabilities may move to Area A.

### ***Shockwave Experiments at the Proton Radiography Facility***

Proton radiography, invented at LANL, provides an understanding of the fundamental behavior of fissionable materials. Proton radiography uses a high-energy proton beam from the LANSCE accelerator to image the properties and behavior of materials under a variety of conditions. The 2008 SWEIS (DOE 2008a) analyzed conducting shockwave experiments using plutonium in the Weapons Neutron Research Facility and the Lujan Center at LANSCE. DOE proposes to conduct the same experiments, using up to 50 grams of plutonium per year, at the Proton Radiography Facility (Figure 2-6).

### ***Electron Beam Test Facility***

DOE proposes to reconfigure TA-53-365 to support installation of an Electron Beam Test Facility at LANSCE (Figure 2-6). The facility would support research and development and other national security projects. The Electron Beam Test Facility electron accelerator and test beam line would be assembled using available accelerator, vacuum, and mechanical equipment.

#### ***2.1.1.3.2 Target Fabrication Facility***

The Target Fabrication Facility comprises three main buildings at TA-35 (213, 455, and 458). The main building is a two-story structure with approximately 61,000 square feet (5,700 square meters) of floor space. Laboratories and offices are located on both floors. Approximately 48,000 square feet (4,500 square meters) is laboratory space; the remainder is used for offices. The Target Fabrication Facility houses activities related to weapons production and laser fusion research. These activities are accomplished through high-technology materials science, effects testing, characterization, and technology development. DOE proposes radioactive fuel fabrication operations at TA-35.

### ***Materials Science and Technology Fuel Fabrication Facility***

DOE proposes to renovate TA-35-189 to accommodate radioactive fuel fabrication operations currently taking place at the Plutonium Complex in TA-55. Current operations at TA-35-189 include research and development on nuclear fuel for nuclear deterrence, energy security, and development and deployment of advanced capabilities. Along with current operations, the facility would commence work currently conducted at the Plutonium Complex, focusing on various compositions of nuclear fuel, primarily uranium-235.

#### **2.1.1.4 Supporting and Ancillary Research**

Proposed supporting and ancillary research projects at the Radiochemistry Facility include the expansion of the clean-room and hot cell activities and biosafety level 2 and radiological laboratory work at TA-46-158.

##### **2.1.1.4.1 Radiochemistry Facility**

The Radiochemistry Facility at TA-48 includes the Radiochemistry Laboratory, the Machine and Fabrication Shop, the Diagnostic Instrumentation and Development Building, the Clean Chemistry/Mass Spectrometry Building, and the Weapons Analytical Chemistry Facility. Activities conducted at the Radiochemistry Facility include research, production of medical radioisotopes, and radiological and chemical sample analyses (DOE 2008a).

##### ***Radiochemistry Laboratory Hot-Cell Facility***

DOE proposes to add a new, stand-alone alpha hot cell at TA-48-28 to support research and development on the production of alpha emitting radioisotopes. This hot cell will complement existing medical and industrial capabilities using primarily beta and gamma emitting radioisotopes at TA-48-1. This hot-cell facility would eliminate interference with analytical and counting activities in other facilities.

##### ***Expand Clean-Room Activities at the Radiochemistry Facility***

DOE proposes to expand the clean-room activities at TA-48. Expansion of building 45 at TA-48 would provide additional specialized clean-room laboratory space to consolidate and support DOE's in vitro bioassay program, to accommodate increasing sample numbers, and to process incident-related samples.

##### **2.1.1.4.2 Bioscience**

LANL's Bioscience Facilities include the main Health Research Laboratory at TA-43 and offices and laboratories located at TAs 3, 16, 35, and 46. The Bioscience Facilities have biosafety level 1 and 2 laboratories and are the focal point of bioscience and biotechnology at LANL. Research performed at the Bioscience Facilities includes structural, molecular, and cellular radiobiology; biophysics; biochemistry; and genetics. Operations at TAs 35, 43, and 46 include chemical, laser, and limited radiological activities that maintain hazardous materials inventories and generate hazardous chemical wastes and very small amounts of low-level radioactive waste.

Biosafety level 1 and 2 activities and laboratories at LANL are covered by the 2008 SWEIS (DOE 2008a).

##### ***Biosafety Level 2 Radiological Laboratory***

DOE proposes to conduct biosafety level 2 and radiological work at building 158 at TA-46. Personnel would conduct research and development using alpha-emitting radioisotopes for medical research. Building upgrades and modernization will be necessary to accommodate this new capability. Additional biosafety level 2 work at LANL is identified in Section 2.5.1.

#### **2.1.1.5 Mission and Facility Support Operations**

Facilities and expertise at LANL support all of DOE's missions: national security, science, energy, and environmental management. The main roles of LANL staff in the fulfillment of mission objectives include a wide range of scientific and technological capabilities that support



nuclear materials handling, processing, and fabrication; stockpile management; materials and manufacturing technologies; counter non-proliferation programs; and waste management.

#### **2.1.1.5.1 Solid Radioactive and Chemical Waste**

The Solid Radioactive and Chemical Waste facilities occupy over 200 structures in an area of 943 acres (382 hectares) in TA-54 and TA-50. The activities performed at the Key Facilities are related to the management of radioactive and chemical wastes generated at LANL, including packaging, characterization, receipt, transport, storage, and disposal. Most waste managed in TA-54 (Figure 2-7) is in a solid physical state, although there are also small quantities of gaseous or liquid hazardous, toxic, and mixed wastes.



**Figure 2-7. TA-54 waste management areas**

Most low-level radioactive waste generated by LANL operations is disposed of off-site, but it is staged on-site at generator sites across the Laboratory and at collection sites at TA-54.

Transuranic waste is stored on-site until it is transported to the Waste Isolation Pilot Plant for disposal. Chemical and mixed radioactive wastes are transported to other off-site facilities for treatment and disposal. Section 3.12 details actual waste volumes generated compared with waste volumes evaluated in the 2008 SWEIS.

##### **2.1.1.5.1.1 Alternatives Analysis and Strategy for Certain Shafts at TA-54**

The 2008 SWEIS (DOE 2008a) analyzed removal of wastes from TA-54 Area G. DOE is considering alternative options that include a plan to stabilize-in-place up to 33 waste disposal shafts at TA-54. Removal of the waste would entail technical, environmental, and safety issues

that may be better approached by stabilizing the wastes in-place. These 1-foot-diameter (0.3-meter-diameter) shafts having carbon steel pipe liners contain remote-handled transuranic waste. DOE is evaluating the feasibility of alternative options and may prepare an environmental assessment for these shafts. Other shafts at LANL are not included in this supplemental analysis because they were previously analyzed in the 2008 SWEIS Appendix I and are under the Consent Order. There are no changes anticipated for decisions on disposition for the other shafts.

#### **2.1.1.5.1.2 Difficult Waste Streams**

Some low-level and mixed low-level wastes generated at LANL are difficult to handle, transport, and treat for disposal. These wastes are stored until an appropriate disposal path is identified. These wastes are covered by previous NEPA documentation identified in each discussion. Difficult-to-treat waste streams include waste with high levels of tritium contamination, high-activity/high-dose<sup>7</sup> waste from medical isotope production, targets from LANSCE beam operations, and waste with classified components or constituents. DOE proposes to disposition seven difficult waste streams (Table 2-3). Routine waste activities are discussed in Section 3.12.

**Table 2-3. Difficult Waste Streams and Possible Disposition Pathways Under Consideration**

Waste Stream	Waste Disposal Options	
	TA-54 / Pit 38	Off-Site
Flanged Tritium Waste Containers Mixed Low-Level Waste (four containers)	No	TBD*
Flanged Tritium Waste Containers Low-Level Waste (five containers)	Under Evaluation	TBD
Irradiators Cesium-137 and Cobalt-60	No	Yes
LANSCE Cooling System Waste Water	Yes	Yes
LANSCE Targets	Yes	Yes
Fort St. Vrain Uranium	Yes	No
Animal Tissue	No	Yes

\* TBD = to be determined

#### **Flanged Tritium Waste Containers**

Operations at the Weapons Engineering Tritium Facility produce one to two newly generated flanged tritium waste containers quarterly. The 2008 SWEIS (DOE 2008a) evaluated the storage and generation of low-level waste and mixed low-level waste from the Weapons Engineering Tritium Facility. DOE's selected the No Action Alternative in the 2008 record of decision (DOE 2008b), which includes operation of the Weapons Engineering Tritium Facility and disposal of routine waste. Nine flanged tritium waste containers produced over the past several years do not have a current disposition path because the packaging does not conform to current transportation and off-site disposal facility requirements.

Four of the containers include regulated chemical constituents (mixed low-level waste) that preclude disposal at LANL. These four containers are expected to require processing or

<sup>7</sup> Dose—a generic term meaning absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or committed equivalent dose. For ionizing radiation, the energy imparted to matter by ionizing radiation per unit mass of the irradiated material (e.g., biological tissue). The units of absorbed dose are the rad and the gray. In many publications, the rem is used as an approximation of the rad.

treatment to meet permanent off-site disposal requirements. These containers are stored at TA-54-1028 and have mixed low-level waste with tritium and tritium-contaminated elemental mercury (80,000 curies), contaminated lead components, and free-standing liquids (approximately 10 percent). Transport of these four containers to an off-site commercial treatment facility is not viable because the internal gas mixtures exceed shipping requirements. These vessels contain oxygen, creating an explosive hazard. DOE proposes to monitor and potentially vent these containers in a storage vessel for safe storage on-site. The storage vessel would be evaluated as a certified shipping container or would be evaluated for compatibility with available shipping containers should a shipping option become available.

The remaining five of the nine containers (low-level waste) have classified tritium waste and are stored at TA-16-205. These units have some internal pressure from radiolytic decomposition of tritium gas. On-site disposal of any flanged tritium waste containers would require exceptions to the TA-54 Area G waste acceptance criteria, which would be evaluated once a disposal path is identified. Because these containers have classified components, they may require special preparation or controls to meet requirements for disposal. DOE is also considering off-site disposal at the National Nuclear Security Site and/or at a commercial facility.

#### ***Cesium-137 and Cobalt-60 Irradiators***

Genotoxicity research funded under Laboratory Research and Development in the 1980s and 1990s used a cesium irradiator system incorporating two cesium-137 sources mounted in a single operating rod assembly with current activities of 4.94 curies and 494 curies. The laboratory also used a cobalt-60 irradiator that emitted an intense beam of gamma rays, generated by the decay of its cobalt-60 source, with a current activity of 227 curies. These sources were identified in LANL's 1999 SWEIS (DOE 1999b). The 2008 SWEIS impact analysis tiers from the 1999 SWEIS.

The cesium-137 source beam irradiator with attenuator system was located in room B-138C of the Health Research Laboratory 1 at TA-43. They were transported to Dome 230, Area G in December 2014 for storage. The teletherapy cobalt-60 source irradiator was located in room B-138A of the Health Research Laboratory 1. It was transported to Dome 230, Area G in November of 2014 for storage. DOE proposes transport the cesium-137 source to an offsite facility for disposal and transfer the cobalt-60 source at the Southwest Research Institute in San Antonio, Texas, for storage until a disposal path is available.

#### ***LANSCE Cooling System Waste Water***

A waste stream was produced on March 31, 2009, as part of the routine maintenance and replacement of water treatment bottles used in the LANSCE target-cooling system. The waste water with activation products was packaged in accordance with LANL waste acceptance criteria and shipped to TA-54 Area G for shaft disposal. However, the shafts were not available for disposition of this waste. Disposal at the Area G shafts was evaluated in the 2008 SWEIS. DOE is evaluating disposition of this waste at an off-site disposal areas. Disposition of this waste will not require additional NEPA evaluation.

#### ***LANSCE Targets***

Two targets that will be dispositioned in the future: 1) the Target, Moderator, Reflector System Mk-I (in the beam from 1998 to 2001) and 2) the Target, Moderator, Reflector System Mk-II (in the beam from 2002 to 2009). Mk-I and Mk-II have been stored in Area A at LANSCE as



potential emergency spare parts. These targets are candidates for material property research so a disposal decision is pending completion of programmatic needs.

Once the programmatic needs for these targets has been completed then DOE will evaluate disposal at Pit 38 or at an offsite facility.

### ***Fort St. Vrain***

Three uranium and graphite core assemblies were shipped to LANL in the 1980s to determine if the uranium, which had not been irradiated in the Fort St. Vrain nuclear reactor in Platteville, Colorado, could be recovered from the assembly. This proved technically unfeasible and the materials shipped from Fort St. Vrain became surplus. These Fort St. Vrain assemblies were packed in three drums and were relocated from TA-18 to the CMR facility when the TA-18 facility was decommissioned. DOE has completed disposition of these drums at TA-54, Pit 38.

### ***Animal Tissue***

Three containers of animal tissues resulting from animal radiological toxicity research and testing at LANL in the 1980s and 1990s require disposal. Picocuries of activity would have been the concentration of most radioisotopes used. Waste could contain formaldehyde or glutaraldehyde. These drums were packaged years ago as low-level waste. The drums hold radiologically contaminated plastics, glass, and animal tissue with trace amounts of Formalin, cellulosic material, and absorbent. These drums underwent real-time radiography and no liquids were found. Assay of the three 30-gallon (0.12-cubic meter) drums was conducted by gamma spectroscopy to identify and quantify the gamma-emitting radionuclides present. One drum has a detection of approximately  $6.14\text{E-}07$  curies of americium-241. The other two drums had no detectable activity. The three drums will be shipped off-site for treatment and disposal. These programmatic actions were identified in LANL's 1999 SWEIS (DOE 1999b). The 2008 SWEIS impact analysis tiers from the 1999 SWEIS.

## **2.1.2 Non-Key Facility Proposed Projects**

Non-Key Facilities comprise all or the majority of the facilities at 30 of the 47<sup>8</sup> LANL technical areas. Non-Key Facilities house more than half the LANL workforce and include such important buildings and operations as the Center for Integrated Nanotechnology, the National Security Sciences Building, and the TA-46 Sanitary Wastewater System Plant.

Some of the LANL non-Key Facilities are designated as radiological or moderate-hazard facilities but do not meet the criteria for Key Facilities. There are no hazard category 2 or 3 nuclear facilities among the non-Key Facilities at LANL.

### **2.1.2.1 Global Security**

The proposed Nuclear Counterproliferation Building will enhance LANL's global security function, providing additional space for computing and assessment capabilities and offering a dedicated space for training United States government response teams.

---

<sup>8</sup> There are 46 contiguous technical areas at LANL. TA-74, previously a contiguous LANL technical area, had large land areas conveyed to Los Alamos County and transferred to the Pueblo de San Ildefonso. TA-57 at Fenton Hill in the Jemez Mountains is about 20 miles (52 kilometers) west of LANL. Leased space in Los Alamos and White Rock is collectively considered as TA-00.

### **Nuclear Counterproliferation Building**

DOE proposes to construct the Nuclear Counterproliferation Building at TA-3 (Figure 2-8). This office building would be approximately 37,000 gross square feet (3,400 square meters) in size and have a related parking lot. The new building would replace two existing buildings and take advantage of the existing utility infrastructure near the Nonproliferation International Security Center, the Metropolis Center, and the National Security Sciences Building. The Physical Science Research Complex was analyzed in the 2008 SWEIS (DOE 2008a) but was not included in a record of decision. The proposed Nuclear Counterproliferation Building would be constructed within the same footprint but would be considerably smaller than the Physical Science Research Complex.



**Figure 2-8. The Proposed Nuclear Counterproliferation Building**

#### **2.1.2.2 Physical Security**

Two proposed projects will support LANL's physical security function by enhancing training opportunities for LANL's protective force.

#### **TA-72 Firing Range Upgrade**

The outdoor firing range at TA-72 is proposed to have several upgrade projects to fulfill mission needs for the protective force at LANL. The scope of this project would upgrade Ranges 1, 2, 3, and 4; construct Range 5 (a 300-yard [274-meter] rifle range east of Range 4); install two ammunition storage buildings; install a new parking area with new access deceleration/acceleration lanes from East Jemez Road; construct a new warehouse; and provide improved drainage for the entire site.

#### **Protective Force Training Facility**

The protective force training facility would be constructed in TA-16 to replace the existing Protective Force training facility in the Los Alamos town site and move Protective Force

personnel closer to Laboratory areas. The building would be approximately 5,000 to 6,000 square feet (460 to 500 square meters) in size and would be collocated with other protective force training facilities.

### **2.1.2.3 Infrastructure**

The following is an overview of proposed infrastructure changes at LANL. These proposed activities include the refurbishment, replacement, or removal of existing infrastructure so that LANL operations are better positioned to meet future needs, challenges, and opportunities.

#### ***Electrical Transmission and Distribution System Upgrade***

A safe, reliable, and efficient electrical transmission and distribution system with sufficient capacity to support future programmatic missions at LANL is needed. There will be four 10-megavolt amperes circuits 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 a 15-kilovolt tie between the eastern technical area to TA-3 substations. This project would increase power import capacity and improve on-site transmission and distribution capacity. This new transmission and distribution system would connect the TA-3 substation and Eastern Technical Area substation to provide full system redundancy. See Section 2.4.4 for discussion about a 200-megawatt transmission line that will be evaluated through separate NEPA documentation.

#### ***Reconductor<sup>9</sup> Norton and Reeves Transmission Lines***

The existing import transmission lines would be removed and larger electrical conductors would be installed. The existing import capacity without reconductoring ranges from 116 megawatts to 143 megawatts. This project would increase the Norton and Reeves transmission lines import capacity to 200 megawatts.

#### ***Fire Stations***

DOE proposes to construct and operate two new fire stations. These new fire stations must meet required response times and provide transportation infrastructure to support egress of the fire station. DOE has two existing fire stations that serve LANL for fire-related emergencies. These 60-year-old stations have insufficient space and configuration to support current fire department operations, and they are in need of significant investment in order to comply with modern code and standards. Fire Station 1 (TA-3-41) does not satisfy the National Fire Protection Association 1710 response travel time goal of 4 minutes for emergency medical response to support the nuclear facilities. The location of Fire Station 5 (TA-16-180) also presents challenges to meeting the National Fire Protection Association 1710 response time. Vehicle bays have insufficient space to house current fire apparatus, equipment, and personnel. Facility heating, ventilation, and air conditioning; electrical; and plumbing systems have reached the end of their lives. Refurbishment of the existing facilities does not address long-term equipment requirements, same response time, and potential damage during seismic events (LANL 2016a). The existing fire stations would remain in service until the new fire stations become operational.

---

<sup>9</sup> Reconductoring means to replace a cable or wire on an electric circuit, typically a high-voltage transmission line, to maintain transmission efficiency and afford a greater electric-current-carrying capability.

### ***Footprint Reduction***

The goal of the Footprint Reduction Program is the shutdown and removal of facilities that have exceeded their useful lifetime. Since 2008, the Footprint Reduction Program has demolished or salvaged over 1,040,882 square feet (96,701 square meters) of aging facilities and will continue to remove aging structures. The 2008 SWEIS evaluated decontamination and decommissioning of buildings and was coordinated with footprint reduction efforts although the formal Footprint Reduction Program was organized after 2008.

### ***Los Alamos Canyon Bridge Refurbishment Project***

The Los Alamos Canyon Bridge (also known as the Omega Bridge) (Figure 2-9) was built in 1951. The bridge spans a 180-foot-deep (55-meter-deep) canyon and is one of three primary access routes to the main LANL campus. The 820-foot-long (250-meter-long) bridge connects LANL's main campus with the Los Alamos town site. The bridge, last renovated in 1992, requires significant refurbishment because of its age and heavy use. The Los Alamos Canyon Bridge Refurbishment Project would address corrective maintenance of the traffic deck, superstructure, and substructure.

### ***Re-purpose and Modernize Existing Facilities***

Improvements and modernization are planned for several facilities at TA-3 and other technical areas. Major facility renovations would include installation of new building automation systems; upgrades to heating, ventilation and air conditioning, lighting, electrical systems, and interior furnishings; and upgrades required for Americans with Disabilities Act access.

### ***Replacement of Office Buildings and Light Laboratories***

There is a need for additional light laboratories and offices at LANL. Modern laboratory and office buildings would consolidate global security, materials science, and chemistry and biological science research and development work from facilities currently outside of the main LANL campus. The 2008 SWEIS (DOE 2008a) analyzed several replacement office buildings and laboratories that were not selected in a record of decision. New on-site replacement office buildings would be constructed within TA-3 and other technical areas where new employees would work. Moderately sized, modular-type construction buildings are being considered.





**Figure 2-9. Omega Bridge in 1963 (top) and 2013 (bottom)**

### **Supplemental Environmental Projects**

In 2014, the state of New Mexico's Hazardous Waste Bureau issued compliance orders for New Mexico Hazardous Waste Act violations. One of the orders stemmed from the improper treatment of transuranic waste shipped from LANL to the Waste Isolation Pilot Plant. A settlement agreement (NMED 2016a) between DOE and the New Mexico Environment Department signed in 2016 includes five projects, which DOE intends to implement by 2019. However, a final completion date has not yet been determined.

- Roads – Improve transportation routes at LANL used for the transportation of transuranic waste to the Waste Isolation Pilot Plant.
- Triennial Review – Conduct an independent, external triennial review of environmental regulatory compliance and operations.
- Watershed Enhancement – Design and install engineering structures in and around LANL to slow storm water flow and decrease sediment load to improve water quality in the area.
- Surface Water Sampling – Conduct increased sampling and improve monitoring capabilities for storm water runoff in and around LANL with the results of sampling and monitoring shared with the public and the New Mexico Environment Department.
- Potable Water Line Replacement – Replace aging potable water lines and install metering equipment for LANL potable water systems. These improvements would reduce potable water losses, minimize reportable spills, and enhance water conservation.

### **Photovoltaic Array**

A 2008 renewable power generation feasibility study (LANL-LAC 2008) found that on-site renewable generation from solar photovoltaic arrays is commercially viable. Adequate sites are available at LANL to support up to 10 megawatts of solar photovoltaic power at a single location. Multiple sites were proposed as suitable mount locations for photovoltaic arrays. In 2015, a photovoltaic feasibility assessment (NREL 2015) further examined and analyzed the potential for photovoltaic installations at LANL and updated the 2008 economic analysis. In 2017, the TA-16 borrow pit was identified as the location for installation of a photovoltaic array; a second 10-megawatt site may also be selected.

#### **2.1.2.4 Manhattan Project National Historical Park**

The Manhattan Project National Historical Park was established and signed into law on December 19, 2014, through § 3039 of the Carl Levin and Howard P. “Buck” McKean National Defense Authorization Act for Fiscal Year 2015 (Act), Pub. L. No. 113-291. The Park is implemented through a *Memorandum of Agreement Between the United States Department of Interior and the United States Department of Energy for the Manhattan Project National Historical Park*, signed on November 10, 2015. The Memorandum of Agreement establishes roles and responsibilities between the two federal agencies for historic properties located within the Park. The Park includes significant historic properties at Los Alamos, New Mexico; Hanford, Washington; and Oak Ridge, Tennessee.

There are 17 historic LANL properties eligible for inclusion in the Park (Figure 1-2). Nine of these properties are currently included within the Park boundaries. The remaining eight properties will be reviewed annually for inclusion within the Park boundary. It is essential to

provide enhanced public access to buildings located within the Laboratory boundary while maintaining adequate security and safety. All 17 Park properties will be maintained, repaired, preserved, and restored in consultation with the New Mexico State Historic Preservation Office and the National Park Service. Enhanced public access for Pajarito Site will be achieved within the next 5 years, with limited public access beginning at the end of fiscal year 2018. Limited visitor access is included in future planning for other Park properties.

### 2.1.2.5 Forest and Vegetation Management

The Forest Management Plan (LANL 2014a) and updated Five-Year Wildland Fire Management Plan (LANL 2016b) define specific forest management treatments and desired final conditions that are more extensive in total treated area and recommend more tree removal than was analyzed in the 2000 Wildfire Environmental Assessment (DOE 2000a). Treatments would respond to continued risk of wildfire, changing environmental conditions, and new forest management science since 2000; proposed prescriptions are summarized in Table 2-4. Treatments would occur anywhere on undeveloped LANL land (~10,700 acres [~4,330 hectares]) provided there are no environmental resources restrictions, in addition to existing fuel treatment units (~11,000 acres [~4,451 hectares]). A new forest management working group that includes subject matter experts in wildland fire, fire protection and forest ecology, as well as field office representatives, would review and update these prescriptions as needed.

**Table 2-4. Forest and Vegetation Management Prescriptions**

Desired Final Conditions or Action	Prescription
Desired final tree density	10–125 trees per acre (4-51 trees per hectare) depending on forest cover type (see Appendix D)
Desired final canopy cover	<=10 percent for piñon, 10–50 percent for other cover types
Open areas and spacing heterogeneity	Tree spacing heterogeneity is desired. Open areas in drier sites can be up to 3 acres (1.2 hectares) if needed to achieve overall site heterogeneity for cover type (see Appendix D).
Desired final understory and species preferences	Retain climate variability resistant species (dry site adapted species).
Mulch/slash and ground fuels	Retain slash/mulch on bare soils.
Woody biomass disposition	Follow updated procedure for disposition (donating to forest products industry, composting, or re-using on-site for erosion control).
Snags and downed wood	Leave snags and downed wood in place. Remove trees that are hazardous to personnel or operations.
Watershed protection	Promote watershed protection through seeding, mulching, and applying other soil erosion best management practices on disturbed areas as needed.
Use of masticator*	Masticator used to reduce fuel to approximately 6 inches (15 centimeters) in height.
Use of clear cutting	No clear cutting is allowed although tree removal for fire roads can be approved
Use of herbicides	Is allowed as described in the Pesticide Discharge Management Plan (LANL 2016c).

\* A masticator can be used to thin road right-of-ways and fuel break areas more efficiently. The masticator cuts and mulches all vegetation to a height of 6 inches (15 centimeters) off the ground.

### **2.1.2.6 Environmental Management Legacy Contaminant Cleanup Program Activities**

In October 2015, DOE's Office of Environmental Management transitioned to the Legacy Cleanup Bridge Contract for the Office of Environmental Management-funded legacy cleanup activities at LANL. The mission under the Bridge Contract includes cleaning up legacy waste sites and protecting northern New Mexico's water resources, maintaining abovegrade stored contact-handled transuranic waste and other waste streams in a safe configuration until treatment and processing of wastes is planned and authorized, and developing and implementing a nuclear safety basis to treat the nitrate salt drum waste stream. The Office of Environmental Management issued a request for proposal in 2016. The evaluation and selection process continues in 2017 and will select a new contractor to take over this mission, including operations at TA-54, from the current LANL contractor, Los Alamos National Security, LLC. The Office of Environmental Management's primary goals include the following operational activities, all of which were analyzed in the 2008 SWEIS (DOE 2008a) as part of implementation of the 2016 Consent Order. The chromium cleanup operation received further NEPA evaluation in 2015 (DOE 2015b) and 2017 (DOE 2017a).

#### ***Chromium and RDX Interim Measures and Final Remedies***

In 2005 and 2006, groundwater samples collected from a groundwater monitoring well in the regional aquifer beneath Mortandad Canyon indicated the presence of chromium contamination. DOE initiated studies to test various methods of removing hexavalent chromium from groundwater and initiated an interim measure to prevent mitigation of the contaminant plume off-site. These initial phase activities were analyzed as general Consent Order actions within the 2008 SWEIS (DOE 2008a). DOE will continue testing and evaluating interim measures for the 8-year period specified in the 2015 environmental assessment for chromium contamination (DOE 2015b) and further analyzed in the supplement analysis (DOE 2017a). A final remedy will be developed and proposed as a result of the studies. Additional NEPA analyses will assess potential impacts associated with the final remedy. Groundwater characterization and monitoring beneath Cañon de Valle in TA-16 indicate that RDX (royal demolition explosive), primarily associated with historical machining of high explosives, has infiltrated into perched intermediate groundwater and locally exceeds the Environmental Protection Agency regional screening level for tap water. A final remedy for RDX will also be evaluated for NEPA compliance. Chromium and RDX groundwater plumes are shown in Figure 2-10.

#### ***Fenton Hill***

Fenton Hill at TA-57 is located about 20 miles (32 kilometers) west of LANL in the Jemez Mountains (Figures 2-11 and 2-12). The site has been used by LANL personnel since 1974, subject to an interagency agreement between DOE and the U.S. Forest Service. The site was originally developed for the Hot Dry Rock geothermal energy program, which was terminated in 1995, and subsequently used for astronomical studies. In 2012, LANL personnel demolished and removed several small structures, trailers, equipment pads, and equipment and implemented site stabilization. DOE and the U.S. Forest Service are now discussing additional facility removal and remediation of this site, including disposition of a 5-million-gallon (19-million-liter) water storage basin. Seven of the 10 sites are still under investigation, including settling ponds and sludge pits associated with the Hot Dry Rock geothermal energy program (LANL 2017a). Some astronomy activities may continue. DOE proposes to complete additional remediation of this former geothermal drilling site.



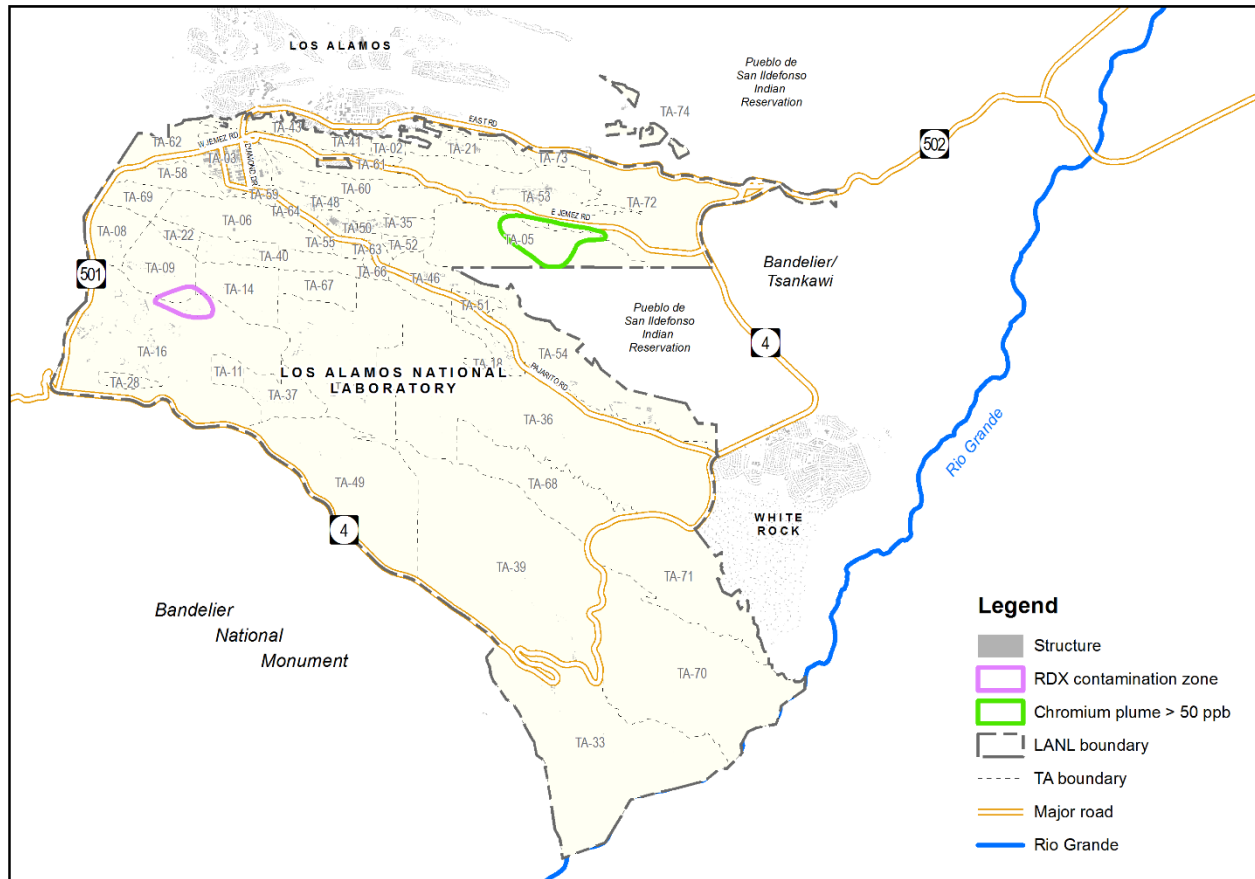
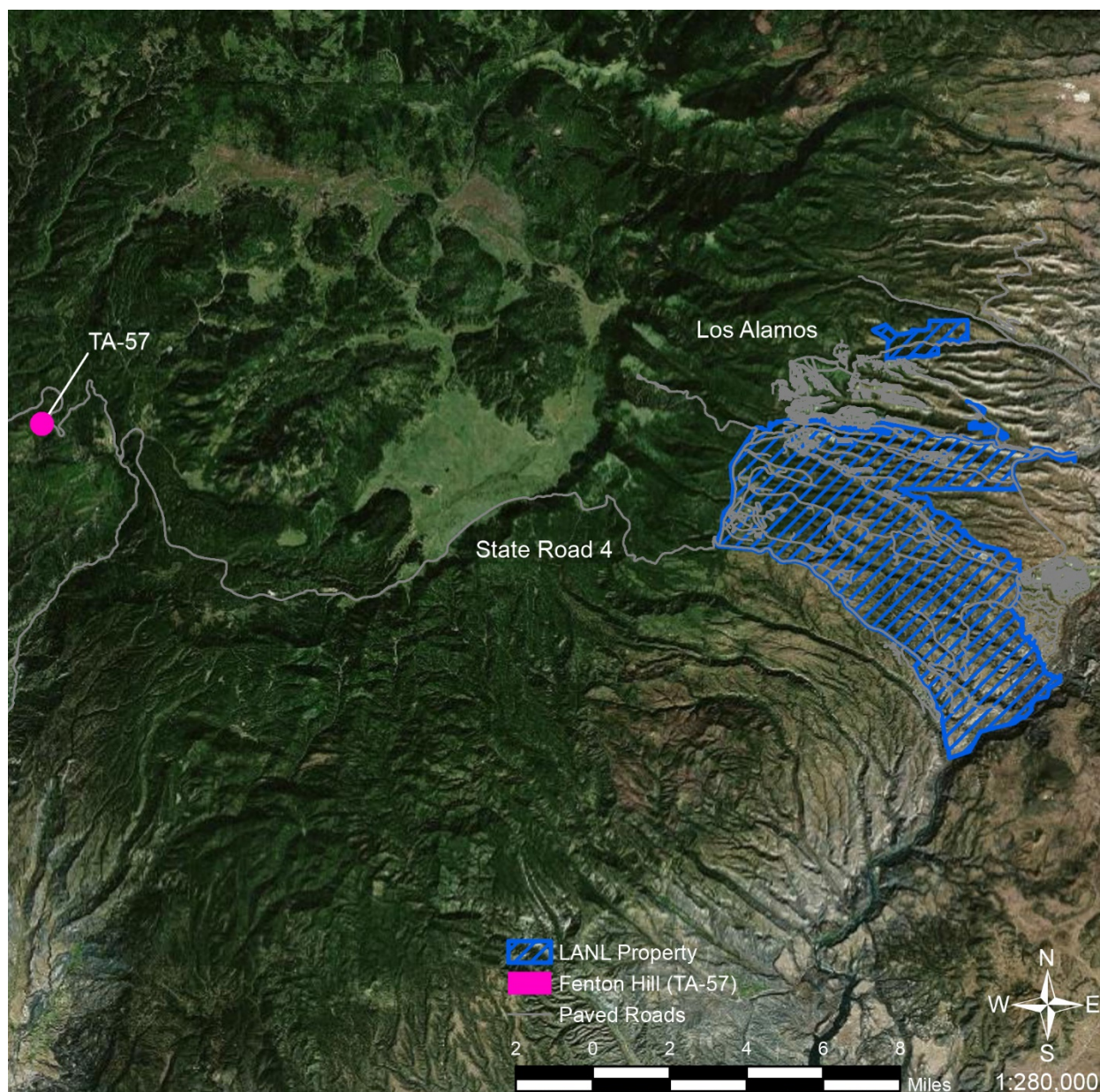


Figure 2-10. Chromium and RDX Groundwater Plumes at LANL



Figure 2-11. Fenton Hill site at TA-57





**Figure 2-12. Location of Fenton Hill at TA-57**

## **2.2 2008 SWEIS Projects Implemented**

The following sections summarize major projects included in the 2008 SWEIS and record of decision (DOE 2008a, 2008b) that have been initiated and/or executed.

### **2.2.1 Nuclear Materials Safeguards and Security Upgrades Project**

The 2008 SWEIS analyzed consolidation of operations onto the Pajarito Corridor. This consolidation has been initiated, and the Pajarito Corridor is undergoing infrastructure redevelopment. The Nuclear Materials Safeguards and Security Upgrades Project (NMSSUP) Phase II construction is complete, and the security protection systems are operational. The NMSSUP replaced existing security systems at TA-55 and TA-3-29, created a new fire alarm

monitoring system, and addressed malevolent vehicle threats. A categorical exclusion was issued in 1999 (DOE 1999c) for the initial project and for Phase II of the project. The 2008 SWEIS (DOE 2008a) included NMSSUP Phase II as part of the No Action Alternative, which was selected by DOE in its 2008 record of decision (DOE 2008b). Phase II of the project was completed in March 2014 (LANL 2015a).

## **2.2.2 Transuranic Waste Facility**

Appendix H.3 of the 2008 SWEIS (DOE 2008a) analyzed construction and operation of a new transuranic waste facility to replace capabilities at Area G for the storing, processing, and shipping of newly generated transuranic waste. The September 2008 record of decision included the new transuranic waste facility stating that “Planning, design, construction and operation of the Waste Management Facilities Transition projects... will replace LANL’s existing facilities for solid waste management. The existing facilities at Technical Area-54 for transuranic waste, low-level waste, mixed low-level waste and hazardous/chemical waste are scheduled for closure and remediation under the Consent Order” (DOE 2008b). TA-63 was analyzed as one of the site options. Construction of the facility at TA-63 was completed in 2017, and operations are scheduled to begin in 2018 (Figure 2-13).



**Figure 2-13. Transuranic Waste Facility at LANL**

## **2.2.3 TA-55 Reinvestment Project**

The TA-55 Reinvestment Project is intended to make seismic improvements and selectively replace and upgrade major facility and infrastructure systems at PF-4 and related structures at TA-55. Project Phases I, IIa, and IIb are complete, Phase IIc is in progress, and Phase III is in the planning process with construction projected to end around 2025 (DOE 2016b). The TA-55 Reinvestment Project was analyzed in Appendix G of the 2008 SWEIS and included in the September 2008 record of decision (DOE 2008a, 2008b). The goal of the project is part of a comprehensive, long-term strategy to extend the life of PF-4 at TA-55 so it can operate securely, safely, and effectively throughout its design life. Construction for TA-55 Reinvestment Project Phase I began in 2009 and addressed building support systems: mechanical (heating, ventilation, and air conditioning and high-efficiency particulate air [HEPA]), electrical (standby and emergency power), utility systems (process gasses and liquids, piping), safety, facility monitoring and control, structural components, and architectural components (i.e., coatings).



Phase II addressed the uninterruptible power supply, air dryers, confinement doors, criticality alarms, the vault water tank cooling system, seismic upgrades of glovebox stands, and exhaust stack sampling. Phase III includes replacement of the fire alarm system that supports PF-4. Additional facility system upgrades (e.g., replacement of fire suppression system, removal of the TA-55 office building from the fire water loop, upgrade of the PF-4 ventilation system) may take place in the future.

#### **2.2.4 Radioactive Liquid Waste Treatment Facility Upgrade**

The Radioactive Liquid Waste Treatment Facility upgrade was analyzed in the 2008 SWEIS, Appendix G (DOE 2008a) and included in both the 2008 and 2009 records of decision (DOE 2008b, 2009a). The 2008 SWEIS Proposed Action, Option 1 (DOE 2008a), was selected and includes construction of a new, single liquid waste treatment building. However, in 2011, DOE incorporated aspects of Option 2, which includes construction of two liquid waste treatment facilities at TA-50 to replace the existing Radioactive Liquid Waste Treatment Facility rather than construct one building for both transuranic and low-level liquid waste processing. Option 2 was analyzed in the 2008 SWEIS and any potential impacts associated with implementing this option were bounded by the 2008 SWEIS analysis (DOE 2008a). The Radioactive Liquid Waste Treatment Facility upgrade project began in 2008 and is ongoing.

The solar evaporation tanks were installed at TA-52 in 2012. The New Mexico Environment Department has not yet approved the tank permit application submitted in 2012. Construction of a replacement low-level Radioactive Liquid Waste Treatment Facility began in 2015, with a projected construction completion date in 2018. The design of the replacement Transuranic Liquid Waste Facility began in 2015, with an anticipated completion in 2020–2021.

#### **2.2.5 March 2005 Compliance Order on Consent**

On March 1, 2005, the New Mexico Environment Department, the New Mexico Attorney General, DOE, and the University of California entered into the final Consent Order. The Consent Order was issued in accordance with the New Mexico Hazardous Waste Act and the New Mexico Solid Waste Act. The Consent Order specified investigations, cleanup, and corrective measures to be conducted at LANL. Appendix I of the 2008 SWEIS (DOE 2008a) evaluated the environmental consequences of Consent Order actions through fiscal year 2016. Implementation of the Consent Order was part of the No Action Alternative. In June 2016, the New Mexico Environment Department, DOE, and LANL entered into the 2016 Consent Order, which superseded the 2005 Consent Order. The purpose of the 2016 Consent Order is to 1) provide a framework for current and future actions to implement regulatory requirements; 2) establish an effective structure for accomplishing work on a priority basis; 3) drive toward cost-effective work resulting in tangible, measurable environmental cleanup; 4) minimize the duplication of investigative and analytical work and documentation and ensure the quality of data management; 5) set a structure for the establishment of additional cleanup campaigns and milestones as new information becomes available and campaigns are completed; 6) facilitate cooperation, enhance information, and ensure participation of the parties; 7) provide for effective public participation; and 8) define and clarify its relationship to other regulatory requirements. The 2016 Consent Order does not change the investigations, cleanup, and corrective measures to be conducted at LANL and therefore is bounded by the 2008 SWEIS (DOE 2008a).

### **2.2.6 Decommissioning, Decontamination, and Demolition of TA-21**

TA-21 closure impacts were analyzed in the 2008 SWEIS, Appendix H.2, and selected in the 2009 record of decision, which states “DOE decided to implement elements of the Expanded Operations Alternative including: Completing the remediation and closure of Technical Area 21 Delta Prime (DP) Site with an emphasis on decommissioning, decontamination, and demolition and environmental remediation of MDAs” (DOE 2008a, 2009a). Decommissioning, decontamination<sup>10</sup>, and demolition began in 2009, and demolition of the Tritium Science and Fabrication Facility (TA-21-209) and the Tritium Systems Test Assembly (TA-21-155) was completed in 2010. Removal of building foundations, infrastructure, and environmental remediation in TA-21 continues. Decommissioning, decontamination, and demolition of the buildings at TA-21 is ongoing. TA-21 is part of the Land Conveyance and Transfer Program, and portions of the tract will be conveyed to Los Alamos County during the period of 2018 through 2022.

### **2.2.7 Decommissioning, Decontamination, and Demolition of TA-18**

Potential impacts associated with the TA-18 closure, including the disposition of the remaining Security Category III and IV capabilities and materials at TA-18, and the decommissioning, decontamination, and demolition of the buildings and structures at TA-18, were analyzed in the 2008 SWEIS, Appendix H.1, and stated in the 2009 record of decision as a specific project implemented as part of the Expanded Operations Alternative (DOE 2008a, 2009a).

Decommissioning, decontamination, and demolition began in 2009 and is ongoing. In 2014, new legislation established the Manhattan Project National Historical Park within the footprint of TA-18. Buildings associated with the park will not be decommissioned or demolished.

## **2.3 Projects Analyzed in a 2008 SWEIS Alternative but not Included in a Record of Decision**

The following projects were analyzed in the 2008 SWEIS (DOE 2008a) but were not included in the two records of decision (DOE 2008b, 2009a). These projects were analyzed as part of the Expanded Operations Alternative and cannot be undertaken unless DOE issues a record of decision or issues a decision based on other NEPA documentation. A decision could be made for some of these projects to begin within the next 5 years.

- Upgrade security—The Security-Driven Transportation Modifications Project would upgrade and enhance security in the Pajarito Corridor West. This project would include new parking lots with a bus transit system to transport employees to TAs 35, 48, 50, and

---

<sup>10</sup> 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. Decommissioning—the process of safely closing a facility to retire it from service after its useful life has ended. This process follows decontamination of the facility and releasing the property for refurbishment for other purposes or demolition. If demolished, the facility footprint is included in the Footprint Reduction Program and construction rubble is tracked for disposal.

55; new connector roads and intersections; improved walkways; and improved security barriers as needed.

- Consolidate staff—The TA-3 Replacement Office Buildings Project would consolidate staff currently located in temporary structures or aging permanent buildings throughout TA-3 or from other parts of LANL. The project would consist of up to nine new buildings and related parking infrastructure.
- Improve safety, security, and efficiency—Construct and operate a remote warehouse and truck inspection station at TA-72 adjacent to East Jemez Road in order to improve safety, security, and efficiency of LANL operations.
- Increase actinide materials operations—and the storage, shipping, and receiving of various actinide materials.
- Expand radiochemistry operations—including beryllium dispersion and mitigation assessments and atom trapping at TA-48.
- Increase pit production—the 2009 record of decision (DOE 2009a) set production of war reserve pits to not exceed 20 pits per year. The 2017 Stockpile Stewardship Management Plan (DOE 2016a) identifies a pit manufacturing capacity that can produce 10 war reserve pits in 2024, 20 pits in 2025, and 30 pits in 2026, followed by 50 to 80 pits per year by 2030. DOE evaluated the production of 80 pits per year in the Expanded Operations Alternative of the 2008 SWEIS (DOE 2008a) and may issue a new record of decision in the future for an increase in pit production. Production of certified pits in any particular year will fluctuate and may be less than the authorized amount due to production constraints; however, pit production would not exceed the number authorized in the record of decision.

## **2.4 Future Projects not Analyzed in this Supplement Analysis**

Proposals that do not specify location or do not have a defined scope are not included in the impact analysis but are briefly summarized below. These projects would require separate NEPA analysis.

### **2.4.1 Future Upgrades to Supercomputing Platforms**

The LANL Metropolis Center houses supercomputing platforms (Figure 2-14) that are upgraded on a routine basis. Computer simulation capabilities are required to support stockpile stewardship certification and assessments to ensure that the nation's nuclear stockpile is safe, reliable, and secure. DOE proposes to construct and operate Advanced Technology System 5 by 2025 and Advanced Technology System 7 in 2030. Power and cooling infrastructure for supercomputers beyond exascale<sup>11</sup> computing platforms will require greater amounts of water and power and will have a separate NEPA evaluation.

---

<sup>11</sup> Exascale, in this usage, refers to floating point operations per second (flops) as a standard measure of computer performance. Teraflops =  $10^{12}$  flops; petaflops =  $10^{15}$  flops; exaflops =  $10^{18}$ .



**Figure 2-14. The Trinity advanced technology system computing platform**

## **2.4.2 Matter and Radiation Interactions in Extremes**

The Matter and Radiation Interactions in Extremes (MaRIE) Project provides a capability to understand and test the response of materials at conditions necessary to determine the links between the microstructure of materials and performance in extreme weapon-relevant environments. There is currently a gap in science tools for stockpile stewardship between atomic-scale materials phenomena and the integral scale addressed by the DARHT Facility and U1a Complex.<sup>12</sup> The MaRIE Project would address this capability gap and simultaneously characterize how microstructure and materials respond in the middle scale or “mesoscale.”

A pre-conceptual reference design includes an x-ray light source at a coherent, brilliant, and high-repetition rate with enough energy to see into and through the mesoscale, including for high-Z materials, with multiple probes to maximize the science return. This preliminary concept incorporates several key elements including:

- A 12-giga electron volt (GeV) electron linear accelerator feeding a magnetic undulator to generate a high-energy photon x-ray free-electron laser
- Connections to the present LANSCE proton accelerator to allow use of those protons for radiography at MaRIE (Figure 2-15)

---

<sup>12</sup> The U1a laboratory at DOE’s Nevada National Security Site is located 960 feet (293 meters) underground. This facility serves as the site for sub-critical experiments. It includes horizontal tunnels, each about 0.5 mile (0.8 kilometer) in length, and vertical shafts. U1a was the first shaft.

- Experimental buildings with programmatic equipment where the x-rays, electrons, and protons dynamically interact with materials of interest in relevant environments
- Conventional facilities to house the accelerator, the experimental halls, a laboratory/office building, and various facility support utility buildings



**Figure 2-15. Rendition of MaRIE laboratory office building at LANSCE**

### **2.4.3 Plutonium Modular Approach**

The Plutonium Modular Approach would provide a means for ensuring the continued availability of sufficient high-hazard, high-security, laboratory space for conducting plutonium operations required for enduring stockpile stewardship and management activities at TA-55. If some of the higher hazard operations were installed in the modules, the approach would benefit the programs by expanding laboratory space and extending the lifetime of PF-4, which was placed in operation in 1978.

The National Defense Authorization Act of 2014 identified the mission need, whereby Congress authorized NNSA to pursue planning and design of a modular building strategy for future plutonium facilities at LANL. Currently, however, an analysis of alternatives is underway, commissioned by NNSA pursuant to the requirements of DOE Order 413.3B. The Plutonium Modular Approach is one of the alternatives being examined.

### **2.4.4 New Transmission Line**

A third transmission line would be constructed across Santa Fe National Forest property from the Public Service Company of New Mexico Norton Line Station to the DOE Southern Technical Area substation. This new line would provide additional capacity, operating up to 155 megawatts and built with a 200-megawatt rating.

### **2.4.5 Access and Related Fencing for Sites in the Manhattan Project National Historical Park**

LANL controls access to several Manhattan Project buildings that were integral to development of the atomic bomb. Those buildings were included within the establishment of the proposed



Manhattan Project National Historical Park. Fencing may be installed for the Park boundaries. Pajarito site would be the first Park area to allow public access.

## 2.5 Projects with Separate NEPA Analyses

This section provides information on all of the separate NEPA actions that have occurred since the 2008 SWEIS. These NEPA actions include categorical exclusions, supplement analyses, environmental assessments, and EISs.

### 2.5.1 Categorical Exclusions Issued

Pursuant to 10 CFR 1021 Subpart D, DOE issues categorical exclusions to those activities that do not individually or cumulatively have a significant effect on the human environment and therefore do not require either an environmental assessment or an EIS. Table 2-5 lists LANL projects and operations occurring since the 2008 SWEIS that have been granted categorical exclusions. More information about a specific categorical exclusion may be found at <https://energy.gov/nepa/categorical-exclusion-determinations-los-alamos-site-office>.

**Table 2-5. Categorical Exclusions Issued by DOE since September 2008**

Title	Date Issued
Construction of Grade Control Structures in Pueblo and DP Canyons	October 2009
Photovoltaic Array Reuse of Los Alamos County Landfill Location	March 2010
Pajarito Road Right-of-Way Shift at Technical Area-50 and Technical Area-55	April 2010
Fuels Research Lab at Technical Area-35-0455	June 2010
Replacement of Los Alamos Neutron Science Center (LANSCE) Operational Equipment	December 2010
Construction of Protective Force Indoor Live Fire Range at Technical Area-16	February 2011
Operation of the CLEAR Line at the Plutonium Facility	May 2011
Construction of Interagency Fire Center at Technical Area-49	January 2012
Installation of a Low Flow Unit at the Abiquiu Hydroelectric Facility	February 2012
Domestic Source Recovery – FY <sup>a</sup> 2012	April 2012
Domestic Source Recovery – FY 2013	November 2012
Storm Water Control Measures at Individual Permit Site, Technical Area-72	November 2012
Foreign Location Source Recovery – FY 2013	November 2012
Storm Water Control Measures at Individual Permit Site, TAs-36 and -68	May 2013
Transfer of Contact-Handled Mixed Transuranic Waste to Idaho National Laboratory for Processing and Shipment to Waste Isolation Pilot Plant	July 2013
Foreign Location Source Recovery – FY 2014	December 2013
Domestic Source Recovery – FY 2014	December 2013
Biosafety Level-2 (BSL-2) Laboratory in Building 3-216	December 2013
Well Pump Tests in Sandia and Mortandad Canyons – Phase II	May 2014
Domestic Source Recovery – FY 2015	December 2014
Foreign Location Source Recovery – FY 2015	December 2014
Lease Extension for the Operation of a Telecommunications Tower at Los Alamos National Laboratory	February 2015

Title	Date Issued
Pueblo Canyon Grade Control Structure Revitalization and Wetlands Stabilization at Technical Area-74	February 2015
Foreign Location Source Recovery – FY 2016	December 2015
Domestic Source Recovery – FY 2016	December 2015
Technical Area-3 Substation Replacement	February 2016
UAS <sup>b</sup> User Facility	June 2016
Domestic and Foreign Sealed Source Recovery Project	January 2017
Transmission Line (Norton Line) Grant of Easement for Right-Of-Way Contract Renewal	January 2017
Los Alamos County Landfill Cap Repair Project	March 2017
Los Alamos County Department of Public Utilities Proposed New Easement for the Construction and Operation of a Switchgear Substation, and Underground Duct Bank including Electric Lines and Related Utility Appurtenances	March 2017
Mortandad Wetland Enhancement	May 2017
Upper Cañon de Valle Watershed Enhancement Project	September 2017
TRU <sup>c</sup> Waste Mobile Loading Unit at TA-55	October 2017

<sup>a</sup> FY = fiscal year

<sup>b</sup> UAS = unmanned aircraft systems (drone)

<sup>c</sup> TRU = transuranic

### 2.5.1.1 Future Categorical Exclusions

DOE is in the early planning stages of some projects that, as currently designed, would qualify for DOE categorical exclusions. These projects are:

#### **TA-3 Power Plant**

DOE proposes to replace the 60-year-old TA-3 Power Plant with a new, more efficient combined heat and power plant. The existing combustion gas turbine generator will be retrofitted and used as the primary heat source. The new unit will be operated as a base-load machine and will provide up to 42 megawatts to meet the growing demand of LANL's mission. This project will significantly reduce greenhouse gas emissions and energy intensity at LANL.

#### **Emerging Threats Biosafety Laboratory**

DOE proposes to use a facility that was constructed in 2004 in TA-3 as an emerging threats laboratory. The facility was originally intended for biosafety level 3 activities; however, the emerging threats laboratory will be used only for biosafety level 2 activities. Existing activities and staff will move from the current laboratory, located in the health research laboratory, to the new building. One laboratory space is proposed to be used for select agents and one to be used for potential chemical and biological toxins. It is anticipated that the emerging threats biosafety laboratory will be in place around 2019.

#### **TA-3 Modular Biosafety Laboratory**

DOE proposes to install a pre-constructed modular facility at TA-3. The facility will be a biosafety level 2 laboratory and include offices and support spaces. Bioscience operations are currently conducted at the health research laboratory at TA-43, which is outside the LANL site

boundary. Existing biosafety level 2 operations and staff currently located at TA-43 will be moved into the new modular facility, which will allow for biosafety level 2 activities to be conducted within the LANL site boundary.

## **2.5.2 LANL NEPA Documents Published since 2008**

Since the issuance of the 2008 SWEIS (DOE 2008a), DOE determined that several projects would require additional or separate NEPA analyses and/or records of decision. These projects are summarized in this section and, where appropriate, described in more detail in this supplement analysis. Projects discussed in Section 1.2.2, DARHT, CMRR Nuclear Facility, and the environmental assessment for the chromium plume, are not repeated here.

### ***Supplement Analysis for Proposed Transport of Low-Level Radioactive Waste by Truck and Rail from Los Alamos National Laboratory (DOE 2009b)***

DOE prepared a supplement analysis to determine if the 2008 SWEIS (DOE 2008a) adequately bounded off-site transportation of low-specific-activity, low-level waste by a combination of truck and rail to EnergySolutions in Clive, Utah. DOE concluded that the proposed shipment of waste to EnergySolutions by truck and rail is bounded by the 2008 SWEIS transportation analysis.

### ***Special Resource Study Environmental Assessment for Manhattan Project Sites (DOI 2010a)***

The Manhattan Project National Historical Park Study Act was passed in 2004 and directed the Secretary of the Department of Interior to study the “preservation and interpretation of historic sites of the Manhattan Project for inclusion in the National Park System.” A special resource study/environmental assessment was completed in 2010. The four proposed sites for the Manhattan Project National Historical Park: Los Alamos, Hanford, Oak Ridge, and Dayton, were analyzed in this report to determine the national significance and suitability for inclusion in the National Park Service. A finding of no significant impact was issued and the Environmentally Preferred Alternative was selected (DOI 2010b) and included Los Alamos, New Mexico, in the new national historical park. DOE adopted the environmental assessment and the finding of no significant impact in 2010.

### ***Supplement Analysis: Transport and Storage of High-Activity Sealed Sources from Uruguay and other Locations (DOE 2011e)***

A supplement analysis that discusses transport and storage of high-activity sealed sources was prepared to assess whether there are substantial changes, or significant new circumstances or information, relevant to environmental concerns associated with continuing NNSA activities to recover and manage high-activity beta/gamma sealed sources relative to the analysis in the 2008 SWEIS and other relevant NEPA reviews [e.g., the Unirradiated Reactor Fuel Transport Environmental Assessment (DOE 2005a)]. This supplement analysis analyzed an aspect of the Off-Site Source Recovery Program not addressed in the 2008 SWEIS (i.e., transportation of sealed sources recovered from foreign countries to the United States through the global commons via commercial cargo aircraft) and examined the role of a commercial facility in Texas to manage these sources. The supplement analysis concluded that there was no need to prepare a SEIS or a new SWEIS.

DOE published an amended SWEIS record of decision (DOE 2011a) on July 20, 2011, in response to the supplement analysis.

***Supplement Analysis for the Environmental Assessment for the Lease of Land for the Development of a Research Park at Los Alamos National Laboratory (DOE 2014a)***

In April 2014, Samitaur Medical Technologies submitted a proposal to the Los Alamos Commerce and Development Corporation to construct and operate an accelerator production facility for producing medical isotopes within a parcel of the Los Alamos Research Park. A supplement analysis (DOE 2014a) to the environmental assessment (DOE 1997a) was completed in October 2014 to determine if additional NEPA documentation was required. The supplement analysis concluded that the projected environmental impacts would cause no significant change in the potential impacts identified in the 1997 environmental assessment. The existing lease between DOE and the Los Alamos Commerce and Development Corporation may require additional modifications and additional NEPA review.

***Supplement Analysis for Chemistry and Metallurgy Research Building Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico (DOE 2015c)***

DOE prepared this supplement analysis to evaluate mission needs and expected PF-4 program changes since the publication of the CMRR EIS (DOE 2003a). NNSA proposes to transfer analytic chemistry and materials characterization to two existing LANL facilities at TA-55: RLUOB and PF-4. NNSA also installed equipment in laboratory space that was then unequipped, and re-equipped three laboratory rooms within RLUOB for analytic chemistry and materials characterization activities with the revised limit for a radiological facility of 38.6 grams of plutonium-239-equivalent<sup>13</sup>. Existing laboratory space for analytic chemistry and materials characterization activities in PF-4 would be adjusted to accommodate activities that require quantities of radiological materials greater than those allowed in RLUOB. DOE issued the supplement analysis in January 2015 and determined that the modification of PF-4 and RLUOB to accommodate the full suite of analytic chemistry and materials characterization capabilities did not represent a substantial change in environmental impacts as described in the CMRR EIS (DOE 2003a).

***Supplement Analysis for a Proposal to Implement Safe Handling and Storage and to Conduct Processing Studies of 60 Transuranic Remediated Nitrate Salts Drums (DOE 2016c)***

In this supplement analysis, DOE proposed to conduct processing studies of remediated transuranic waste drums containing remediated nitrate salts, and to implement facility modifications to maintain safe handling and storage. The processing studies include implementing minor building modifications, installing a pressure release device with supplemental filtration, and conducting tests to determine appropriate treatment methodologies. DOE determined the environmental impacts of the proposed actions were bounded by the 2008 SWEIS analysis (DOE 2008a) and required no further NEPA documentation.

***Supplement Analysis for Treatment, Repackaging, and Storage of Nitrate Salt Waste Drums at Los Alamos National Laboratory, Los Alamos, New Mexico (DOE 2016d)***

DOE proposed to treat, repack, transport on-site, and store 89 transuranic waste drums in preparation for transport and ultimate disposition at the Waste Isolation Pilot Plant. These drums contain wastes referred to as remediated nitrate salts, and 29 drums of un-remediated nitrate

---

<sup>13</sup> The term plutonium-239-equivalent is used in this supplement analysis to refer to quantities of different radionuclides on a common health-risk basis. The mass or radioactivity of other radionuclides can be expressed in terms of the amount of plutonium-239 that would result in the same committed effective dose upon inhalation.

salts. After analyzing and considering potential environmental impacts associated with the proposed action, DOE determined there would be no substantial changes and the proposed actions are bounded by analyses presented in the 2008 SWEIS (DOE 2008a).

***Environmental Assessment for Radiological Laboratory/Utility/Office Building (RLUOB) designation as a Hazard Category 3 Nuclear Facility (DOE 2017b)***

DOE is currently preparing an environmental assessment (DOE 2017b) to evaluate an alternative reflecting recategorization of RLUOB to a material-at-risk limited hazard category 3<sup>14</sup> nuclear facility, with more analytic chemistry and materials characterization operations at RLUOB than those evaluated in the 2015 CMRR supplement analysis (DOE 2015c). NNSA identified the potential to designate RLUOB (Figure 2-16) as a hazard category 3 nuclear facility with an increased material-at-risk limit from 38.6 grams plutonium-239-equivalent to 400 grams plutonium-239-equivalent. This would allow certain laboratory capabilities previously planned for PF-4 to be installed in RLUOB. Fewer modifications to PF-4 would be required, while additional modifications would be made to RLUOB. Modifications to PF-4 and RLUOB would not require changes to the structure of either facility.



**Figure 2-16. The RLUOB Facility**

## **2.6 Project Cancellations and Deferrals**

Since the issuance of the 2008 SWEIS (DOE 2008a), several proposed projects that were discussed and analyzed in the SWEIS or in other NEPA documents have been cancelled or deferred. These projects are described in this section, but are not analyzed any further in this supplement analysis.

- The **CMRR Nuclear Facility** was the subject of a SEIS (DOE 2011d). Although DOE issued an amended record of decision in 2011 (DOE 2011f), construction of the CMRR Nuclear Facility was deferred in 2012 for at least 5 years. Construction of the CMRR

<sup>14</sup> DOE facilities that handle radioactive materials are classified as either hazard category 1, 2, or 3, depending only on the quantities of radioactive material in the facility. Safety basis requirements only apply to hazard category 1, 2, and 3 nuclear facilities (10 CFR 830; Appendix A).

Nuclear Facility was cancelled in 2015. NNSA developed a plutonium infrastructure strategy that involves the recategorization of RLUOB to a material at risk-limited hazard category 3 nuclear facility. The recategorization of RLUOB is discussed in the RLUOB environmental assessment, Section 2.5.2 (DOE 2017b).

- The **Radiological Sciences Institute**, including an Institute for Nuclear Nonproliferation Science, was proposed to replace aging research laboratories. This project has not been implemented, so related projects (e.g., relocation of the CMR Building Wing 9 hot cell to the Radiological Sciences Institute) have not occurred. Some of the Wing 9 hot-cell capabilities would move to Area A at LANSCE.
- The **Los Alamos Science and Engineering Complex**, referred to as the Science Complex in the 2008 SWEIS, was proposed to be constructed adjacent to the Los Alamos Research Park at TA-3. This project was cancelled in 2009.
- A high-energy x-ray **Radiography Facility at TA-55**, which would eliminate transfers of material between TA-8 and TA-55, was proposed for construction and operation. In 2006, DOE established an interim radiography capability in an existing area at the Plutonium Facility Complex and the proposed Radiography Facility. This project was cancelled in 2012.
- The **Physical Science Research Complex** was proposed to provide a new, modern facility to consolidate staff currently located throughout TA-3, the Target Fabrication Facility (TA-35), and LANSCE (TA-53) currently housed in temporary structures or aging permanent buildings in failing and poor condition. This project has not moved forward.
- The **remote warehouse and truck inspection station** at TA-72 would relocate existing operations to a new facility. The existing warehouse at TA-3 would be demolished or reused, and the existing truck inspection station on East Jemez road would be demolished. This project has not moved forward.
- An **increased research scope in radioisotope imaging** and therapy studies would lead to additional diversity in isotopes produced and separated at the Radiochemistry Facility. Work would be conducted at TA-48 and TA-59 to accommodate growth and increased research scope. This project has not moved forward.
- The 2008 SWEIS (DOE 2008a) analyzed the impacts of repairs to the LANSCE Facility for the **LANSCE Refurbishment Project**, including its operating systems and equipment. The proposed project included a series of refurbishment activities that would ensure reliable facility operations and improve operational effectiveness. The LANSCE Refurbishment Project is now the LANSCE Risk Mitigation Project.
- The 2008 SWEIS (DOE 2008a) analyzed the proposal to implement **security-driven transportation modifications** that would enhance security by restricting privately owned vehicles along portions of the Pajarito Corridor West between TA-48 and TA-63. The access for staff and visitors to this controlled area would be provided by an internal shuttle system linked to large parking lots at TA-48 and TA-63. The construction of bridges and new connecting roads from TA-35 to Sigma Mesa and Sigma Mesa to TA-61 was analyzed as auxiliary actions. None of these proposed actions were initiated.

## 3.0 AFFECTED ENVIRONMENT AND POTENTIAL IMPACTS TO RESOURCE AREAS

### 3.1 Overview of the Affected Environment

Principal changes in the affected environment since the issuance of the 2008 SWEIS include:

- **2009 Defense Nuclear Facilities Safety Board Recommendation.** The recommendation (DNFSB 2009) identified the need to execute both immediate and long-term actions to reduce risks posed by a seismic event at PF-4. The TA-55 Reinvestment Project is addressing the increased estimated probabilistic seismic hazard. LANL's Seismic Analysis of Facilities and Evaluation of Risk project is conducting a detailed, multiyear analysis of the seismic design loads on existing facilities within the Plutonium Complex. This comprehensive seismic hazard analysis provides a better understanding of the stresses on PF-4 and how it might react during a seismic event. The analysis incorporated new geologic data and computer modeling and predicts that a large earthquake occurring in north-central New Mexico every 2,500 years could cause significant damage to some parts of PF-4. The analysis also identified areas of the facility that, if strengthened, could increase its seismic response capability and would reduce the potential impact to the facility even under a worst-case seismic event. On January 3, 2017, the Defense Nuclear Facilities Safety Board recognized that numerous upgrades have been completed and other improvements will continue (DNFSB 2017).
- **Las Conchas Fire.** Although the June 2011 Las Conchas fire burned substantial areas of land adjacent to and upstream of LANL, only 1 acre (0.4 hectares) of LANL land burned (Figure 3-1). However, LANL closed for approximately 8 workdays<sup>15</sup>. Erosion controls that help manage increased runoff and flooding from burned areas in the region surrounding LANL have been installed. DOE determined that post-fire actions were bounded by the 2008 SWEIS and did not require additional NEPA analyses like that completed after the Cerro Grande fire in 2000 (DOE 2000b).
- **Revised Supplemental Guidance to DOE Standard 1027.** In November 2011, NNSA issued revised supplemental guidance (DOE 2011g)<sup>16</sup> for implementation of DOE Technical Standard 1027. This guidance incorporated the latest scientific principles on radionuclide behavior in the body and dose conversion factors issued by the International Council on Radiation Protection (ICRP 1995). Incorporating Standard 1027 at LANL resulted in a change to allowable inventory limits for many radionuclides. For example, the allowable limit of plutonium-239 at a radiological facility increased from 8.4 grams to 38.6 grams.

<sup>15</sup> For reference, the Cerro Grande fire in May 2000 caused a Laboratory closure of approximately 13 workdays.

<sup>16</sup> Provides updates to original document DOE Standard 1027, "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports," December 1992, Change Notice No. 1, September 1997.





**Figure 3-1. Las Conchas Fire near TA-3 at LANL**



- **Flooding in September 2013.** In early September 2013, heavy rainfall caused extreme flooding over much of the LANL site. More than 7 inches (18 centimeters) of rain fell in a 5-day period (Bruggeman and Dewart 2013) in areas affected by the Las Conchas fire. The Laboratory did not close during this event. Although Laboratory facilities on mesa tops suffered relatively little damage, canyons on and around Laboratory property were subject to damaging floods. Flooding affected canyons, trails, monitoring stations, and a variety of other mission activities and resources. The storm waters moved a large amount of sediment down the canyons; however, four canyon-bottom grade-control structures trapped much of the sediment, thereby maintaining stability in key portions of canyons and reducing the force of the water moving downstream.
- **Federally Listed Species.** In September 2013, the Jemez Mountains salamander (*Plethodon neomexicanus*) was federally listed as an endangered species (DOE 2013b). The LANL Habitat Management Plan was revised in 2014 to include the updated listing for the Jemez Mountains salamander and its habitat. The Jemez Mountains salamander has been found on LANL property (Hathcock et al. 2015). The LANL Habitat Management Plan was updated again in 2015 to include changes in the federal designation for the yellow-billed cuckoo (DOE 2014b) and the New Mexico meadow jumping mouse (DOE 2014c). Both of these species occur or have designated habitat in areas close to the LANL boundary but have not been identified on LANL property to date (LANL 2014b, 2015b).
- **Land Conveyances and Transfers.** Since issuance of the 1999 LANL SWEIS (DOE 1999b), DOE has conveyed 920 acres (370 hectares) of property to Los Alamos County and 6 acres (2.43 hectares) to the Los Alamos School District and has transferred 2,018 acres (817 hectares) of property to the Bureau of Indian Affairs to be held in trust for the Pueblo de San Ildefonso (Figure 3-2) (DOE 1999d). These areas are no longer part of the LANL footprint, thus shrinking the size of the Laboratory. Several areas conveyed to Los Alamos County have been subsequently developed.
- **Effects of Global and Regional Trends in Climate.** Northern New Mexico is experiencing rising temperatures, a downward trend in precipitation, a decrease in snowfall, and a shorter snowfall season (LANL 2017b) as a result of trends in regional and global climate. These trends are not caused by LANL operations or projects. However, such impacts are expected to continue into the future both at LANL and in the surrounding area (IPCC 2014a). LANL continues its efforts to reduce its environmental impacts and to mitigate the local effects of these changes. Effects of trends in climate are identified in Section 3.17.

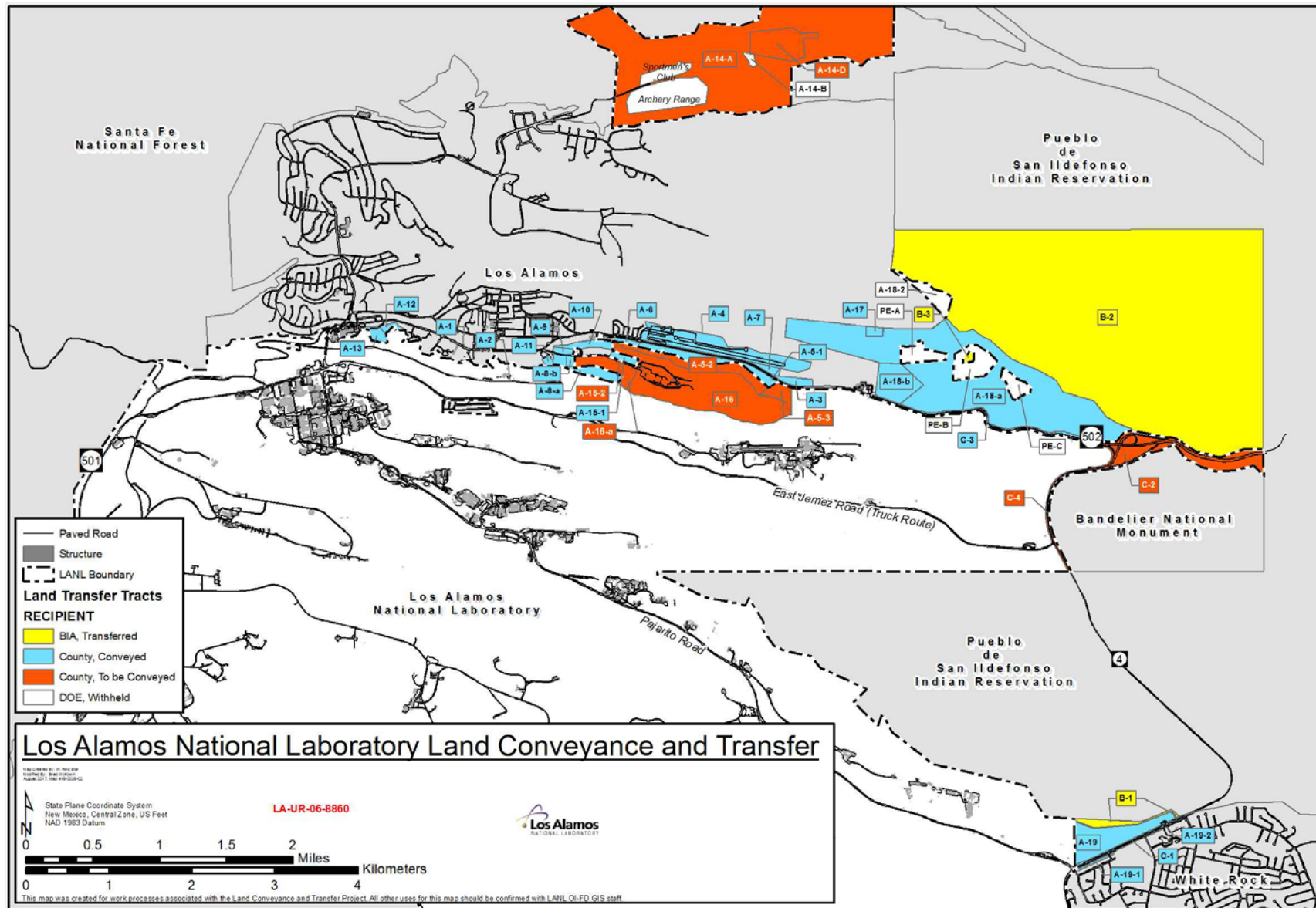


Figure 3-2. Land conveyance and transfer map

### **3.1.1 Potential Impacts to Resource Areas**

The following resource areas and potential environmental impacts are discussed in this chapter:

- land resources and visual environment
- geology and soils
- water resources
- air quality
- noise
- ecological resources
- human health and worker health/safety
- cultural resources
- socioeconomics
- infrastructure
- waste management
- traffic and transportation
- environmental justice
- environmental remediation
- facility accidents
- climate trends and greenhouse gases
- forest health and wildland fire preparedness
- mitigations

This section discusses impacts during the period from 2008 through 2017 and changes in potential impacts resulting from proposed projects and modifications in site operations likely to be implemented at LANL through the year 2022. Potential environmental impacts for each resource are compared with impacts analyzed in the 2008 SWEIS or other NEPA documents.

Table 3-1 identifies DOE-proposed projects at LANL that may influence or be influenced by the affected environment.

## **3.2 Land Resources and Visual Environment**

LANL is surrounded by other federal agencies including the National Park Service, the U.S. Forest Service, and the Bureau of Land Management, as well as the Pueblo de San Ildefonso and Santa Clara Pueblo. The Laboratory supports, sponsors, and engages its neighbors to promote common land use goals and interests and to resolve cross-jurisdictional issues.

### **3.2.1 Land Use**

Most of LANL consists of undeveloped grassland, shrubland, woodland, and forests that serve as security and safety buffer zones and lands for future uses. The topography of LANL makes much of the land within the approximate 40 square miles (25,600 acres [10,360 hectares]) not readily developable.

**Table 3-1. Environmental Factors Summary for LANL Projects**

LANL Projects	Environmental Factors																	
	Land Resources and Visual Environment	Geology and Soils	Water Resources	Air Quality	Noise	Ecological Resources	Human Health and Worker Health and Safety	Cultural Resources	Socioeconomics	Infrastructure	Waste Management	Traffic and Transportation	Environmental Justice	Environmental Remediation	Facility Accidents	Climate Trends and Greenhouse Gases	Forest Health and Wildland Fire Preparedness	Mitigations
Increased Pit Disassembly/Conversion and Disposition				■			■		■		■	■	■		■			
Parking structure at TA-50 and support office building(s) along Pajarito Corridor	■	■	■	■	■	■		■		■	■							
CMR Wing 9 Hot Cell							■				■				■			
Large-Vessel Handling				■	■		■				■				■			
Energetic Materials Characterization Facility	■	■	■	■	■	■	■	■	■	■					■			
Scorpius Integrated Test Stand			■	■	■		■			■					■			
DARHT Vessel Cleanout Facility	■	■	■	■	■	■	■	■		■	■				■			
High-Power Beam Delivery at Area A				■			■			■	■							
Hot-Cell Work in Area A				■			■			■	■				■			
Shockwave Experiments at the Proton Radiography Facility				■			■			■	■							
Electron Beam Test Facility				■	■		■			■	■				■			
Radiochemistry Laboratory Hot-Cell Facility				■			■			■	■				■			
Materials Science and Technology Fuel Fabrication Facility				■			■			■	■							
Expand Clean Room Activities at the Radiochemistry Facility							■											
Biosafety Level 2 Radiological Laboratory							■	■			■							
Alternatives Analysis and Strategy for Certain Shafts at TA-54	■	■	■				■				■		■	■				

LANL Projects	Environmental Factors																
	Land Resources and Visual Environment	Geology and Soils	Water Resources	Air Quality	Noise	Ecological Resources	Human Health and Worker Health and Safety	Cultural Resources	Socioeconomics	Infrastructure	Waste Management	Traffic and Transportation	Environmental Justice	Environmental Remediation	Facility Accidents	Climate Trends and Greenhouse Gases	Forest Health and Wildland Fire Preparedness
Difficult Waste Streams (flanged tritium waste containers, irradiators, LANSCE Cooling System Waste Water, LANSCE targets, Fort St. Vrain, animal tissue)							■				■	■					
Nuclear Counterproliferation Building	■	■	■	■	■				■	■	■						
TA-72 Firing Range upgrade	■		■	■	■	■		■		■	■						
Protective Force Training Facility	■	■	■	■	■	■		■		■	■						
Infrastructure – Construct two new fire stations, upgrade electrical transmission and distribution system, re-conductor Norton and Reeves transmission lines, reduce footprint, refurbish Los Alamos Canyon bridge, re-purpose and modernize existing facilities, replace office buildings and light laboratories, implement Supplemental Environmental Projects, and install photovoltaic array	■	■	■	■		■	■	■	■	■	■	■	■	■			■
Manhattan Project National Historical Park	■		■				■	■	■			■					
Forest Health and Wildland Fire Preparedness	■	■	■			■	■	■						■		■	■
Environmental Management Legacy Contaminant Cleanup Program Activities (Chromium and RDX Final Remedies; Fenton Hill)			■			■	■	■	■	■	■		■	■			

### **3.2.1.1 2008 SWEIS Analysis**

According to the 2008 SWEIS, in 2005 LANL occupied about 40 square miles (25,600 acres [10,360 hectares]) spread across 48 technical areas (DOE 2008a). LANL facilities comprised 8.6 million gross square feet (799,000 square meters) of laboratory, production, administrative, storage, and other space. There were 952 permanent structures, 373 temporary structures (e.g., trailers, transportables, and transportainers), and 897 miscellaneous structures (e.g., sheds and utility structures). About 2,400,000 gross square feet (223,000 square meters) of space in 409 buildings housed personnel in offices. Leased office space in White Rock and Los Alamos totaled 450,000 gross square feet (42,000 square meters). The 2008 SWEIS reported that 43 percent of the structures at LANL (not including leased or rented space) were more than 40 years old and 52 percent were more than 30 years old. The 2008 SWEIS projected 351,000 gross square feet (32,600 square meters) of excess space would be decontaminated, decommissioned, and demolished.

The 2008 SWEIS assumed the continued conveyance and transfer of lands from LANL to Los Alamos County, the Los Alamos School District, the New Mexico Department of Transportation, and the Bureau of Indian Affairs to be held in trust for the Pueblo de San Ildefonso under Public Law 105-119 (42 USC 2391) (DOE 1999d). The 2008 SWEIS noted that these land conveyances and transfers could impact site and regional land use.

Environmental remediation under the Consent Order, which was to be implemented under all 2008 SWEIS alternatives, was also projected to impact land use.

The 2008 SWEIS stated that records of decision for the Complex Transformation SPEIS (DOE 2008d) could also result in impacts to land use.

### **3.2.1.2 Changes since the 2008 SWEIS (2008 through 2017)**

Currently, LANL buildings and facilities total approximately 8.2 million gross square feet (762,000 square meters) (LANL 2017c), including about 850 permanent and 500 temporary and miscellaneous structures. Approximately 40 percent of the square footage at the site is laboratory or production space; the remaining square footage is administrative, storage, and other space. About 40 percent of LANL facilities are more than 50 years old. Leased space accounts for approximately 40 buildings. DOE leases spaces in Los Alamos, White Rock, and Carlsbad, New Mexico.

From 2008 to 2017, over 1 million gross square feet (94,000 square meters) of excess space was eliminated at LANL (Table 3-2), a number much greater than the 356,000 square feet (33,100 square meters) projected in the 2008 SWEIS (DOE 2008a).

Before any transfer or conveyance actions, DOE owned approximately 45 square miles (117 square kilometers) (28,800 acres [11,700 hectares]). To date, approximately 4.7 square miles (12 square kilometers) (3,000 acres [1,200 hectares]) have been conveyed or transferred under Public Law 105-119. Approximately 3.2 square miles (8.1 square kilometers) (2,000 acres [810 hectares]) were transferred to the Bureau of Indian Affairs to be held in trust for the Pueblo de San Ildefonso, and approximately 1.4 square miles (3.7 square kilometers) (920 acres [370 hectares]) of land have been conveyed to Los Alamos County and the Los Alamos School District (DOE 1999d). The resulting DOE land ownership is about 40 square miles (104 square



kilometers) (25,600 acres [10,360 hectares]). The original 10 tracts have been subdivided. Table 3-3 provides information on the remaining tracts.

**Table 3-2. Reduction in Gross Square Feet at LANL since 2008**

Year	Elimination (gross square feet)*	Cumulative (gross square feet)*
2008	79,000	79,000
2009	53,835	132,835
2010	268,902	401,737
2011	425,343	827,080
2012	46,407	873,487
2013	49,032	922,519
2014	36,672	959,191
2015	29,025	988,216
2016	27,345	1,015,561

\* Multiply square feet by 0.092903 to get square meters.

**Table 3-3. Tracts Analyzed in the Land Conveyance and Transfer EIS  
that Remain to be Conveyed**

Land Tract	Approximate Acres/Hectares	Location
TA-21/A-16	250/101	On the eastern end of the mesa where the central business district of Los Alamos is located. To be subdivided into smaller sub-tracts.
Rendija Canyon/A-14a,c,d	890/360	North of and below the Los Alamos Barranca Mesa residential subdivision. Deed restrictions require resolution before conveyance.
Airport-3 South 2/A-5-2	44/18	The Airport Site, situated north of TA-21 and south of State Road 501.
Airport Road South 2/A-5-3	15/6	Part of the Airport-3 (South) tract, situated east of A-5-2, north of TA-21 and south of State Road 501
TA-21 West 2/A-15-2	1/0.4	DP Road
C-2 and C-4	150/61	State Road 501 (White Rock "Y" and Main Hill Road)

In January 2012, DOE issued an amended record of decision (DOE 2012a). This document addressed the remaining acreage that became available for conveyance to Los Alamos County after environmental remediation was conducted as part of the 2009 American Recovery and Reinvestment Act.

Additional projects completed since issuance of the 2008 SWEIS that were examined for their potential to impact land resources include, but are not limited to:

- Decontamination, decommissioning, and demolition of TA-18
- Decontamination, decommissioning, and demolition of TA-21

- Construction of the Transuranic Waste Facility
- Construction of RLUOB
- Consent Order cleanup projects including Material Disposal Area B and the chromium project
- Expansion of TA-49 training facilities
- Construction of the Sanitary Effluent Reclamation Facility and expansion
- The Protective Force Indoor Firing Range and Tactical Training Facility
- Installation of a photovoltaic solar array on the former Los Alamos County landfill
- Construction of the National Park Service-operated Interagency Wildfire Center at TA-49
- Implementation of the Consent Order continues pursuant to revisions made in 2016
- Establishment of the Manhattan Project National Historical Park in December 2014; the park includes areas within LANL (Public Law 113-291, Section 3039; 16 USC 410uuu) and has the potential to impact land use.

### **3.2.1.3 Analysis of Projected Changes (2018 through 2022)**

New, modified, or continuing projects (Table 3-1) considered for land resources include: 1) the parking structure at TA-50 and support office building(s) along Pajarito Corridor, 2) the Energetic Materials Characterization Facility, 3) the DARHT Vessel Cleanout Facility; 4) the Nuclear Counterproliferation Building, 4) the TA-72 Firing Range Upgrade, 5) the Protective Force Training Facility, 6) infrastructure modernization including the Supplemental Environmental Projects and Photovoltaic Array, 7) the Manhattan Project National Historical Park, and 8) Forest Health and Wildland Fire Preparedness. During the next 5 years, 2018 through 2022, footprint reduction will continue. DOE will also continue to consolidate operations on the Pajarito Corridor.

Land conveyances will continue under Public Law 105-119. Remaining tracts, about 2.1 square miles (5.3 square kilometers) (1,320 acres [534 hectares]), will be conveyed by 2022.

The 2016 Consent Order will continue to be implemented throughout LANL. Once remediated, some lands may become available for redevelopment. Lands being cleared within developed areas, particularly at TA-3, may be suitable for infill and/or brownfield redevelopment to accommodate new facilities.

### **3.2.1.4 Conclusion**

The new, modified, and continuing projects and modifications in site operations through 2022 would not significantly change land use at LANL and are consistent with the impacts analyzed in the 2008 SWEIS; therefore, further supplementation of the 2008 SWEIS for potential impacts to land use is not needed.

## **3.2.2 Visual Environment**

Construction projects may result in short-term visual impacts. Tree removal that allows aboveground structures and facilities to become visible would result in long-term impacts to the

visual environment. Soil or groundwater remediation activities would not have long-term visual impacts.

### **3.2.2.1 2008 SWEIS Analysis**

The 2008 SWEIS analyzed visual resource impacts resulting from the Cerro Grande fire, drought, tree-thinning, proposed construction, night lighting, and proposed remediation of contaminated areas. Laboratory workers and members of the public were considered in the analysis.

### **3.2.2.2 Changes Since the 2008 SWEIS (2008 through 2017)**

Continued drought and tree-thinning, construction, and remediation of some contaminated areas has occurred since 2008. The Las Conchas fire burned some additional tree cover on the flanks of the Jemez Mountains and reburned some of the Cerro Grande fire areas in 2011. However, the viewscape changes are similar to the Cerro Grande fire's effects and the visual impacts identified in the 2008 SWEIS. Regrowth of shrubby vegetation and emergence of aspen trees in the Cerro Grande fire scar has lessened the starkness that was apparent in the years immediately following the Cerro Grande fire.

Although fuels mitigation efforts have continued and drought has resulted in additional tree loss, the changes in visibility of structures on LANL property have been negligible. Because LANL roads were closed to public access, fewer visitors are exposed to industrial areas at LANL. Removal of buildings at TA-21 has decreased visibility of LANL operations along the public roads entering the Los Alamos town site. LANL has begun to remove the aboveground storage domes at the Solid Radioactive and Chemical Waste Facility at TA-54, but the remaining domes continue to be visible from many points in the surrounding region.

The 2008 SWEIS projected that remediation of contaminated areas would open up vistas in the immediate vicinity. Since the remediations projected in the 2008 SWEIS have not yet been completed, the resulting viewshed effects have not yet been fully realized except in the vicinity of TA-21. Removal of buildings at TA-21 has opened the view from the Main Hill Road toward the south. The industrial character of that area of the Laboratory has also been reduced.

Since the issuance of the 2008 SWEIS, the New Mexico Night Sky Protection Act [74-12-1 to 74-12-10 NMSA 1978] requirements have been incorporated into the LANL Engineering Standards. This Act, enacted in 1999, regulates outdoor night lighting fixtures to preserve and enhance the New Mexico's dark sky while also promoting safety, conserving energy, and preserving the environment for astronomy.

### **3.2.2.3 Analysis of Projected Changes (2018 through 2022)**

New, modified, or continuing projects (Table 3-1) considered as part of the visual environment include: 1) installation of a photovoltaic array at TA-16 and 2) Forest Health and Wildland Fire Preparedness.

DOE will continue implementing the Consent Order. Since the 2008 SWEIS analyzed a more extensive full remediation of the contaminated areas, the potential environmental impacts related to this less-extensive remediation are bounded by the potential impacts analyzed in the 2008 SWEIS. Additionally, as waste stored in the TA-54 domes is shipped off-site, the domes will be removed, reducing LANL's visibility in the surrounding area.

#### **3.2.2.4 Conclusion**

The new, modified, and continuing projects and modifications in site operations would not significantly change the visual environment at LANL and are consistent with the impacts analyzed in the 2008 SWEIS; therefore, additional supplementation of the 2008 SWEIS for potential environmental impacts to visual environment is not needed.

### **3.3 Geology and Soils**

LANL sits on the Pajarito Plateau (Figure 3-3) below the Jemez Mountains along the western edge of the Rio Grande rift valley. The Española Basin is located in the Rio Grande watershed in northern New Mexico. Figure 3-4 shows the Española Basin with LANL located in the southwestern portion. The Española Basin comprises an aquifer system that currently contains the primary source of water for LANL. Soil erosion is discussed in Section 3.18, Forest Health and Wildland Fire Preparedness.

Potential mineral resources at LANL consist of rock and soil for use as backfill or borrow material, or for construction of waste unit covers. Rock and mineral resources, including sand, gravel, and volcanic pumice, are mined throughout the surrounding counties. Sand and gravel are primarily used at LANL for road building, and pumice is used for landscaping. The welded<sup>17</sup> and harder units of the Bandelier Tuff are suitable as foundation aggregate, structural and ornamental stone, and insulating material. Volcanic tuff is used as aggregate in soil-cement sub-base for roads (DOE 2008a).

Much of the LANL site is undeveloped because of topography and the need for buffer areas between technical areas, and the majority of the site is not disturbed. There is a potential for seismic impacts to LANL facilities. Figure 3-5 shows seismic faults, including the three largest: Pajarito fault, Rendija Canyon fault, and Guaje Mountain fault (Kelley 2017).

The East Jemez Road borrow pit in TA-61 is the only borrow pit currently in use at LANL and is used for soil and rubble storage and retrieval. This borrow pit is cut into the upper Bandelier Tuff. There are numerous commercial off-site borrow pits and quarries near LANL that primarily produce sand and gravel. Eleven pits or quarries are located within 30 miles (48 kilometers) of LANL, which is the distance considered the upper economically viable limit for hauling borrow material to LANL (DOE 2015a).

#### **3.3.1 2008 SWEIS Analysis**

Actions associated with implementing the Consent Order and facility and construction projects were proposed in the 2008 SWEIS and were analyzed for impacts to geology and soils. The 2008 SWEIS projected that approximately 3.2 million cubic yards (2.4 million cubic meters) of soil and rock would be disturbed (although 90 percent was previously disturbed) if all of the Consent Order projects were completed (DOE 2008a). The 2008 SWEIS noted that, under the Consent Order, material disposal area remediation could require an additional 1.2 to 2.5 million cubic yards (920,000 to 1.9 million cubic meters) of crushed tuff and other materials for evapotranspiration covers if the Capping Option was selected. About 2.2 million cubic yards

---

<sup>17</sup> Welded is a term that refers to depositional heat consolidation and compaction of volcanic ash when it is erupted.

(1.7 million cubic meters) of backfill and surface materials would be needed under the Removal Option.

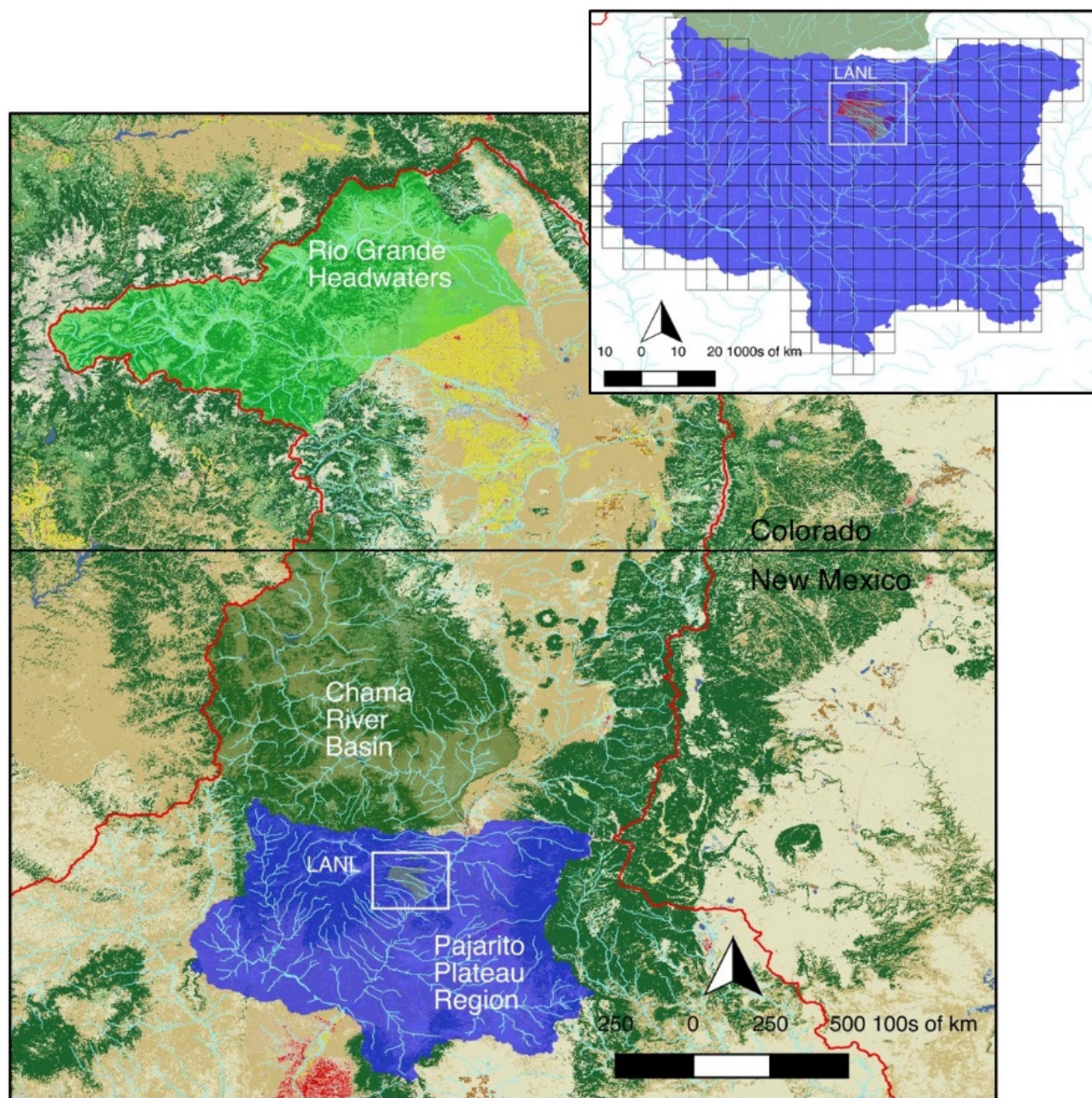


Figure 3-3. Pajarito Plateau around LANL



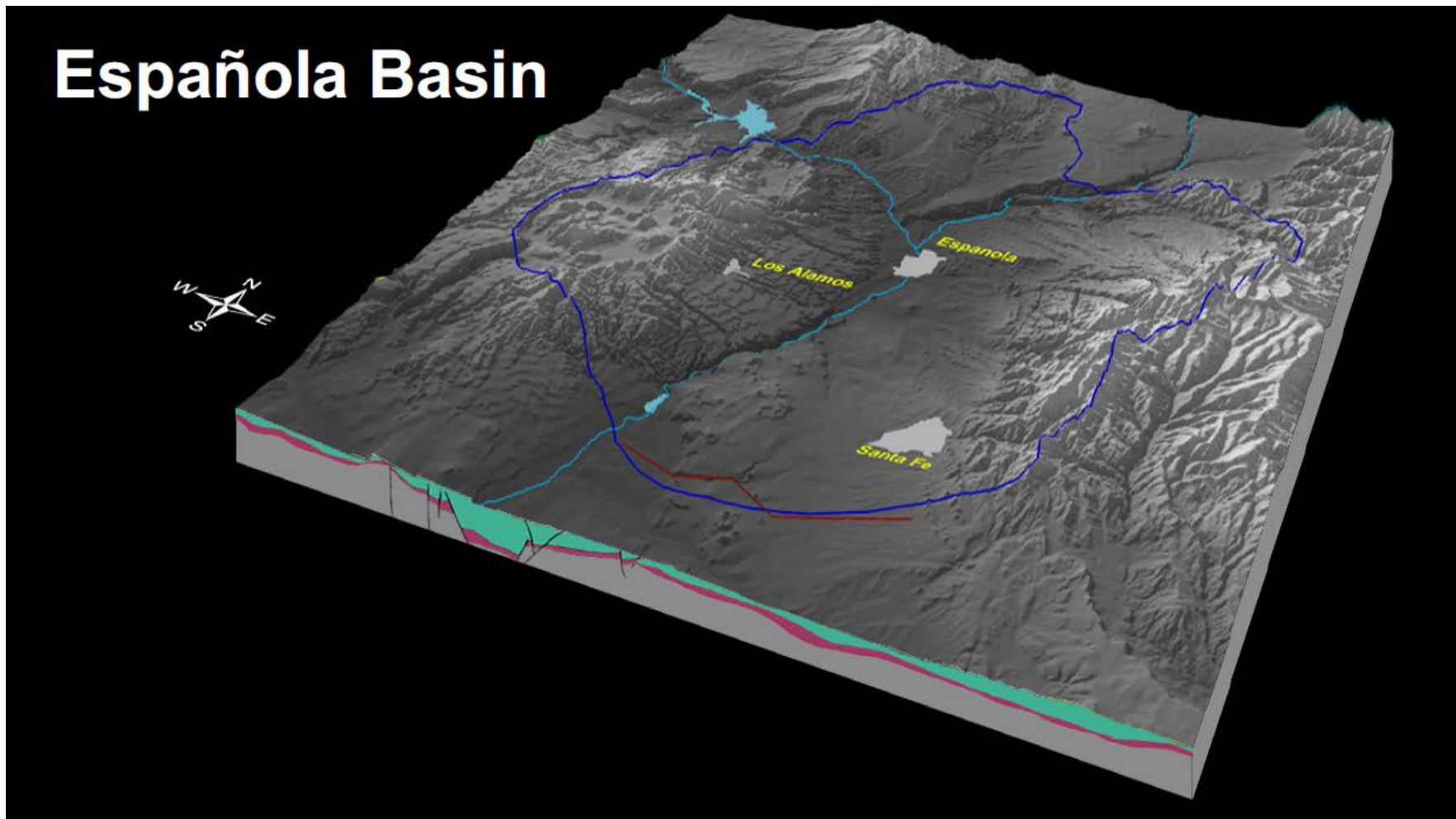


Figure 3-4. Española Basin



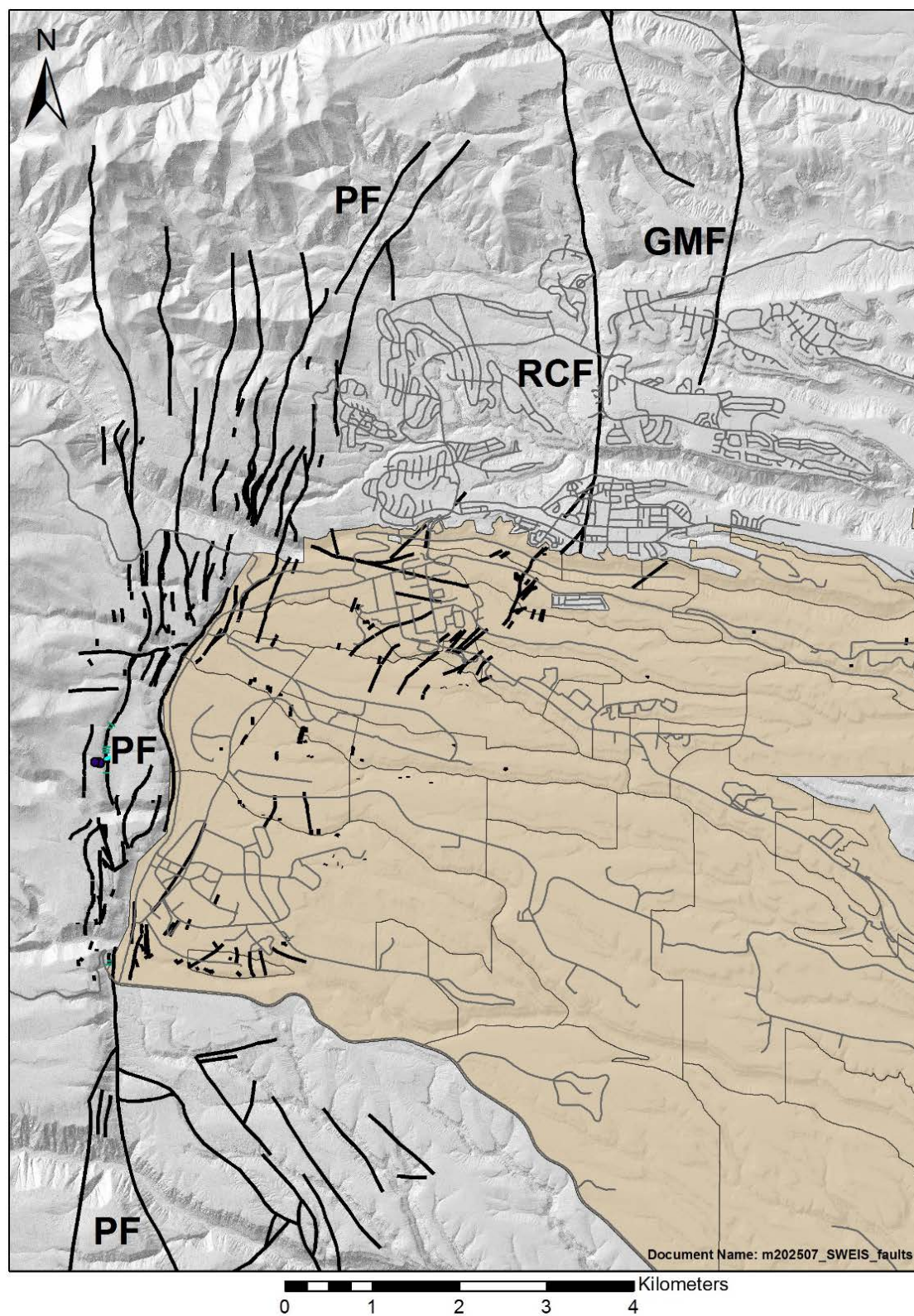


Figure 3-5. Seismic faults around LANL

The 2008 SWEIS addressed the 2007 seismic hazard analysis (URS 2007) that presented an increased estimated probabilistic seismic hazard for the Laboratory. Consequently, the hazard assessments for existing and planned facilities are evaluated and updated as necessary to meet DOE facility design criteria identified in DOE Standard 1020 (DOE 2016e). The 2008 SWEIS also analyzed the decontamination, decommissioning, and demolition of the CMR Building and relocation of CMR activities to facilities designed to better withstand earthquakes.

### **3.3.2 Changes since the 2008 SWEIS (2008 through 2017)**

Local seismicity within about 74 miles (120 kilometers) of Los Alamos was unusually high in 2010 and 2011, but only two earthquakes since 2008 have been large enough and close enough to be recorded near LANL. Those included a magnitude 2.5 earthquake near Sierra Los Pinos, south of the Valle Grande, and a magnitude 3.0 earthquake between Cuyamungue and the Rio Grande. On average, there are two earthquakes per month, mostly smaller than magnitude 1.0<sup>18</sup>.

Since the issuance of the 2008 SWEIS, Material Disposal Area B at TA-21 was remediated. In 2012, an institutional clean fill yard at TA-60 was established to facilitate reuse of fill on-site. Construction of this reuse yard was one of the commitments in the 2008 SWEIS mitigation action plan (DOE 2008e).

A 2009 recommendation from the Defense Nuclear Facilities Safety Board (DNFSB 2009) identified the need to execute both immediate and long-term actions to reduce risks posed by a seismic event at PF-4. The TA-55 Reinvestment Project, analyzed in the 2008 SWEIS, is addressing the increased estimated probabilistic seismic hazard. LANL's Seismic Analysis of Facilities and Evaluation of Risk project is conducting a detailed, multi-year analysis of the seismic design loads on existing facilities in the Plutonium Complex. This comprehensive seismic hazard analysis will provide a better understanding of the stresses on PF-4, and how it might react during a seismic event. On January 3, 2017, the Defense Nuclear Facilities Safety Board recognized that numerous upgrades have been completed and other improvements will continue to be implemented at the Plutonium Facility Complex (DNFSB 2017).

In accordance with revised LANL engineering standards, new or proposed facilities are designed to meet the latest seismic response criteria.

### **3.3.3 Analysis of Projected Changes (2018 through 2022)**

Eight new, modified, or continuing projects (Table 3-1) considered for geology and soils include: 1) the parking structure at TA-50 and support office building(s) along Pajarito Corridor, 2) the Energetic Materials Characterization Facility, 3) the DARHT Vessel Cleanout Facility, 4) analysis and strategy for certain shafts in TA-54, 5) the Nuclear Counterproliferation Building, 6) the Protective Force Training Facility, 7) two new fire stations under infrastructure, and 8) Forest health and wildland fire preparedness. Other soil disturbances would occur with

---

<sup>18</sup> This magnitude is based on the Richter magnitude scale, the most common standard of measurement for earthquakes. The Richter scale is used to rate the magnitude of an earthquake, that is, the amount of energy released during an earthquake. The Richter scale is a base-10 logarithmic scale, meaning that each order of magnitude is 10 times more intensive than the last one. In other words, a 2.0 earthquake is 10 times more intense than a 1.0 and a 3.0 is 100 times greater than a 1.0. The amount of energy released increases 31.7 times between whole number values.

other infrastructure modernization projects. Although the facilities are not designed yet, their construction would disturb considerably less soil and rock than the amount analyzed in the 2008 SWEIS. All projects located in areas analyzed in the 2007 seismic hazard analysis are bounded within the analysis of the 2008 SWEIS for seismic risk. Actions associated with forest health would have a beneficial impact by reduced soil erosion.

Some of the facility and construction projects discussed in Section 2.1 and analyzed in the 2008 SWEIS may be implemented from 2018 through 2022. These projects would disturb considerably less than the 3.2 million cubic yards (2.4 million cubic meters) of soil and rock analyzed in the 2008 SWEIS. Additional Consent Order cleanups will continue, including work to close Material Disposal Area G at TA-54. The amount of soils and rock required for these actions would be less than the 1.2 to 2.5 million cubic yards (920,000 to 1.9 million cubic meters) analyzed in the 2008 SWEIS Removal Option.

### **3.3.4 Conclusion**

The new, modified, and continuing projects and modifications in site operations would not significantly change impacts to geology and soils at LANL and are consistent with the impacts analyzed in the 2008 SWEIS; therefore, further supplementation of the 2008 SWEIS for potential impacts to geology and soils is not needed.

## **3.4 Water Resources**

Water resources within LANL are characterized by intermittent surface water streams through canyon areas. These water resources are discussed as they relate to the National Pollutant Discharge Elimination System Permit for LANL. Floodplain and wetland areas are discussed as well as potential impacts from wildfires. Water use (consumption) is discussed in Section 3.11, Infrastructure.

### **3.4.1 2008 SWEIS Analysis**

The affected environment discussion in the 2008 SWEIS includes a description of local surface water and groundwater resources at LANL, flow characteristics and relationships, and existing water quality (DOE 2008a).

#### **3.4.1.1 Surface Water**

The 2008 SWEIS discussed impacts to surface water quality from LANL operations, with the greatest effects caused by past discharges into Acid, Pueblo, Los Alamos, and Mortandad canyons (DOE 2008a). Surface water data generated by DOE was assessed by the New Mexico Environment Department in the decision making process for listing and delisting causes of impairment as assessment units. Within the boundaries of LANL, 31 assessment units were identified: 26 are impaired for one or more designated uses; one is in full support of designated uses; and four have not been assessed. Some of the constituents (i.e., gross alpha activity and aluminum) causing the impairment can be attributed to background sources and from developed areas at the Laboratory not necessarily associated with historical operations (Gallegos 2017). Most samples of 200 possible constituents have concentrations far below regulatory standards or risk-based advisory levels (DOE 2008a).

Water resources are regulated by a variety of standards, including the Clean Water Act, Safe Drinking Water Act, the New Mexico Water Quality Control Commission standards, and DOE Derived Concentration Guides (DOE 2011h). As New Mexico stream water quality standards have become more stringent, LANL programs are emphasizing improved management of the site's storm water runoff. LANL personnel also routinely monitor surface water, storm water, and sediments as part of their ongoing environmental monitoring and surveillance program. The monitoring results are published in the LANL annual site environmental reports (DOE 2008a). The 2008 SWEIS states, "impacts to surface water were projected to have little or no adverse impacts to surface water quality because of installation of storm water and erosions and sediment controls" (DOE 2008a).

#### **3.4.1.1.1 National Pollutant Discharge Elimination System Permits**

##### ***Industrial Outfalls***

The National Pollutant Discharge Elimination System Permit NM0028355, allowing the Laboratory to discharge industrial and sanitary liquid effluent through outfalls under specific conditions, was issued in 2007. At the time of the 2008 SWEIS, LANL had 21 permitted outfalls including three from wastewater treatment facilities, discharging treated effluent, and five associated with effluent treated for high-explosives compounds and other materials at TA-16.

##### ***Multi-Sector General Permit***

Effective since December 2000, the Multi-Sector General Permit regulates storm water runoff from the industrial activities and sites at LANL (DOE 2008a). At the time of the 2008 SWEIS, DOE maintained and implemented 15 storm water pollution prevention plans that covered 26 facilities and site-wide solid waste management units, sampled storm water flow at 75 monitoring stations, inspected and maintained best management practices, and published and reported monitoring results to the Environmental Protection Agency and the New Mexico Environment Department under the Permit.

At the issuance of the 2008 SWEIS, solid waste management units were considered an industrial activity and storm water runoff was managed under the Multi-Sector General Permit Program. Beginning in 2003, DOE transitioned to managing storm water runoff from the solid waste management units under an individual National Pollutant Discharge Elimination System industrial activity permit. DOE implemented an integrated storm water monitoring program to meet the anticipated requirements of the Federal Facility Compliance Agreement and submitted the first part of an individual permit application in late 2004. The Agreement was issued in 2005 and actions to comply with the agreement were analyzed in the 2008 SWEIS (DOE 2008a).

##### ***Construction General Permit***

At the time of the 2008 SWEIS, the Construction General Permit Program required all LANL construction activities and projects that disturb 1 acre (0.4 hectares) or more to be permitted. These permits required development and implementation of a site-specific storm water pollution prevention plan and the use of best management practices to reduce or eliminate the potential for off-site erosion and sediment and/or constituent transport off-site. The 2008 SWEIS evaluated an increase in the total area of impervious surfaces<sup>19</sup> at LANL, primarily because of new

---

<sup>19</sup> Impervious surfaces are mainly artificial structures—such as pavements (roads, sidewalks, driveways, and parking lots, as well as industrial areas such as airports, ports, and logistics and distribution centers, all of which use

development. An increase in surface runoff was also projected to occur as a result of the increased impervious surfaces and flooding due to wildfires. However, because LANL soils are relatively permeable and abundant undeveloped acreage remains for groundwater recharge, the impact of this increase was expected to be minimal (DOE 2008a).

#### **3.4.1.1.2 Floodplains**

Floodplains are areas adjacent to watercourses that can become inundated with surface waters during high flows from runoff due to precipitation or snowmelt. At LANL, the floodplains are generally located in the canyons that lie between the mesa fingers that make up the Pajarito Plateau. DOE regulations [10 CFR 1022.4] consider the critical action floodplain to be those areas affected during a 500-year flood (with a 0.2 percent chance of occurrence in any given year). The base floodplain, which is the floodplain considered by Resource Conservation and Recovery Act Permit for LANL, is the 100-year floodplain (based on a 100-year flood, which has a 1.0 percent chance of occurrence in any given year) [40 CFR 270.14(b)(11)(iii)].

In May 2000, the Cerro Grande fire changed the extent and elevation of the floodplains in the canyons that traverse LANL. The Cerro Grande fire created hydrophobic soils on the lands uphill from LANL and removed vegetation, so surface water runoff and soil erosion were greatly increased over pre-fire levels. Due to concerns about the increased potential for flooding of LANL facilities and homes down-canyon from the burned areas, several flood and sediment-retention structures were constructed as part of the emergency response (DOE 2008a). The 2008 SWEIS stated that there would be few impacts associated with proposed actions to the floodplains situated at LANL. The only impact explicitly discussed was a reduction in potential contaminant sources associated with TA-18 operations, which would be eliminated when the site, specifically the Solution High-Energy Burst Assembly, was removed. Appendix E lists floodplain and wetland assessments conducted for LANL projects since the 2008 SWEIS.

#### **3.4.1.1.3 Wildland Fire**

The 2000 Cerro Grande fire changed the water resources environment by removing vegetation and decreasing infiltration of water into the soils at LANL. These changes caused increased surface water runoff and soil erosion, which impacted water quality. These impacts were analyzed in the 2000 Special Environmental Assessment (DOE 2000b) and the 2008 SWEIS (DOE 2008a). The 2008 SWEIS states that storm waters and sediment transport would diminish over time as infiltration increased with the growth of new vegetation in the burn areas.

#### **3.4.1.2 Groundwater**

At the time of the 2008 SWEIS, DOE was preparing to implement the Consent Order, which specified processes for groundwater monitoring at LANL. As the result of the Consent Order, DOE changed the focus to watershed-specific investigations to find groundwater contamination and contaminant transport mechanisms (DOE 2008a). Implementation of the Consent Order was a fundamental part of the 2008 SWEIS (DOE 2008a), and understanding impacts from past, current, and future LANL operations to groundwater was central to this agreement.

---

considerable paved areas) that are covered by impenetrable materials such as asphalt, concrete, brick, stone—and rooftops. Soils compacted by urban development are also highly impervious.

### **3.4.2 Changes since 2008 SWEIS (2008 through 2017)**

Several changes and improvements concerning surface water, floodplain, wildland fire, and groundwater impacts have occurred since the 2008 SWEIS. These changes are described below.

#### **3.4.2.1 Surface Water**

Several permits were renewed between 2008 and 2017 including the National Pollutant Discharge Elimination System Permit, the Multi-Sector General Permit, the Individual Permit, and the Construction General Permit. The Las Conchas fire in 2011 and subsequent flooding event in 2013 saw significant increases in runoff from the surrounding landscape adjacent to LANL and all local canyons experienced substantial channel and bank erosion as well as widespread sediment deposition. Floodplain improvements projects were conducted in DP, Pueblo, Los Alamos, Sandia, and Water canyons.

##### **3.4.2.1.1 National Pollutant Discharge Elimination System Permits**

###### ***Industrial Outfalls***

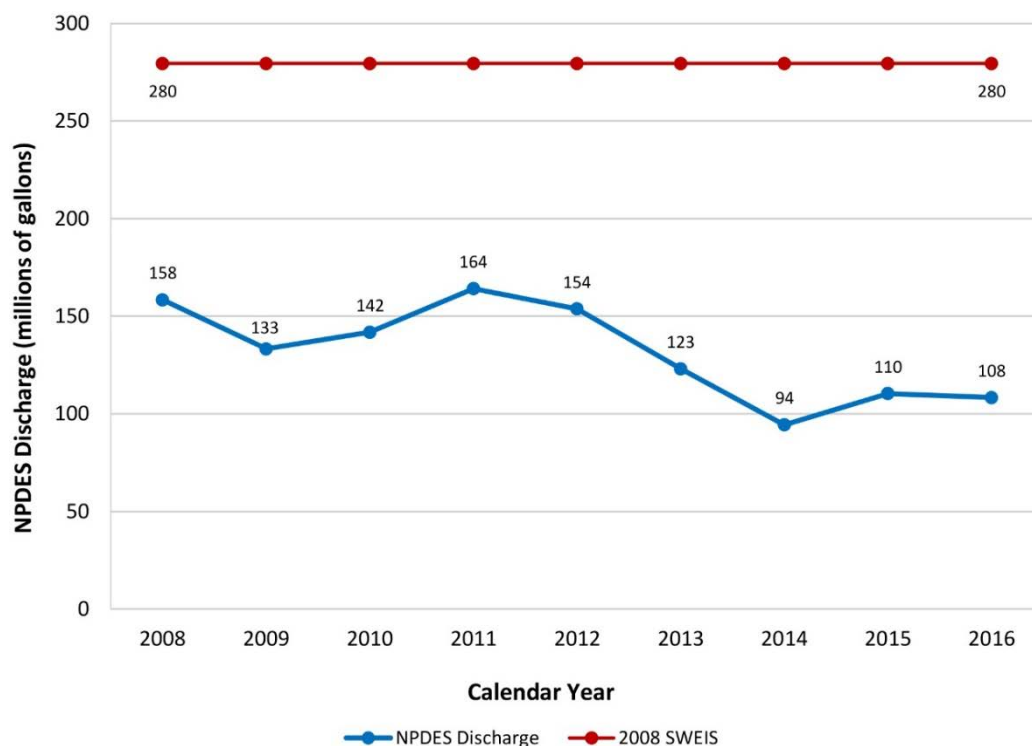
National Pollutant Discharge Elimination System Permit Number NM0028355 with new limits went into effect in 2014 and is expected to expire in September 2019 (EPA 2014). In 2007, DOE initiated an Outfall Reduction Project for LANL. Since that time, LANL has reduced the number of permitted outfalls from 21 to 11. Notable outfall closures include the Tritium Facility, CMR, the Sigma Complex, High-Explosives Processing, High-Explosives Testing, and LANSCE (LANL 2016d).

In November 2010, the Radioactive Liquid Waste Treatment Facility at TA-50 stopped discharging treated effluent to Mortandad Canyon and began evaporating all effluent in a mechanical gas-fired evaporator (LANL 2011a). In 2012, construction began for the TA-52 solar evaporation tanks, part of achieving zero liquid discharge. The solar evaporation tank has not been placed into service yet pending approval from the New Mexico Environment Department (LANL 2015c). Also in 2012, the Sanitary Effluent Reclamation Facility Expansion project was initiated (DOE 2010a). The expansion project was designed to increase the efficiency of the Sanitary Effluent Reclamation Facility and consider the impacts of decreasing the effluent discharge flow to Sandia Canyon from Outfall 001. One outfall in the high-explosives Key Facility area remains active.

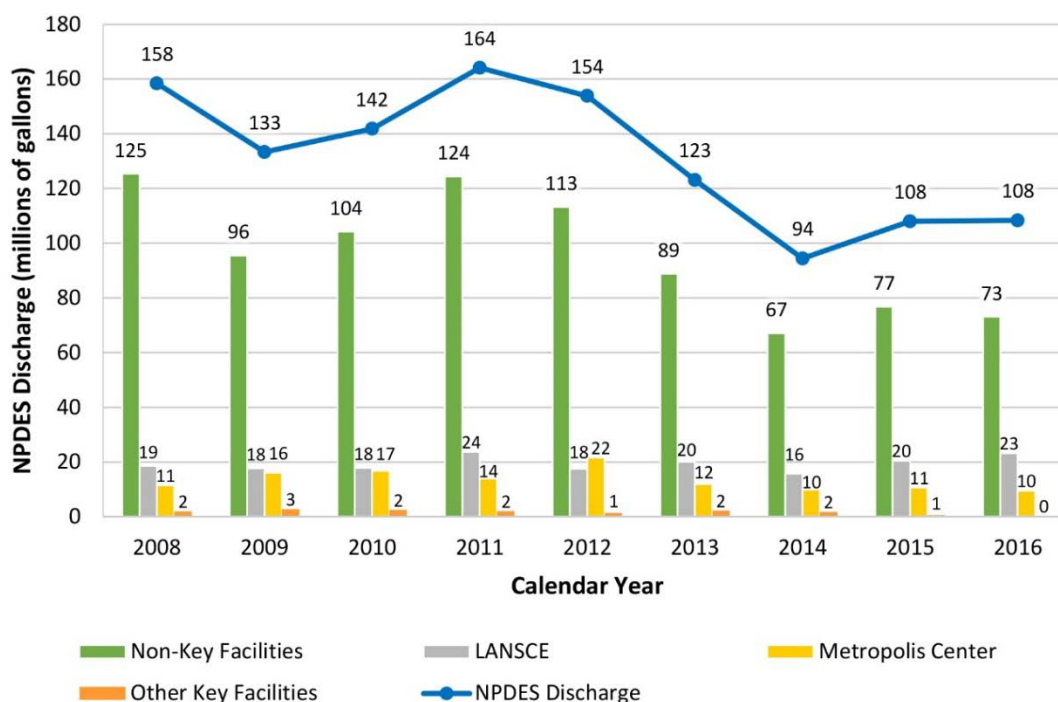
Seven of the remaining permitted outfalls are associated with Key Facilities and four are associated with non-Key Facilities. Figure 3-6 shows effluent discharge in millions of gallons (multiply gallons by 3.79 to get liters) of water from 2008 through 2016 (LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b, Del Signore 2017). All discharged effluent volumes are bounded by the 279.5-million gallon (1,058-million liter) volume analyzed in the 2008 SWEIS.

Although there are only four outfalls associated with non-Key Facilities, they account for the majority of effluent discharge at LANL (Figure 3-7). From 2008 through 2016, non-Key Facilities generated between 70 to 80 percent of the total effluent discharge at LANL. As discussed above, the Sanitary Effluent Reclamation Facility Expansion helped decrease effluent flow to Sandia Canyon. The Sanitary Effluent Reclamation Facility treats liquid effluent for reuse in the cooling towers at the Metropolis Center (DOE 2008a). The Metropolis Center then uses treated and reclaimed water for cooling.





**Figure 3-6. National Pollutant Discharge Elimination System total discharge from 2008 through 2016**



**Figure 3-7. National Pollutant Discharge Elimination System discharge by LANL facilities from 2008 through 2016**

### ***Multi-Sector General Permit***

The Multi-Sector General Permit (NMR05GB21) became effective in September 2008. This permit and the authorization to discharge expired in September 2013. New changes to the permit include an increase in the frequency of storm water monitoring, increased stringency in monitoring benchmark values, a defined corrective action process for identified issues, and new documentation requirements. The Permit (NMR053195) was renewed in June 2015 and is expected to expire in June 2020.

Compliance with the Multi-Sector General Permit requirements at LANL has generally improved the quality of storm water discharges from regulated facilities. In accordance with permit conditions, various constituents found in storm water are required to be analyzed. Results from these analyses have been used to provide evidence that additional monitoring is not necessary since analytical levels were below Multi-Sector General Permit benchmark values or were attributable to natural background concentrations.

### ***Individual Permit***

Since the issuance of the 2008 SWEIS, LANL received a new Individual Storm Water Permit (National Pollutant Discharge Elimination System Permit Number NM0030759). The permit was issued by the Environmental Protection Agency and became effective in November 2010. The permit expired in March 2014. A draft permit renewal was submitted by DOE on March 19, 2015, and the November 2010 permit was administratively continued on July 21, 2015. DOE is awaiting the final Individual Permit renewal from the Environmental Protection Agency.

The Individual Permit lists 405 permitted sites (i.e., solid waste management units and areas of concern) that are managed to prevent the transport of constituents to surface waters via storm water runoff. The Permit establishes target action levels that are equivalent to New Mexico State water-quality criteria. These target action levels are used as benchmarks to determine the effectiveness of control measures implemented under the Permit. That is, confirmation monitoring sample results for a site monitoring area are compared with applicable target action levels. If one or more confirmation monitoring result exceeds a target action level, the Permittees must take corrective action. More than 70 corrective action controls (earthen berms, run-on diversion, and drop inlets) have been installed at Individual Permit sites, including controls to address the September 2013 flood event. Confirmation sampling results consistently show aluminum, copper, zinc, and polychlorinated biphenyls appearing to be very close to background concentrations.

### ***Construction General Permit***

On February 16, 2012, the Environmental Protection Agency issued a new Construction General Permit (NMR120000), which included new requirements for inspection and corrective actions. This revised permit added additional requirements for construction sites 1 acre (0.4 hectares) or more in size to protect storm water quality. The new permit also required increased frequency of site inspections, reduced time frames for completion of required maintenance activities, and more restrictive best management practices and corrective actions. This permit was renewed in February 2017 (NMR100000). New construction since the issuance of the 2008 SWEIS increased the total area of impervious surface within LANL. The largest area is in TA-55 and TA-50, where approximately 17 acres (7 hectares) of new impervious surfaces were created. This resulted in an increase in runoff volumes, but there have been minimal environmental

impacts. Per the Construction General Permit requirements, these sites are required to manage runoff velocities to pre-development conditions. Site features, such as storm water detention ponds, are installed to manage the increased volumes and control runoff velocity and to mitigate downstream impacts. Compliance with approved storm water pollution prevention plans during construction has prevented impacts to surface water from erosion associated with construction.

#### **3.4.2.1.2 Floodplains**

Since the issuance of the 2008 SWEIS, significant work within floodplains occurred in DP, Pueblo, Los Alamos, Sandia, and Water canyons as part of the Consent Order implementation and to mitigate the impacts of 2013 flooding. Grade-control structures were constructed in DP, Pueblo, and Sandia canyons. Appendix E is a summary of all floodplain assessments at LANL since the 2008 SWEIS.

The grade-control structures in DP and Pueblo canyons were installed to stabilize watercourse channels and maximize the retention of sediment within the watercourses. Floodplain assessments were prepared for these projects in 2009, with the determinations that the grade-control structures would have minimal initial impacts and positive long-term effects for the canyons (LANL 2009a, 2009b). The Sandia Canyon grade-control structure was built to stabilize the existing wetland. Sediment removal at the Los Alamos Canyon weir is conducted to mitigate flooding. Sediment behind a low-head weir in lower Los Alamos Canyon is removed annually or more frequently as necessary. To mitigate damage from erosion in Water Canyon at the crossing of State Road 502, and to protect the integrity of the roadway, an existing culvert was replaced with a new box culvert and associated infrastructure to dissipate energy in runoff flows. The Sandia Canyon grade-control structure was installed to mitigate headcutting. A floodplain assessment was prepared in 2012 to evaluate the impacts of these erosion controls in Sandia Canyon. The long-term effects for the 100-year floodplain in Sandia Canyon were determined to be positive. The floodplain would be initially disturbed, but ultimately structures would reduce the amount of potentially contaminated soil leaving LANL property and reduce the strength of flood events moving down the canyon (LANL 2012b).

#### **3.4.2.1.3 Wildland Fire Impacts**

In 2011, the Las Conchas fire burned more than 150,000 acres (50,700 hectares) in areas adjacent to LANL. This changed the hydrologic conditions and potential sediment yield within these areas. Storm water runoff volumes and velocities and associated sediment transfer increased in the burned areas and affected areas of LANL. The increased flows caused flooding and erosion damage, including damage to multiple sections of security fencing, along the west boundary of the Laboratory.

On September 13, 2013, the Pajarito Plateau was subjected to what has been classified as a greater-than-1,000-year rainfall event. Anywhere from 2.49 to 3.52 inches (6.25 to 8.94 centimeters) of rain fell at different locations around the Laboratory within a 24-hour period. All of the local canyons flooded and some experienced substantial channel and bank erosion and widespread sediment deposition. There was also significant damage to infrastructure, including roads, gaging stations, and other sampling equipment (LANL 2015d).

Environmental impacts associated with the flooding were mitigated under the 2008 SWEIS (DOE 2012b, 2014d, 2015e). Activities included cleanout of culverts and channels conveying

storm water from U.S. Forest Service property onto LANL and the installation of new culverts. No permitted National Pollutant Discharge Elimination System outfalls were impacted.

#### **3.4.2.2 Groundwater**

Since the issuance of the 2008 SWEIS, many actions have been taken to implement the Consent Order. Currently, two groundwater projects under the Consent Order are being conducted. The first was analyzed in the “Final Environmental Assessment for Chromium Plume Control Interim Measure and Plume-Center Characterization, Los Alamos National Laboratory, Los Alamos, New Mexico” (DOE 2015b) and is being undertaken in Mortandad Canyon (TA-5). The second is RDX (high-explosive) contamination in the Cañon de Valle area of TA-16. This project is currently in the testing phase to identify the potential spread of the high-explosive contamination (LANL 2016d).

In November 2011, the Laboratory submitted a Groundwater Discharge Permit Application (DP-1793) for the Land Application of Treated Groundwater from Pumping Tests across LANL. The New Mexico Environment Department authorized DOE to discharge on September 13, 2013, allowing land application of treated groundwater. The final permit was issued on July 27, 2015. The environmental assessment analyzed application of treated groundwater as part of the proposed alternatives for the project (DOE 2015b). Under the permit, in 2016, DOE discharged 16.28 million gallons (61.6 million liters) of groundwater over 107 days for the chromium project in Mortandad Canyon. Additionally, DOE discharged 407,779 gallons (1.5 million liters) of groundwater over 27 days for the RDX project in Cañon de Valle (LANL 2017d).

#### **3.4.3 Analysis of Projected Changes (2018 through 2022)**

New, modified, or continuing projects (Table 3-1) considered for water quality are discussed within each subsection below.

##### **3.4.3.1 Surface Water**

Projects involving construction of new buildings or significant modification of existing buildings include: 1) the parking structure at TA-50 and support office building(s) along Pajarito corridor; 2) the Energetic Materials Characterization Facility; 3) the Scorpius Integrated Test Stand; 4) the DARHT Vessel Cleanout Facility; 5) the Nuclear Counterproliferation Building; 6) the TA-72 Firing Range Upgrade; 7) the Protective Force Training Facility; and 8) infrastructure modernization including the Supplemental Environmental Projects, the Manhattan Project National Historical Park, Forest Health and Wildland Fire Preparedness, and the Environmental Management Transition Activities for Mortandad Canyon and Cañon de Valle.

From 2018 through 2022, DOE would continue monitoring wastewater and storm water under applicable regulations. Detailed descriptions of sampling locations, constituents present, analyses, and subsequent actions are published in the LANL annual site environmental reports. DOE monitors all storm events of greater than 0.25 inches (0.6 centimeters) in 30 minutes per rainy season for radioactive and nonradioactive constituents in accordance with National Pollutant Discharge Elimination System permits issued by the Environmental Protection Agency. DOE is also required to visually inspect the storm water runoff per requirements in the Multi-Sector General Permit to observe runoff quality.

### **3.4.3.1.1 National Pollutant Discharge Elimination System Permits**

#### **Industrial Outfalls**

No proposed projects identified in Table 3-1 are anticipated to significantly impact liquid effluent discharge to permitted outfalls at the Laboratory. The Radioactive Liquid Waste Treatment Facility will continue to evaporate effluent with the mechanical evaporator and, with New Mexico Environment Department approval, the solar evaporation tanks. Construction of the new Radioactive Liquid Waste Treatment Facility will continue.

#### **Multi-Sector General Permit**

All proposed projects identified in Table 3-1 would comply with Multi-Sector General Permit requirements.

#### **Individual Permit**

The Individual Permit renewal for National Pollutant Discharge Elimination System Permit Number NM0030759 is anticipated to be completed soon. Site-specific storm water controls that reflect best management practices are applied at all 405 permitted sites (solid waste management units and areas of concern). Individual Permit activities will continue and all identified projects in Table 3-1 located within solid waste management units or areas of concern would comply with Individual Permit requirements.

#### **Construction General Permit**

Projects that involve areas larger than 1 acre (0.4 hectares) in size will follow requirements identified in the Construction General Permit. Implementation of Construction General Permit requirements and incorporation of low-impact development features will reduce sediment transport and improve surface water quality.

### **3.4.3.1.2 Floodplains**

Grade-control and sediment-retention structures will continue to be monitored across the Laboratory to ensure that floodplains are not significantly impacted. Additional grade-control and sediment-retention structures may be constructed if conditions in floodplains should change.

### **3.4.3.1.3 Wildland Fire Impacts**

Continual improvement of vegetation growth in areas burned by wildfires should reduce runoff volume and velocity of flows and associated sediment transport (Hastings et al. 2003). Threats of wildfire in northern New Mexico will continue. Implementation of forest health and wildland fire preparedness under the Wildland Fire Management Plan and the Forest Health Management Plan would reduce risks to LANL facilities and operations.

### **3.4.3.2 Groundwater**

Continuing projects considered for groundwater include the Environmental Management Transition Activities for Mortandad Canyon and Cañon de Valle. DOE will continue to conduct groundwater monitoring at wells and springs and report results in LANL's annual site environmental report and the Environmental Information Management database.

Consent Order projects analyzed in the 2008 SWEIS will likely continue from 2018 through 2022. Interim measures for the chromium and RDX projects in Mortandad Canyon and Cañon del Valle are anticipated to continue under the existing Groundwater Discharge Permit

(DP 1793) and Injection Permit (DP 1835), which are expected to expire in 2020. Final remedies for Consent Order projects will be subject to additional NEPA analyses as appropriate.

### **3.4.4 Conclusion**

The new, modified, and continuing projects and modifications in site operations through 2022 are not expected to exceed Environmental Protection Agency or New Mexico Environment Department requirements for water quality and are consistent with the impacts analyzed in the 2008 SWEIS. DOE will continue to implement all applicable regulations for surface and groundwater. A general improvement in the quality of storm water runoff, as well as reduced soil erosion, is expected from compliance with more stringent requirements in the National Pollutant Discharge Elimination System permits, including Multi-Sector General Permits, Individual Permits, and Construction General Permits, and implementation of the Supplemental Environmental Projects. Therefore, further supplementation of the 2008 SWEIS for water resources is not needed.

## **3.5 Air Quality**

All LANL activities with the potential to produce air pollutant emissions were evaluated in the 2008 SWEIS (DOE 2008a) to determine the need for permits and assessed for continued compliance. The areas of major concern for air quality at LANL are criteria air pollutants (non-radiological) and radiological emissions. This section also discusses impacts during the period from 2008 through 2017.

### **3.5.1 2008 SWEIS Analysis**

The affected environment discussion in the 2008 SWEIS includes a description of radiological air emissions and non-radioactive air emissions at LANL (DOE 2008a). The following discussion focuses on radiological air emissions and non-radioactive air emissions.

#### **3.5.1.1 Radiological Air Emissions**

Radiological air emissions from DOE-owned or operated sites are subject to the National Emission Standards for Hazardous Air Pollutants (40 CFR 61 Subpart H). An annual summary of radionuclide emissions and subsequent off-site dose is required under the Clean Air Act and is submitted to the Environmental Protection Agency Region 6 annually (LANL 2017e). The National Emission Standards for Hazardous Air Pollutants for radionuclide emissions to the ambient air from DOE facilities during normal operating conditions shall not exceed an effective dose equivalent of 10 millirem per year to a member of the public. Compliance with the standard is determined by calculating the highest effective dose equivalent to the maximally exposed individual<sup>20</sup> member of the public<sup>21</sup>.

Permissible quantities of radioactive air emissions are emitted to the atmosphere by LANL facilities from stack releases (point sources) and diffuse sources (non-point sources). The 2008 SWEIS evaluated routine radiological emissions from Key Facility and non-Key Facility

---

<sup>20</sup> Maximally exposed individual—a hypothetical individual whose location and habits result in the highest total radiological or chemical exposure (and thus dose) from a particular source for all exposure routes (i.e., inhalation, ingestion, direct exposure, resuspension).

<sup>21</sup> The maximum exposed individual dose is the resulting dose from the combination of all LANL site radionuclide releases to ambient air at a nearby off-site location such as a school, business, or residence.



operations on the basis of dose to the maximally exposed individual and collective dose to the public within 50 miles (80.5 kilometers) of the site (population dose).

The 2008 SWEIS projected annual radioactive stack emissions for LANL at 34,000 curies<sup>22</sup> per year, a value dominated by emissions of radioactive gases from the LANSCE accelerator facility. The 2008 SWEIS projected additional emissions from the remediation of the larger material disposal areas. These additional emissions would depend on radionuclides present, whether a material disposal area was being capped or removed, the number of material disposal areas being remediated at one time, and whether exhumation occurred under an enclosure. Short-term increases were also projected to occur during construction and decontamination, decommissioning, and demolition activities. Potential reductions in air emissions from upgrades and installation of new equipment at the Plutonium Facility Complex were projected for the TA-55 Reinvestment Project. After about 2009, TA-18 and TA-21 were projected to not contribute to radiological air emissions, thereby reducing the maximally exposed individual and population doses.

### **3.5.1.2 Non-radioactive Air Emissions**

The 2008 SWEIS projected minor impacts on non-radiological air quality would occur from construction-type activities with temporary elevated concentrations of criteria air pollutants, especially fugitive dust from heavy equipment activity. Non-radioactive air emissions come primarily from industrial-type support equipment such as boilers, emergency generators, the TA-3 power plant, and an asphalt plant at TA-60. In accordance with the Clean Air Act and New Mexico Administrative Code Title 20, Section 2, Part 70 (20.2.70), the management and operating contractor of LANL and DOE were required to obtain a Title V Operating Permit from the New Mexico Environment Department for sources of non-radioactive air emissions. Regulated air pollutants include carbon monoxide, sulfur dioxide, nitrogen oxides, particulate matter, volatile organic compounds, and hazardous air pollutants. These emissions are estimated using various operating parameters and emission factors and reported annually to the New Mexico Environment Department. National ambient air quality standards must be met at all locations. These standards are set by the Environmental Protection Agency and the New Mexico Environment Department. Permits for new sources cannot be issued without a dispersion modeling analysis demonstrating any new LANL emissions do not cause or contribute to an exceedance of an ambient standard. In accordance with 20.2.73 New Mexico Administrative Code, construction or new source review permits are required before construction of a new project or facility.

### **3.5.2 Changes since the 2008 SWEIS (2008 through 2017)**

Changes to radiological air emissions and non-radioactive air emissions since the 2008 SWEIS are described below.

#### **3.5.2.1 Radiological Air Emissions**

The 2008 SWEIS projected annual radioactive stack emissions for LANL to be 34,000 curies per year. Annual radiological air emissions from 1999 to 2005 were used to project the air emissions

---

<sup>22</sup> The projected radiological air emissions changed from the 10-year annual average of 21,700 curies in the 1999 SWEIS to 34,000 curies in the 2008 SWEIS. The projection is based on worst-case measured conditions at LANSCE, projected over an entire year's operational cycle.

in the 2008 SWEIS (DOE 2008a). Emission projections are dominated by radioactive gases from the LANSCE accelerator facility; these LANSCE emissions estimates consist of worst-case measured emissions extrapolated over a year's operational cycle.

Since 2008, LANL radiological stack emissions have been well under the bounding condition analyzed in the 2008 SWEIS, with the highest emissions (1,670 curies) occurring in 2008 (LANL 2009c, 2010a, 2011b, 2012c, 2013c, 2014c, 2015e, 2016e) with a consistent reduction occurring over time (Table 3-4). LANL emissions were dominated by elevated levels of LANSCE radioactive gases and tritium emissions. LANL has continued to operate well below the 2008 SWEIS projections.

**Table 3-4. Radiological Air Emissions from Point Sources**

Radiological Air Emissions from Point Sources	2008 SWEIS Projection	Actual Emissions (calendar year)								
		2008	2009	2010	2011	2012	2013	2014	2015	2016
Curies per year	34,000*	1,670	790	298	328	227	220	384	126	254

\* The projected radiological air emissions changed from the 10-year annual average of 21,700 curies in the 1999 SWEIS to 34,000 curies in the 2008 SWEIS. See preceding paragraphs for details (LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b, 2009c, 2010a).

The 2008 SWEIS projected annual tritium emissions for LANL to be 2,400 curies per year. Since 2008, tritium emissions from Key Facilities were well below the 2008 SWEIS projections (Table 3-5).

**Table 3-5. Tritium Emissions from Key Facilities**

Tritium Emissions from Key Facilities	2008 SWEIS Projection	Actual Emissions (calendar year)								
		2008	2009	2010	2011	2012	2013	2014	2015	2016
Curies per year	2,400	739	48	64	76	75	52	278	38	63

In 2009, the Environmental Protection Agency Region 6 approved the air permit for remediation of the legacy waste disposal site, Material Disposal Area B at TA-21. Remediation of Material Disposal Area B under the Consent Order was completed in 2012 (LANL 2013b). In addition to the cleanup of Material Disposal Area B, DOE completed the decontamination, decommissioning, and demolition of legacy buildings at TA-21. Two new Airnet stations were installed to monitor diffuse sources associated with these activities.

In 2009, two new exhaust systems were designed and installed at TA-54. The new exhaust systems were deployed on buildings that previously housed radiological operations; therefore, no pre-construction notifications to Environmental Protection Agency Region 6 were required. In 2011, construction of a new process line within Dome 375 at TA-54 required an approved pre-construction application from the Environmental Protection Agency Region 6.

In 2010, the Environmental Protection Agency changed the discharge standards for treated water discharged out of outfalls. The Radioactive Liquid Waste Treatment Facility was unable to meet the new requirements for discharging water into Mortandad Canyon and alternative strategies

were developed. A new evaporator was installed at the Radioactive Liquid Waste Treatment Facility to process radioactive liquid waste; operation began in 2011. The new evaporator was evaluated as a minor source, and Environmental Protection Agency Region 6 was notified of this change in the 2011 Radionuclide Air Emissions report (LANL 2012c). LANL operations were suspended for approximately 8 days during the 2011 Las Conchas fire. DOE increased ambient air monitoring during the fire to quantify what, if any, impact the fire had on radiological air concentrations. Measurements indicated that the air concentrations were identical to those associated with large-scale wildfires in other areas and there were no specific LANL-related radionuclide emissions from the fire (LANL 2012c).

In the 2008 and 2009 SWEIS records of decision (DOE 2008b, 2009a), DOE selected the two liquid waste treatment facilities option analyzed in the 2008 SWEIS at TA-50 to replace the existing Radioactive Liquid Waste Treatment Facility. In 2015, the Environmental Protection Agency Region 6 approved the final application for pre-construction for the Low-level Liquid Waste Facility and construction began. Construction of the Transuranic Liquid Waste Facility at TA-50 has not begun but will be considered a major point source with a monitored release. A pre-construction approval application will be submitted to Environmental Protection Agency Region 6 before construction.

On November 28, 2011, DOE issued supplemental guidance (DOE 2011g) that incorporated improvements to radiological dose modeling from the International Commission on Radiological Protection Publication 72 (ICRP 1995). Under the revised guidance, DOE Standard 1027G was revised to allow a less than hazard category 3 radiological facility to have an inventory of up to 38.6 grams of plutonium-239-equivalent, an increase from the previous inventory amount of up to 8.4 grams of plutonium-239-equivalent. However, the off-site dose consequence associated with the revised inventory quantities remains the same (Fuehne 2014). The new guidance has allowed changes to operations for radiological facilities at LANL. For instance, in 2013, inventory threshold changes from DOE Standard 1027G were incorporated at the Radiochemistry Facility at TA-48-1. No changes in emissions or off-site doses have been measured at the Radiochemistry Facility stacks as a result (Fuehne 2014).

In 2014, RLUOB adopted the inventory threshold from DOE Standard 1027G and raised the allowable inventory from 8.4 grams of plutonium-239-equivalent up to 38.6 grams of plutonium-239-equivalent. Notification of the commencement of radiological operations within RLUOB was sent to Environmental Protection Agency Region 6 in September 2014. The RLUOB stack met American National Standards Institute/Health Physics Society N13.1-1999 (ANSI 1999) design criteria in 2012 and the facility is managed as a radiological point source.

In 2013, a new point source at TA-54, Dome 375 was added for radioactive material operations to be conducted at this location. Dome 375 was designated to process large fiberglass-reinforced plywood waste boxes and other large items too large to process at existing repackaging facilities (e.g., TA-50-69, TA-54 Dome 231, or TA-54-412). Radioactive material operations at Dome 375 are contained in a large PermaCon® structure within the dome and air emissions are exhausted through a HEPA-filtered stack that is sampled for radiological particulate emissions per American National Standards Institute/Health Physics Society N13.1-1999 (ANSI 1999) design criteria.

In 2014 and 2015, changes to the Airnet ambient air monitoring program were initiated. Ten existing Airnet stations were shut down and nine new stations started up. The majority of these changes were relocations of existing stations to better evaluate dose consequences from LANL diffuse emissions to present-day public receptors in the surrounding communities. Changes were driven by DOE requirements to move all air monitoring stations from private property onto DOE land or Los Alamos County lands.

As part of the TA-55 Reinvestment Project, the air emissions sampling systems at PF-4 were upgraded in 2017. The new sampling systems are being certified to meet requirements of the American National Standards Institute/Health Physics Society standard N13.1-1999<sup>23</sup>. The sampling systems were installed in the exhaust air ductwork in the basement of PF-4, where flow conditions will provide superior sampling ability.

### **3.5.2.2 Non-radioactive Air Emissions**

Criteria pollutant<sup>23</sup> emissions from LANL fuel-burning equipment are reported in the annual Emissions Inventory Report as required by 20.2.73 New Mexico Administrative Code (LANL 2017e). Since 2008, more than half of the significant criteria pollutants (nitrogen oxides and carbon monoxide) originated from combustion of natural gas at the TA-3 Power Plant. The annual emissions of criteria air pollutants from LANL operations from 2008 to 2016 remained within 2008 SWEIS projections for three of the four categories: carbon monoxide, nitrogen oxides, and particulate matter. Sulfur dioxide emissions were above the 2008 SWEIS projection (Table 3-6).

Since the 2008 SWEIS was published, regulated air pollutant emissions from LANL remained within projections with the exception of sulfur dioxide as stated above; however, the Title V Operating Permit levels for LANL were not exceeded (Table 3-7).

In 2004, the New Mexico Environment Department issued the first Title V Operating Permit to the management and operating contractor of LANL and DOE. Under the Clean Air Act, a formal review of the existing operating permit is required every 5 years. In August 2009, the first formal renewal permit was issued. In June 2012, a permit modification was issued to incorporate all permit conditions from RLUOB's previously issued New Source Review Permit into the Title V Operating Permit. New Source Review Permit conditions for the July 2011 modification to the TA-3 Power Plant were also incorporated at this time. In July 2013, the second 5-year renewal permit application was submitted. The New Mexico Environment Department issued the renewal permit on February 27, 2015. This revised permit included one new regulated source, a soil vapor extraction unit at Material Disposal Area L. In February 2017, a modification to the Title V Operating Permit was issued, adding another new regulated source, three evaporative sprayers for the sanitary effluent reclamation facility evaporation ponds with the ability to add

---

<sup>23</sup> Criteria pollutant—an air pollutant that is regulated under the National Ambient Air Quality Standards. The U.S. Environmental Protection Agency must describe the characteristics and potential health and welfare effects that form the basis for setting, or revising, the standard for each regulated pollutant. Criteria pollutants include sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, and two size classes of particulate matter (less than 10 micrometers] in diameter and less than 0.0001 inches [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.)

two more sprayers of the same make and model. The current permit (P100-R2M1) expires in 2020.

**Table 3-6. Non-Radioactive Regulated Air Emissions, Based on Annual Emissions Inventory Report<sup>a</sup>**

Pollutants	2008 SWEIS Projection (tons/year) <sup>b</sup>	Actual Emissions (tons/calendar year)								
		2008	2009	2010	2011	2012	2013	2014	2015	2016
carbon monoxide	58	14.5	15.8	17.2	14.5	12.5	12.3	10.0	11.4	10.0
nitrogen oxides	201	20.8	21.8	23.7	20.2	19.4	20.7	16.3	19.9	16.8
sulfur dioxide	0.98	0.3	0.4	0.6	1.2	2.5	2.4	2.0	2.0	2.2
particulate matter	11	2.8	2.6	2.7	2.3	0.8	0.4	0.2	0.54	0.41

<sup>a</sup> This table is based on the annual Emissions Inventory Report and therefore does not include insignificant sources (e.g., small, exempt boilers and heaters and exempt standby emergency generators) (LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b, 2009c, 2010a).

<sup>b</sup> Multiply tons per year by 0.91 to get metric tons per year.

**Table 3-7. Non-Radioactive Regulated Air Emissions, Based on Title V Operating Permit Emissions Report<sup>a</sup>**

Pollutants	2008 SWEIS Projection (tons/year) <sup>b</sup>	Title V Facility-Wide permit	Actual Emissions (tons/calendar year)								
			2008	2009	2010	2011	2012	2013	2014	2015	2016
carbon monoxide	58	225	32.5	33.5	36.5	38.3	32.7	30.4	26.4	26.9	24.3
nitrogen oxides	201	245	45.9	46.6	51.0	54.0	49.3	44.2	38.4	35.9	32.4
sulfur dioxide	0.98	150	0.6	0.7	0.9	1.5	0.8	4.2	3.6	3.5	3.5
particulate matter	11	120	4.5	4.3	4.7	4.7	4.6	0.7	0.5	0.47	0.38

<sup>a</sup> This table is based on the Title V Operating Permit Emissions Report and includes two categories of insignificant sources not required in the annual Emission Inventory Report: 1) small, exempt boilers and heaters and 2) exempt standby emergency generators (LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b, 2009c, 2010a).

<sup>b</sup> Multiply tons per year by 0.91 to get metric tons per year.

Modifications of two existing New Source Review Permits were made between 2008 and 2016. In July 2011, the TA-3 Power Plant New Source Review Permit was modified at LANL's request to allow additional operation of the combustion gas turbine generator, with a corresponding decrease in allowable use of the three large power plant boilers. Annual fuel use is restricted by the New Source Review Permit for both the older boilers and the combustion gas turbine generator to avoid classification as a major stationary source for new source review permitting. In the future, LANL intends to rely more on the combustion gas turbine generator

instead of the boilers, which were installed in the 1950s. Overall, there was a plant-wide reduction in allowable annual emissions.

In 2012, the RLUOB New Source Review Permit was modified to remove the requirement to conduct startup testing of utility building boilers using fuel oil. These are natural gas-fired boilers and startup testing was done with natural gas. The New Mexico Environment Department agreed that emission testing with an emergency-use-only fuel should not be required.

From 2008 to 2016, LANL submitted 36 exemption notices to the New Mexico Environment Department Air Quality Bureau for sources such as emergency standby generators, small comfort heaters and boilers, and other sources that have potential to emit less than 0.5 tons (0.45 metric tons) per year of any regulated pollutant. During this same period, LANL submitted seven No Permit Required Determination applications for sources that did not meet specific exemption criteria but were below new source review permitting thresholds. The New Mexico Environment Department Air Quality Bureau approved all of these submittals and incorporated them via administrative permit revision.

Criteria pollutants (nitrogen oxides, sulfur dioxide, and carbon monoxide), and particulate matter (total suspended particles, particulate matter 10, and particulate matter 2.5), as well as volatile organic compounds and hazardous air pollutants, are regulated under the Clean Air Act and the Title V Operating Permit. Semi-annual reporting to the New Mexico Environment Department is required under the permit. The miscellaneous chemical usage, as well as fuel combustion throughout the Laboratory, results in emissions of these regulated air pollutants. The 2008 SWEIS projections for volatile organic compounds and hazardous air pollutants were expressed as concentrations rather than emissions; therefore, direct comparisons cannot be made between collected data and the 2008 SWEIS limits. Total actual emissions of criteria pollutants, hazardous air pollutants, and volatile organic compounds for 2008 through 2016 are presented in Table 3-8 (LANL 2017e, 2009c, 2010a, 2011b, 2012c, 2013c, 2014c, 2015e, 2016e, 2012d). All emissions were well below the facility-wide Title V Operating Permit limits.

**Table 3-8. Hazardous Air Pollutants and Volatile Organic Compounds**

Pollutant	Title V Emission Limits (tons/year)*	Actual Emissions (tons/calendar year)								
		2008	2009	2010	2011	2012	2013	2014	2015	2016
hazardous air pollutants	24	4.5	5.2	3.8	2.6	6.2	3.5	5.1	4.4	6.4
volatile organic compounds	200	9.0	13.5	6.7	6.4	8.8	9.6	10.9	9.1	12.7

\* Multiply tons per year by 0.91 to get metric tons per year.

### 3.5.3 Analysis of Projected Changes (2018 through 2022)

New, modified, or continuing projects (Table 3-1) considered for radiological air emissions are discussed below.



### **3.5.3.1 Radiological Air Emissions**

#### ***Surplus Plutonium Disposition SEIS: Increased Pit Disassembly/Conversion and Disposition at LANL***

In 2015, DOE updated its analysis for disassembly, conversion, and disposition to consider additional inventory in the Surplus Plutonium Disposition SEIS (DOE 2015a). Radiological air emission impacts from expanded pit disassembly and conversion activities at LANL were analyzed in the SEIS (DOE 2015a). Small increases in radiological air emissions from the expansion of pit disassembly would be mitigated by the use of glovebox confinement and HEPA air filtration systems to remove radioactive particulates before discharging process exhaust air into the atmosphere and the use of internal scrubbers to reduce chemical gas concentrations. The 2008 SWEIS analyzed some pit disassembly, conversion, and disposition; however, not at the levels analyzed in the Surplus Plutonium Disposition SEIS, so implementation of this proposed action requires a record of decision.

#### ***Large-Vessel Handling***

Disposition of two large containment vessels annually in Wing 9 of the CMR Building was analyzed in the 2008 SWEIS. Operations in Wing 9 are monitored for radiological air emissions. Processing one additional vessel per year is not expected to exceed 2008 SWEIS projections for radiological air emissions.

#### ***DARHT Vessel Cleanout Facility***

Construction of a new Vessel Cleanout Facility in TA-15 to allow the repair and cleanout of vessels for increased hydrodynamic shots at DARHT will be a minor source of radiological air emissions (resulting in less than 0.1 millirem off-site dose). A new minor source activity will be reported to the Environmental Protection Agency for the year that the new operations begin.

#### ***Hot Cells Area A***

Modernization of existing hot cells in Area A at LANSCE (TA-53-4) to allow radiochemical processing of irradiated targets for actinium-225 would require a pre-construction permit from the Environmental Protection Agency Region 6. The current sampling systems will need to be evaluated in order to capture any new radioactive air releases from the hot cell work. Hot cell work at LANL was analyzed in the 2008 SWEIS, and this proposed action is not expected to exceed 2008 SWEIS projections for radiological air emissions.

#### ***Radiochemistry Laboratory Hot-Cell Facility***

Modifications would be made to TA-48-28 to add a new alpha hot cell. A preconstruction application permit would be submitted to Environmental Protection Agency Region 6 prior to the building modifications. Radiological air monitoring would be required for this work.

#### ***High-Power Proton Beam Delivery to Area A***

Resumption of high-energy, low-current proton beam experiments at Area A at LANSCE (TA-53-4) is proposed. A pre-construction permit from the Environmental Protection Agency Region 6 is required prior to the proposed upgrades. The current sampling systems will need to be evaluated for this project. High-power proton beam delivery at LANL was analyzed in the 2008 SWEIS, and this proposed action is not expected to exceed 2008 SWEIS projections for radiological air emissions.

### ***Shockwave Experiments at Proton Radiography***

Shockwave experiments were analyzed in the 2008 SWEIS using up to 50 grams of plutonium per year at the Lujan Center and Weapons Neutron Research Facility. Some background air emission measurements will be taken before the experiments begin at the Proton Radiography Facility. The shockwave experiments are not expected to exceed 2008 SWEIS projections for radiological air emissions.

### ***Materials Science and Technology Fuels Fabrication***

The relocation of radioactive fuel fabrication operations from TA-55 to TA-35-189 will require would require a pre-construction permit from the Environmental Protection Agency Region 6. This facility will be considered a minor source; however, the capability for stack monitoring will be included in the design and construction, so it could become a major source in the future. Radioactive fuel fabrication operations were analyzed in the 2008 SWEIS, and radiological air emissions associated with this relocation are not expected to exceed 2008 SWEIS projections.

### ***Electron Beam Test Facility***

The Electron Beam Test Facility will be installed at LANSCE in building TA-53-365 (formerly the location of the Navy's Free Electron Laser and the Low-Energy Demonstration Accelerator Building). The 100-MeV electron beam will be used to support research and development. TA-53-365 is not currently monitored for radiological air emissions. The Electron Beam Test Facility operations may result in point-source monitoring at this location; however, similar tests were analyzed in the 2008 SWEIS, and radiological air emissions associated with these operations are not expected to exceed 2008 SWEIS projections.

### ***Environmental Management Legacy Contaminant Cleanup Program Activities***

As discussed in Section 2.1.2.6, a new contractor will execute the environmental management work described in the Consent Order and will be managed by the DOE Office of Environmental Management, Los Alamos Field Office. As part of this Environmental Management program work, three monitored stacks at TA-54 would be transferred to the DOE Office of Environmental Management; however, these stacks, along with several minor point sources and eight on-site Airnet stations would continue to be monitored. Any new stacks, point sources, or other air monitoring would be subject to the Laboratory-wide permit requirements.

#### **3.5.3.2 Non-radioactive Air Emissions**

New, modified, or continuing projects (Table 3-1) considered for non-radioactive air emissions include: 1) the office building and parking structure at TA-50, 2) the Nuclear Counterproliferation Building, 3) the TA-72 Firing Range Upgrade, 4) the Protective Force Training Facility, and 5) replacement of offices and light laboratory buildings under Infrastructure. During construction, there will be some particulate matter emitted as a part of the site grading and preparation and an increase in regulated pollutants from operation of gasoline and diesel-fueled construction machinery. However, the regulated air pollutant emissions are expected to remain below the values estimated in the 2008 SWEIS. Any new emission source will be reviewed before construction to determine whether a New Source Review Permit or Permit Exemption is required.

### **3.5.4 Conclusion**

The new, modified, and continuing projects and modifications in site operations through 2022 are not expected to exceed Environmental Protection Agency or New Mexico Environment Department requirements for air quality and are consistent with the impacts analyzed in the 2008 SWEIS. Radiological and non-radiological air emissions associated with proposed projects from 2018 through 2022 would remain within the 2008 SWEIS projections and are not expected to have significant environmental impacts. Therefore, further supplementation of the 2008 SWEIS for air quality is not needed.

## **3.6 Noise**

Noise generated by LANL operations is regulated by Los Alamos County ordinances and worker protection standards. All LANL activities with the potential to have noise impacts were evaluated in the 2008 SWEIS (DOE 2008a) to determine the need for mitigations and assessed for continued compliance.

### **3.6.1 2008 SWEIS Analysis**

The 2008 SWEIS projected that activities associated with the continued operation of LANL would have little noise impact on the public with the exception of sporadic explosive detonations at the High Explosives Testing Key Facility and vehicular traffic. The 2008 SWEIS projected a temporary increase in truck traffic associated with decontamination, decommissioning, and demolition activities and Consent Order activities (e.g., material disposal area remediation activities). The increase in noise associated with trucks and personal vehicles was projected to result in public annoyance. Specifically, the 32 percent increase in traffic along DP Road where Consent Order activities would be undertaken was projected to affect nearby businesses and residents (DOE 2008a).

### **3.6.2 Changes since the 2008 SWEIS (2008 through 2017)**

As projected in the 2008 SWEIS, DOE proposed to remove many aging structures as part of its footprint elimination program. The demolition activities at TA-8 and TA-21 resulted in temporary increases in truck traffic noise levels. Consent Order activities to remediate Material Disposal Area B were completed in September 2011. Noise levels temporarily rose because of increases in the number of personal vehicles, heavy-duty trucks hauling materials and waste to and from the remediation site, and equipment used in the remediation activities.

Since the 2008 SWEIS was published, some construction projects have occurred at LANL. Storm water control measures were installed at various locations across LANL, including the new grade-control structures installed in Sandia, Pueblo, and DP canyons. The Radiological Laboratory Utility Office Building (TA-55), the Protective Force running track (TA-62), the Indoor Live Firing Range (TA-16), the Tactical Training Facility (TA-16), and the Interagency Fire Center (TA-49) were constructed. These projects resulted in small changes in traffic and equipment noise from construction, employee vehicles, and shipments. The construction activity noise levels were temporary and primarily limited to involved workers and resulted in no ongoing adverse effects to threatened and endangered species or their habitats.

### **3.6.3 Analysis of Projected Changes (2018 through 2022)**

New, modified, or continuing projects (Table 3-1) considered for noise include: 1) the office building and parking structure at TA-50, 2) the Energetic Materials Characterization Facility, 3) the Scorpius Integrated Test Stand, 4) the DARHT Vessel Cleanout Facility, 5) the Nuclear Counterproliferation Building, 6) the TA-72 Firing Range Upgrade, 7) the Protective Force Training Facility, and 8) infrastructure modernization including the Supplemental Environmental Projects. There will be temporary increases in truck traffic and equipment noise levels during construction and environmental remediation activities; however, based on the proximity of equipment and construction and remediation sites, increases would be temporary and are not expected to exceed 2008 SWEIS projections.

### **3.6.4 Conclusion**

The new, modified, and continuing projects and modifications in site operations through 2022 may contribute to increased noise associated with construction, environmental remediation activities, and traffic. Noise associated with construction and operation of new facilities may be discernible in off-site areas; however, on-site noise increases will be temporary. Noise projections are consistent with the impacts analyzed in the 2008 SWEIS; therefore, further supplementation of the 2008 SWEIS for potential noise impacts on the public is not needed.

## **3.7 Ecological Resources**

This section discusses potential impacts to ecological resources from proposed projects and modifications in site operations that are likely to be implemented at LANL through the year 2022.

### **3.7.1 2008 SWEIS Analysis**

The 2007 LANL Biological Resources Management Plan identified institutional goals, objectives, and strategies for biological resources management at LANL (LANL 2007a). A qualitative analysis in the 2008 SWEIS addressed the impacts of proposed activities to ecological resources, including forests, wildlife, protected and sensitive species, and wetlands existing within LANL boundaries (DOE 2008a). The sources of potential impacts considered included construction activities, wildland fire, and responses to fire, drought, and outfall closures. A site-wide biological assessment was prepared and submitted to the U.S. Fish and Wildlife Service in 2006 (LANL 2006a). The U.S. Fish and Wildlife Service issued three concurrence letters stating that all but one of the projects described in the 2008 SWEIS “may affect, but are not likely to adversely affect” federally listed species. The U.S. Fish and Wildlife Service asked DOE to reinitiate consultation on the security-driven transportation modifications when more details are known about the project site selection and implementation. As discussed in Section 2.6, the Security Driven Transportation Modifications Project has not been initiated.

Drought and wildland fire were identified in the 2008 SWEIS as having impacted large forested areas at LANL (DOE 2008a). The 2000 Cerro Grande fire directly impacted ecological resources in terms of a reduction in habitat and the loss of wildlife. Fire mitigation work, including installation of flood-retention structures, affected about 50 acres (20 hectares) of undeveloped DOE land. Additionally, in 2001, 2002, and 2003, about 10,000 total acres (4,047 total hectares) of DOE property were thinned to reduce the potential of wildfires (DOE 2000a). Two years after the fire, a bark beetle outbreak resulted in 95 percent mortality of piñon pine trees and 12 percent

mortality of ponderosa pine trees across the Pajarito Plateau. During this same time period, at lower elevations of the mixed conifer forest on north-facing slopes of the canyons, up to 100 percent of the Douglas fir trees were killed by drought.

At the time of the 2008 SWEIS, surveys identified 34 acres (14 hectares) of wetlands at LANL. Federally listed wildlife at LANL included two endangered species: the black-footed ferret and the southwestern willow flycatcher; two threatened species: the bald eagle and the Mexican spotted owl; one candidate species: the yellow-billed cuckoo; and seven species of concern: the Jemez Mountains salamander, the American peregrine falcon, the arctic peregrine falcon, the northern goshawk, the Goat Peak pika, the New Mexico meadow jumping mouse, and Townsend's big-eared bat.

New Mexico protected and sensitive animals included one endangered species: the southwestern willow flycatcher; seven threatened species: the Jemez Mountains salamander, the American peregrine falcon, the arctic peregrine falcon, the bald eagle, the gray vireo, the New Mexico meadow jumping mouse, and the spotted bat; and 13 sensitive species: the Rio Grande chub, the loggerhead shrike, the Mexican spotted owl, the northern goshawk, the yellow-billed cuckoo, the fringed myotis, the Goat Peak pika, the long-eared myotis, the long-legged myotis, the Ringtail, Townsend's big-eared bat, the western small-footed myotis, and the Yuma myotis.

### **3.7.2 Changes since the 2008 SWEIS (2008 through 2017)**

Since the preparation of the 2008 SWEIS biological assessment (LANL 2006a), 21 biological assessments on individual projects or actions have been submitted to the U.S. Fish and Wildlife Service (Appendix F). All of these projects have been initiated or completed.

In 2011, approximately 156,600 acres (63,374 hectares) of forested lands adjacent to LANL burned during the Las Conchas fire; some of this land burned during the 2000 Cerro Grande fire. The Pajarito Plateau continued to experience widespread tree mortality caused by drought stress and insect outbreaks (LANL 2014a). Also in 2011, LANL published a migratory bird protection best management practices document that provides LANL site-wide mitigation measures to reduce risks to birds protected under the Migratory Bird Treaty Act (LANL 2011c).

DOE constructed a grade-control structure in 2012 at the downstream end of the Sandia Canyon wetlands (DOE 2010a). This structure controls the erosion of sediments out of the wetland and maintains sufficiently high water levels to retain a 3-acre (1-hectare) wetland, despite reduced water inputs from LANL outfalls. DOE annually monitors the effects of the grade-control structure on the wetland size and vegetation quality.

A storm event in September 2013 (described in Section 3.1) resulted in extensive damage across LANL. All of the local canyons flooded and some experienced substantial channel and bank erosion and widespread sediment deposition, including the stream channel and wetland within Pueblo Canyon (LANL 2013d). Resulting incised channels reduce water available to floodplains, perpetuating vegetation and soil loss. The existing grade-control structure in Pueblo Canyon was repaired and work was done to stabilize the wetland and promote vegetation in the existing channel.

The Jemez Mountains salamander occurs on DOE property and was listed as a federally endangered species in September 2013 (DOE 2013b). DOE submitted a site plan for protection

of the Jemez Mountains salamander to the U.S. Fish and Wildlife Service in July 2013. The U.S. Fish and Wildlife Service concurred with DOE's determination and the site plan was finalized in February 2014 (Hathcock 2014).

In 2014, the New Mexico meadow jumping mouse and the western distinct population segment of the yellow-billed cuckoo were listed as endangered and threatened (DOE 2014b, 2014c). These species were incorporated into LANL's Threatened and Endangered Species Habitat Management Plan (LANL 2015b).

The 2015 Sensitive Species Best Management Practices Source Document provides guidance on how to manage state-listed species at LANL (LANL 2015f).

### **3.7.3 Analysis of Projected Changes (2018 through 2022)**

New, modified, or continuing projects (Table 3-1) considered for ecological resources include: 1) the parking structure at TA-50 and support office building(s) along Pajarito Corridor; 2) the Energetic Materials Characterization Facility; 3) the DARHT Vessel Cleanout Facility; 4) the TA-72 Firing Range Upgrade; 5) the Protective Force Training Facility; 6) the Supplemental Environmental Projects, the Los Alamos Canyon Bridge refurbishment, and several replacement office and laboratory buildings under Infrastructure; 7) Forest Health and Wildland Fire Preparedness; and 8) Environmental Management Legacy Contaminant Cleanup Program Activities for Mortandad Canyon, Cañon de Valle, and Fenton Hill. DOE will comply with regulations protecting ecological resources and habitat as required.

The Los Alamos Canyon Bridge is located within the habitat for the federally listed Jemez Mountains salamander. A biological assessment may be required for any potential effects on these species from the refurbishment project because of the potential ground disturbing activities and paint removal.

Several activities would be implemented under the Consent Order, including the final remediation of the Fenton Hill site (TA-57), the chromium and RDX final remedies, and the groundwater protection program. Construction of roads and well pads are likely to continue in currently undeveloped areas, as well as other ground-disturbing activities associated with implementation of the Consent Order. DOE will comply with regulations protecting ecological resources as required and will submit biological assessments for activities whenever there is the potential for effects on a federally protected species.

### **3.7.4 Conclusion**

Potential impacts to ecological resources at LANL will be minimized through continued implementation of the Biological Resources Management Plan (LANL 2007a), the Threatened and Endangered Species Habitat Management Plan (LANL 2014b), and the 2008 SWEIS mitigation action plan (DOE 2008e). Through these documents, DOE has necessary controls in place to manage potential impacts to ecological resources through 2022. DOE will continue to complete necessary biological assessments and obtain concurrence from the U.S. Fish and Wildlife Service on any identified impacts. The new, modified, and continuing projects and modifications in site operations through 2022 will not significantly affect ecological resources and are consistent with the impacts analyzed in the 2008 SWEIS; therefore, further



supplementation of the 2008 SWEIS for potential environmental impacts to ecological resources is not needed.

### **3.8 Human Health and Worker Health/Safety**

DOE Order 231.1B, “Environment, Safety, and Health Reporting,” requires collection and reporting of information on environmental issues that could adversely affect the health and safety of the public and the environment. The Laboratory’s compliance and surveillance programs regularly collect and analyze air, surface and ground water, sediment and effluent release, and foodstuff and biota samples on and around the LANL site. Results from these studies are published in the LANL annual site environmental reports.

DOE Order 458.1, “Radiation Protection of the Public and the Environment,” requires that radiation doses are kept as low as reasonably achievable<sup>24</sup> (ALARA). This requirement is achieved through the use and implementation of shielding, safe work practices, procedures, and personal protective equipment. Worker doses are required to be kept below 5,000 millirem<sup>25</sup> per year, as mandated in 10 CFR Part 835, “Occupational Radiation Protection.” DOE established an agency-wide administrative control limit of 2,000 millirem per year in its Radiological Control Manual (DOE 1994). This manual also requires DOE contractors to establish a lower administrative control limit, on the order of 500 millirem to 1,500 millirem per year. The established action level at LANL for whole-body dose is 1,000 millirem<sup>26</sup>. Environmental ALARA is implemented at LANL as well, and sampling results are used to systemically verify and document that environmental radiological impacts are ALARA.

In November 2011, DOE issued revised supplemental guidance (DOE 2011g) for implementation of DOE Technical Standard 1027 (DOE 1997b). The updated Standard 1027 resulted in a change to allowable inventory limits for many radionuclides. Plutonium-239, a common reference nuclide, increased from its prior limit of 8.4 grams to 38.6 grams of plutonium-239-equivalent.

#### **3.8.1 2008 SWEIS Analysis**

The affected environment discussion in the 2008 SWEIS (Chapter 4) includes a discussion of human health for the public, worker health, and worker safety (DOE 2008a).

##### **3.8.1.1 Human Health**

Under the 2008 SWEIS analysis, the dose to the off-site maximally exposed individual was expected to remain within the 10-millirem-per-year standard required by 40 CFR 61, Subpart H, “National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities.” Implementation of the projects, programs, and activities

---

<sup>24</sup> As low as reasonably achievable—An approach to radiation protection to manage and control worker and public exposures (both individual and collective) and releases of radioactive material to the environment to as far below applicable limits as social, technical, economic, practical, and public policy considerations permit. ALARA is not a dose limit but a process for minimizing doses to as far below limits as is practicable.

<sup>25</sup> Millirem is one-thousandth of a rem (0.001 rem). Rem is an acronym for roentgen equivalent man, 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.

<sup>26</sup> Whole-body dose—defined for the purposes of external exposure include head, trunk (including male gonads), arms above and including the elbow, or legs above and including the knee (10 CFR 835).

analyzed in the 2008 SWEIS would not increase in the risk of latent cancer fatalities<sup>27</sup> among the general public. The dose to the maximally exposed individual was less than the 10-millirem-per-year standard (40 CFR 61). The maximally exposed individual dose was calculated to be 8.2 millirem (DOE 2008a).

### 3.8.1.2 Worker Health

The 2008 SWEIS identified the projected radiation exposure for the average individual worker to be 174 millirem per year and 543 person-rem<sup>28</sup> for the worker population. None of the alternatives would result in an increase in latent cancer fatalities (DOE 2008a).

### 3.8.1.3 Worker Safety

The 2008 SWEIS analyzed available data for occupational injury and illness rates at LANL (DOE 2008a). These rates reflect reportable injuries and illnesses during the year for 200,000 hours worked or roughly 100 workers (Table 3-9).

**Table 3-9. Occupational Injury and Illness Rates at LANL<sup>a</sup>**

Calendar Year	1999	2000	2001	2002	2003	2004	2005
Total recordable cases <sup>b</sup>	2.52	1.97	1.96	2.39	2.30	2.86	2.80
Days away, restricted, or transferred <sup>c</sup>	1.37	0.94	0.91	1.46	1.26	1.35	0.99

<sup>a</sup> All workers, including University of California workers.

<sup>b</sup> Total recordable cases = number per 200,000 hours worked.

<sup>c</sup> Days away, restricted, or transferred = number of cases per 200,000 hours worked. Source: (DOE 2008a), Table 4-30.

## 3.8.2 Changes since the 2008 SWEIS (2008 through 2017)

Changes and improvements to human health for the public, worker health, and worker safety since the 2008 SWEIS are described below.

### 3.8.2.1 Human Health

In the 2008 SWEIS, the maximally exposed individual dose at LANL was projected to be less than 8.2 millirem per year (annual risk of  $5 \times 10^{-6}$  latent cancer fatalities per year) and the population dose was projected to be 36.2 person-rem per year (annual risk of  $2.2 \times 10^{-2}$  latent cancer fatalities per year) (DOE 2008a). This is below the Environmental Protection Agency 10 millirem per year individual dose standard. During remediation of Material Disposal Area B

<sup>27</sup> A latent cancer fatality is a death from a cancer that results from, and occurs an appreciable time after, exposure to ionizing radiation. Death from radiation-induced cancers can occur any time after the exposure. However, latent cancers generally occur from 1 year to many years after exposure. Using a conversion factor of 0.0006 latent cancer fatality per rem of radiation exposure (ISCORS 2002), the result is the increased lifetime probability of developing a latent fatal cancer. For example, if a person received a dose of 0.033 rem, that person's risk of latent cancer fatality from that dose over a lifetime would be 0.00002. This risk corresponds to 1 chance in 50,000 of a latent cancer fatality during that person's lifetime. Because estimates of latent cancer fatalities are statistical, the results often indicate less than 1 latent cancer fatality for cases that involve low doses or small populations. For instance, if a population collectively received a dose of 500 person-rem, the number of potential latent cancer fatalities would be 0.3.

<sup>28</sup> Person-rem is 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.

in 2011, the maximally exposed individual dose reached 3.53 millirem, the highest since issuance of the 2008 SWEIS, well below the 10 millirem per year individual dose standard (Table 3-10) (LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b, Hoover 2017). Table 3-10 shows a downward trend for population dose since 2008 due to improved engineering controls at facilities and year to year variations based on operations.

**Table 3-10. Individual Dose to the Public from LANL Radioactive Air Emissions**

Year	Effective Dose Equivalent millirem per year (latent cancer fatalities per year)	Population Dose person-rem/year (latent cancer fatalities per year)
2008	0.55 ( $3.3 \times 10^{-7}$ )	0.791 ( $4.7 \times 10^{-4}$ )
2009	0.55 ( $3.3 \times 10^{-7}$ )	0.566 ( $3.4 \times 10^{-4}$ )
2010	0.33 ( $2.0 \times 10^{-7}$ )	0.218 ( $1.3 \times 10^{-4}$ )
2011	3.53 ( $2.1 \times 10^{-6}$ )	0.576 ( $3.5 \times 10^{-4}$ )
2012	0.58 ( $3.3 \times 10^{-7}$ )	0.272 ( $1.6 \times 10^{-4}$ )
2013	0.21 ( $1.2 \times 10^{-7}$ )	0.14 ( $8.4 \times 10^{-4}$ )
2014	0.24 ( $1.4 \times 10^{-7}$ )	0.284 ( $3.4 \times 10^{-4}$ )
2015	0.13 ( $7.8 \times 10^{-8}$ )	0.06 ( $1.7 \times 10^{-4}$ )
2016	0.12 ( $7.8 \times 10^{-7}$ )	0.10 ( $6.0 \times 10^{-5}$ )

In 2012, the Laboratory implemented DOE Order 458.1, which replaced DOE Order 5400.5. This order established new requirements to protect the public and the environment against undue risk from radiation associated with activities conducted at DOE facilities. Protections include the all-pathway public dose limit of 100 millirem per year, requirements for clearance of real and personal property, ALARA public exposure requirements, requirements for environmental monitoring, and all-pathway dose limits for the protection of biota.

LANL operations from 2008 through 2017 resulted in minimal impact to the public and the environment (Table 3-10). Radioactive discharges from LANL operations to air and water were below regulatory standards, and the potential radiation doses from Laboratory operations were significantly less than national dose standards and 2008 SWEIS projections.

### 3.8.2.2 Worker Health

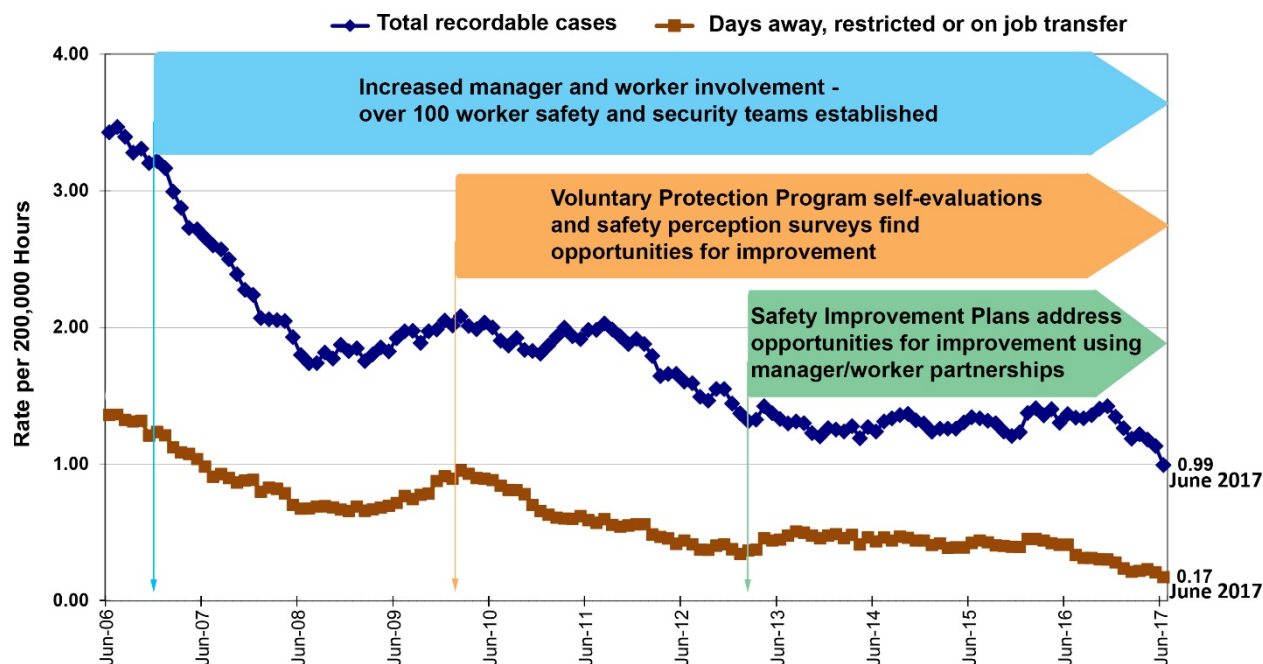
Workers in areas that contain radiological materials wear radiation dosimeters to measure ionizing radiation exposure.<sup>29</sup> In 2016, the Laboratory reported occupation radiation exposure for the LANL radiological workforce as an average individual worker dose<sup>30</sup> of 86 millirem and 95.6 person-rem per year (Hoover 2017).

<sup>29</sup> Thermoluminescent dosimeters are used to measure ionizing radiation exposure by measuring the intensity of [visible light](#) emitted from a crystal in the detector when the crystal is heated. The intensity of light emitted is dependent upon the radiation exposure. Ionizing radiation carries enough [energy](#) to liberate [electrons](#) from [atoms](#) or [molecules](#), thereby [ionizing](#) them.

<sup>30</sup> Average individual worker dose is the sum of the total effective dose value for all individuals in a specified population, expressed in units of person-rem.

### 3.8.2.3 Worker Safety

The total reportable cases and days away, restricted, or transferred have continued to decline since the 2008 SWEIS was published. Figure 3-8 provides data to show that the decrease in reportable cases and days away from work coincides with implementation of safety teams, management initiatives, and safety improvement plans at LANL (LANL 2017f).



**Figure 3-8. LANL total reportable cases and days away, restricted, or transferred annual rates**

In 2013, LANL paused work on all fissile material operations in PF-4. The pause stemmed from self-reported procedural issues and resulted in management evaluation of work, identifying potential deficiencies in work processes and procedures and mechanisms for continuous improvement. In response to the Defense Nuclear Facilities Safety Board, DOE has taken actions to address the criticality safety concerns. Corrective actions include revising the Nuclear Criticality Safety Program. In addition, a causal analysis of criticality safety infractions that occurred in 2013 was conducted and a plan was submitted to DOE for reopening PF-4 for operations. Finally, corrective actions from prior assessments were incorporated into the 2014 Nuclear Criticality Safety Program Upgrades Project Management Plan (LANL 2014d). Full operations, including pit manufacturing, resumed at PF-4 in August 2016.

### 3.8.3 Analysis of Projected Changes (2018 through 2022)

New, modified, or continuing projects (Table 3-1) considered for human health include:

1) increased pit disassembly/conversion and disposition, 2) CMR Wing 9 Hot Cell, 3) Large-Vessel handling, 4) the Energetic Materials Characterization Facility, 5) the Scorpius Integrated Test Stand, 6) the DARHT Vessel Cleanout Facility, 7) High-Power Beam Delivery at Area A, 8) Hot-Cell Work in Area A, 9) Radiochemistry Laboratory Hot-Cell Facility, 10) Shockwave Experiments at the Proton Radiography Facility, 11) the Electron Beam Test Facility, 12) the Materials Science and Technology Fuel Fabrication Facility, 13) Expand Clean Room Activities at the Radiochemistry Facility, 14) Biosafety Level 2 Radiological Laboratory, 15) Alternatives

Analyses and Strategy for Certain Shafts at TA-54, 16) Difficult Waste Streams, 17) Infrastructure Modernization, 18) the Manhattan Project National Historical Park, 19) Forest Health and Wildland Fire Preparedness, and 20) Environmental Management Legacy Contaminant Cleanup Program Activities.

LANL operations from 2018 through 2022 are expected to result in minimal impacts to human and worker health and safety and the environment. Radioactive discharges are expected to continue to be minimal, and radiation doses from Laboratory operations are expected to continue to be less than national dose standards and 2008 SWEIS projections (DOE 2008a). Continued implementation of the Consent Order will likely contribute to temporary increases to the maximum exposed individual. Completion of Material Disposal Area B remediation resulted in an increase in dose to workers for 2011 (Table 3-10). However, remaining remediation actions are not expected to cause as much of an increased dose to workers and will remain below the 10 millirem per year individual dose standard.

### **3.8.4 Conclusion**

The new, modified, and continuing projects and modifications in site operations through 2022 will not significantly impact human and worker health and safety at LANL and are consistent with the impacts analyzed in the 2008 SWEIS; therefore, further supplementation of the 2008 SWEIS for potential impacts to human health and safety is not needed.

## **3.9 Cultural Resources**

This section discusses potential impacts to cultural resources from proposed projects and modifications in site operations that are likely to be implemented at LANL through the year 2022. Cultural resources are defined and protected by a series of federal and state laws and regulations and include archaeological resources, historic buildings and structures, and traditional cultural properties.

### **3.9.1 2008 SWEIS Analysis**

The affected environment discussion in the 2008 SWEIS (Chapter 4) includes a description and analysis of cultural resources at LANL and management strategies for mitigating impacts to cultural resources from LANL operations and projects (DOE 2008a). The LANL Cultural Resource Management Plan provides practical steps and procedures for complying with federal historic preservation laws and regulations and with DOE policies and directives related to cultural resources at LANL (LANL 2006b). Implementation of the Cultural Resources Management Plan is governed by the *Programmatic Agreement between DOE, the Advisory Council on Historic Preservation, and the New Mexico State Historic Preservation Office* (DOE 2006). By carrying out the terms of the Programmatic Agreement, DOE fulfills its responsibilities under federal and state historic preservation laws.

#### **3.9.1.1 Archaeological Resources**

In the 2008 SWEIS analysis, approximately 2,000 archaeological sites were identified at LANL. A majority of these sites were associated with Paleoindian, Archaic, and Ancestral Pueblo Cultures. At the time, about 400 archaeological sites had been determined to be eligible for the National Register of Historic Places. Most of the remaining sites had yet to be formally assessed

and, therefore, were assumed to be eligible until assessed (DOE 2008a). Approximately 80 percent of Laboratory lands had been inventoried for cultural resources.

### **3.9.1.2 Historic Buildings and Structures**

In the 2008 SWEIS analysis, 179 historic buildings and structures had been evaluated for eligibility for the National Register of Historic Places (DOE 2008a).

Decontamination, decommissioning, and demolition of historic properties was analyzed in the 2008 SWEIS analysis (DOE 2008a). Compliance with federal and state historic preservation laws requires DOE to conduct historic building and structure surveys and make recommendations for eligibility before historic properties are demolished.

### **3.9.1.3 Traditional Cultural Properties**

There are 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 traditional cultural properties within the boundaries of LANL. In addition to physical cultural entities, concern has been expressed that “spiritual,” “unseen,” “undocumentable,” or “beingness” aspects may be present at LANL that are an important part of Native American culture. Under the 2008 SWEIS, Native American tribes are provided access to sacred sites within LANL boundaries for ceremonies or other purposes in accordance with visitor safety and site security protocols (DOE 2008a).

## **3.9.2 Changes since the 2008 SWEIS (2008 through 2017)**

The 2017 Cultural Resources Management Plan (LANL 2017g) was distributed for comment to Native American Tribes that claim cultural affiliation to sites within the LANL area, including the Four Accord Pueblos of San Ildefonso, Cochiti, Santa Clara, and Jemez; Acoma Pueblo; Santa Ana Pueblo; the Hopi Tribe; the Mescalero Apache; and the Jicarilla Apache. In 2017, the Programmatic Agreement was also revised to be issued for an additional 5 years (DOE 2017c). This updated Agreement was signed by the DOE/NNSA Los Alamos Field Office, the New Mexico State Historic Preservation Office, and the Advisory Council on Historic Preservation.

### **3.9.2.1 Project Completions**

Several ongoing cultural resources projects have been completed since the 2008 SWEIS and are described below.

#### ***Nake'muu Monitoring for DARHT Impacts***

In compliance with the 1995 DARHT EIS (DOE 1995) and associated mitigation action plan (DOE 1996b), DOE has continued to conduct a long-term monitoring program to assess the impact of LANL mission activities on a significant archaeological site, an ancestral pueblo named Nake'muu. The site was occupied from circa 1200 to 1325 AD and contains 55 rooms with walls standing up to 6 feet (2 meters) high. The site is visited annually to monitor the displacement of architectural elements in the standing walls. In 2009, DOE completed its extensive 9-year study of the impacts to Nake'muu from DARHT operations, determining that architectural losses resulted from natural freeze/thaw patterns and not from DARHT operations (Vierra and Schmidt 2008). A 3-dimensional model of the site was created in 2014 as part of a new exhibit on cultural resources at the Bradbury Science Museum.



### **Cerro Grande Fire Recovery**

From 2000 through 2013, DOE conducted archaeological surveys and fieldwork on 96 prehistoric archaeological sites, 14 historic homestead-era sites, and 13 historic buildings requiring additional rehabilitation work or follow-up actions as a result of the Cerro Grande fire. Documentation and eligibility assessment of sites for the National Register of Historic Places has been ongoing. In 2013, remediation efforts at all sites impacted by the Cerro Grande fire were shown to have been successful and were completed (DOE 2014d).

#### **3.9.2.2 Archaeological Resources Inventory**

As of 2017, approximately 93 percent of LANL land had been inventoried for cultural resources. The number of archaeological sites is approximately 2,000, but DOE has worked to more clearly define site boundaries and to consolidate site numbers for archaeological sites originally identified from the 1960s to the 1990s.

#### **3.9.2.3 Historic Buildings and Structures Activities**

Since the issuance of the 2008 SWEIS, DOE has continued decontamination, decommissioning, and demolition activities involving approximately 90 historic buildings and structures. Several hundred historic properties must be evaluated as eligible for the National Register of Historic Places (LANL 2016d).

In 2009, DOE began conducting phased restoration work at three historic buildings that comprise Gun Site to restore the area to its original Manhattan Project appearance. In 2012, additional restoration work was conducted at Gun Site, including substantial concrete repairs, loading dock and stairway repair and reconstruction, vegetation removal, and drainage improvement work in the earthen fill located on top of the three buildings (LANL 2017g, 2008).

In 2014, the Manhattan Project National Historical Park was signed into legislation. The Park includes historic properties located at LANL, Hanford, and Oak Ridge (Table 3-11) (LANL 2016d, 2017g).

#### **3.9.2.4 Traditional Cultural Properties Access**

Since the issuance of the 2008 SWEIS, DOE has continued to consult with various Pueblos to maintain an open dialog concerning access to traditional cultural properties with LANL boundaries. Agreements are in place to facilitate pueblo access to traditional cultural properties at LANL.

**Table 3-11. Manhattan Project National Historical Park Properties at LANL**

Building Name	Year	Function and Significance
TA-6-37 (Concrete Bowl)	1944	Plutonium recovery for implosion device (Fat Man/Trinity)
TA-8-1 (Gun Site)	1943	Laboratory and shop supporting Little Boy bomb
TA-8-2 (Gun Site)	1943	Shop and storage area supporting Little Boy bomb
TA-8-3 (Gun Site)	1943	Laboratory supporting Little Boy bomb
TA-8-172 (Guard Shack)	Circa 1940s to 1950s	Representative portable security facility used at Gun Site
TA-11-1 (K-Site)	1944	Control laboratory for implosion research
TA-11-2 (K-Site)	1944	Betatron and cloud chamber for implosion research

Building Name	Year	Function and Significance
TA-11-3 (K-Site)	1944	Betatron and cloud chamber for implosion research
TA-12-4 (67-4)(Firing Pit)	1945	Firing pit supporting implosion research
TA-14-6 (Q-Site)	1944	Shop and dark room for implosion research
TA-16-58 (Magazine)	1944	Explosives storage in support of TA-16 activities
TA-16-516 (V-Site)	1944	Development of Fat Man and Trinity device assembly
TA-16-517 (V-Site)	1944	Development of Fat Man and Trinity device assembly
TA-18-1 (Slotin Building)	1946	Laboratory supporting implosion and criticality research
TA-18-2 (Battleship Building)	1944	Control bunker supporting implosion research
TA-18-29 (Pond Cabin)	1914	Initially served as Ashely Pond's office; later supported fission and implosion research
TA-22-1 (Quonset Hut)	1945	Assembly and loading for Fat Man bomb

### 3.9.3 Analysis of Projected Changes (2018 through 2022)

New, modified, or continuing projects (Table 3-1) considered for cultural resources include: 1) the parking structure at TA-50 and support office building(s) along Pajarito Corridor; 2) the Energetic Materials Characterization Facility; 3) the DARHT Vessel Cleanout Facility; 4) the Biosafety Level 2 Radiological Laboratory; 5) the TA-72 Firing Range Upgrade; 6) the Protective Force Training Facility; 7) infrastructure modernization; 8) the Manhattan Project National Historical Park; 9) Forest Health and Wildland Fire Preparedness; and 10) Environmental Management Legacy Contaminant Cleanup Program Activities including Mortandad Canyon, Cañon de Valle, and Fenton Hill.

#### 3.9.3.1 Archaeological Resources

Management of cultural resources is conducted in accordance with the 2017 Cultural Resources Management Plan and the new Programmatic Agreement (DOE 2017c). None of the proposed projects identified in Table 3-1 are anticipated to have adverse impacts on archaeological resources at LANL.

#### 3.9.3.2 Historic Buildings and Structures

Decontamination, decommissioning, and demolition activities are anticipated to continue. Consultation on projects listed in Table 3-1 with the potential for impacts to cultural resources will be completed in compliance with cultural resources requirements.

#### 3.9.3.3 Traditional Cultural Properties

Potential impacts to traditional cultural properties that may exist within LANL boundaries will be minimized through continued implementation of the 2017 Cultural Resources Management Plan (LANL 2017g). Consultation with the Four Accord Pueblos of San Ildefonso, Cochiti, Santa Clara, and Jemez will continue for projects that have the potential to impact traditional cultural properties and archaeological sites.

### **3.9.4 Conclusion**

DOE will continue to implement all federal and state historic preservation laws applicable to cultural resources located at LANL in accordance with the 2017 Programmatic Agreement and the revised Cultural Resources Management Plan.

The new, modified and continuing projects and modifications in site operations are not expected to affect cultural resources and are consistent with the impacts analyzed in the 2008 SWEIS. Impacts to cultural resources would remain within the 2008 SWEIS projections; therefore, supplementation of the 2008 SWEIS for cultural resources is not needed.

### **3.10 Socioeconomics**

This section discusses changes in potential socioeconomic impacts from proposed projects and modifications in site operations that are likely to be implemented at LANL through the year 2022.

#### **3.10.1 2008 SWEIS Analysis**

The affected environment discussion in the 2008 SWEIS (Chapter 4) includes a general description of socioeconomics in terms of demographic and economic characteristics of a region (DOE 2008a). In particular, the 2008 SWEIS described LANL socioeconomics and analyzed trends, including regional economic and demographic characteristics, income, employment, housing, and local government finance and services. The LANL workforce was projected to remain steady at around 13,500 employees and perhaps increase up to 2.2 percent per year between 2007 and 2011. The 2008 SWEIS concluded that these employment increases would generate additional local government revenue in a tri-county area (Rio Arriba, Santa Fe, and Los Alamos counties). More employees, in both absolute and relative terms, would be expected to reside in Rio Arriba and Santa Fe counties instead of Los Alamos County because the housing supply and variety in Los Alamos and White Rock was more limited and costly, and because highways had been recently improved to facilitate faster and safer commutes.

#### **3.10.2 Changes since the 2008 SWEIS (2008 through 2017)**

From 2008 through 2017, LANL continued to be a major economic force in Santa Fe, Los Alamos, and Rio Arriba counties and in northern New Mexico. In 2015, the Laboratory paid almost \$77 million in gross receipts taxes, nearly \$974 million in salaries, and about \$318 million in New Mexico procurements, including \$263 million in New Mexico small business procurements.

The socioeconomic region of influence for LANL now includes the four-county area of Los Alamos, Rio Arriba, Sandoval, and Santa Fe counties (DOE 2015a). The majority of LANL employees reside in this four-county area. As of 2017, the total direct LANL employment was about 11,200 (LANL 2017h), which represents about 6 percent of the employment in this four-county area (DOE 2015c).

The most recent University of New Mexico Bureau of Business and Economic Research report indicated that during fiscal year 2009, LANL added more than \$1.4 billion directly into the northern New Mexico economy (UNM 2011). The Laboratory Community Commitment Plan invests approximately \$3 million per year in education, economic development, community

giving, in-kind and other community investments, technology transfer, and other regional initiatives (UNM 2011).

Since 2008, the size of the Laboratory workforce has remained below what was projected in the 2008 SWEIS and has been relatively consistent. The Laboratory is actively recruiting new staff to replace retiring workers.

The 2008 SWEIS projected that the 2005 level of employment would remain steady at about 13,500 employees (DOE 2008a). The 11,200 employees at the end of calendar year 2016 represent a 17 percent reduction compared with the 2008 SWEIS projection (LANL 2017c).

### **3.10.3 Analysis of Projected Changes (2018 through 2022)**

New, modified, or continuing projects (Table 3-1) considered for socioeconomic impacts include: 1) Increased Pit Disassembly/Conversion and Disposition, 2) the Energetic Materials Characterization Facility, 3) the Nuclear Counterproliferation Building, 4) infrastructure modernization, 5) the Manhattan Project National Historical Park, and 6) Environmental Management Legacy Contaminant Cleanup Program Activities. While these projects may increase the temporary workforce, they may not result in permanent changes to the size of the LANL workforce. As LANL workers retire, others will be hired to take their places. It is unknown if new employees will choose to live in Los Alamos County or commute. The 2018 management and operating contract change and the new Environmental Management contract will affect the LANL workforce and its demands upon the surrounding communities. It is estimated that over 2,500 new employees will be hired between 2018 and 2022. These new hires would mostly replace existing staff.

### **3.10.4 Conclusion**

The new, modified, and continuing projects and modifications in site operations are not expected to significantly change the socioeconomic impacts bounded by the 2008 SWEIS. The projected socioeconomic impacts are therefore consistent with those analyzed in the 2008 SWEIS, and further supplementation of the 2008 SWEIS for potential environmental impacts to socioeconomic impacts is not needed.

## **3.11 Infrastructure**

This section discusses changes in electric power transmission and distribution system, the natural gas and liquid fuel (fuel oil, diesel fuel, and gasoline) supply systems, and the water supply system.

### **3.11.1 2008 SWEIS Analysis**

Potential infrastructure impacts were assessed by comparing projections of utility resource requirements with utility system capacities. While many LANL facilities were not metered at the time of the 2008 SWEIS, annual site-wide demands were calculated to project utility use associated with each of the alternatives. Baseline trends in site-wide infrastructure requirements, as well as within the larger region of influence, were identified and extrapolated to predict future utility needs. Any projected demand for utilities exceeding their availability was regarded as an indicator of potential impact. Table 3-12 shows projected utility use and the percent of the system capacity for each resource for each 2008 SWEIS alternative (DOE 2008a).

**Table 3-12. LANL Site Total Projected Utility Use from the 2008 SWEIS**

Resource	No Action Alternative	Reduced Operations Alternative	Expanded Operations Alternative
Electricity Requirements	645,000 megawatt-hours total (495,000 megawatt-hours for LANL); 49 percent of system capacity	516,000 megawatt-hours total (366,000 megawatt-hours for LANL); 39 percent of system capacity	827,000 megawatt-hours total (677,000 megawatt-hours for LANL); 63 percent of system capacity
Electric Peak Load	111 megawatts total (91.2 megawatts for LANL); 74 percent of system capacity	80.6 megawatts total (60.4 megawatts for LANL); 54 percent of system capacity	144 megawatts total (124 megawatts for LANL); 96 percent of system capacity
Natural Gas Requirements	2,215,000 decatherms total (1,197,000 decatherms for LANL); 27 percent of system contract supply capacity	2,181,000 decatherms total (1,163,000 decatherms for LANL); 27 percent of system contract supply capacity	2,331,000 decatherms total (1,313,000 decatherms for LANL); 29 percent of system contract supply capacity
Water Requirements*	1,621 million gallons total (380 million gallons for LANL); 90 percent of system available water rights	1,544 million gallons total (303 million gallons for LANL); 85 percent of system available water rights	1,763 million gallons total (522 million gallons for LANL); 98 percent of system available water rights

\* Multiply gallons by 3.78533 to get liters.

The Los Alamos Power Pool supplies electricity to LANL through an agreement between DOE and Los Alamos County whereby each entity's electricity resources are consolidated or pooled. Import capacity is limited by the physical capability (thermal rating) of the transmission lines. On-site electricity generation capability for the Los Alamos Power Pool is limited by the capacity of the existing TA-3 Co-generation Complex, also referred to as the TA-3 Power Plant (the power plant generates both steam and power).

The 2008 SWEIS No Action Alternative used the average actual electricity consumption of 495,000 megawatt-hours from the years 1999 to 2005 for LANL operations. Similarly, the expected electricity peak load under the No Action Alternative was 91,200 kilowatts.

Selected elements of the 2008 SWEIS Expanded Operations Alternative were included for implementation in the two records of decision (DOE 2008b, 2009a), expansion of the capabilities and operational levels at the Metropolis Center was one of these projects. This decision impacted the total electricity peak load and the total electricity consumption at LANL. Therefore, the 2008 SWEIS No Action Alternative plus selected elements of the Expanded Operations Alternative identified in the 2008 SWEIS records of decision projection for electricity consumption represents 91,200 kilowatts for LANL plus 18,000 kilowatts operating requirements for the Metropolis Center. The projection for electricity peak load is 91.2 megawatts for LANL plus 12 megawatts to expand the capabilities and operational levels of the Metropolis Center.

Los Alamos County and LANL receive their natural gas from the Public Service Company of New Mexico. The 2008 SWEIS No Action Alternative used the average actual natural gas consumption of 1,197,000 decatherms from the years 1999 to 2005 to represent the average LANL consumption. This included both gas used for electricity production and heat production. LANL electricity generation from gas is used to fill the difference between peak loads and the

electricity import capability, and for training the power plant operators in turbine operation. Implementation of specific projects in the Expanded Operations Alternative did not affect gas consumption projections.

The 2008 SWEIS records of decision projected the use of approximately 460 million gallons<sup>31</sup> (1.7 billion liters) of water per year.

### **3.11.2 Changes since the 2008 SWEIS (2008 through 2017)**

Figures 3-9 through 3-12 show trends by year in electrical, water, and gas consumption from 2008 through 2016 compared with 2008 SWEIS projections (LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b, 2018, Erickson 2017). Figures 3-9 through 3-11 shows an increase in the 2008 SWEIS value being measured. The increase resulted from a DOE decision in December 2010 on the LANSCE project (Table 2-5).

In 2011, Los Alamos County completed construction of a 3-megawatt, low-flow hydro-turbine on the U.S. Army Corp of Engineer's Abiquiu Dam. In 2013, to diversify the power portfolio for LANL and in accordance with the site sustainability goals, DOE partnered with Los Alamos County and the U.S. Army Corps of Engineers to adjust the water flow at Abiquiu Dam to provide 1 to 2 megawatts of reserve power.

In 2011 and 2012, during expansion of the Sanitary Effluent Reclamation Facility, water consumption at LANL was 445 million gallons (1,685 liters) (Figure 3-11). The water needs for supercomputing prior to operation of the Sanitary Effluent Reclamation Facility were a major factor. The LANSCE water requirements, approximately 40 million gallons (160 million liters) per year, were not projected in the 2008 SWEIS, but approved in 2010 as a categorical exclusion (Table 2-5). Thus, the 2008 SWEIS water consumption bounding limit was increased in 2011 by 42.2 million gallons (169 million liters) per year as indicated in Figure 3-11. In 2013, when the Sanitary Effluent Reclamation Facility resumed operations, water consumption dropped to almost 90 million gallons (341 million liters) below the 2008 SWEIS records of decision projection (LANL 2015c).

---

<sup>31</sup> This number represents 380 million gallons (1,520 million liters) for LANL under the No Action Alternative, plus 32 million gallons (128 million liters) to expand the capabilities and operational levels of the Metropolis Center, and 5.8 million gallons (23 million liters) to be used during material disposal area remediation activities (DOE 2009a).



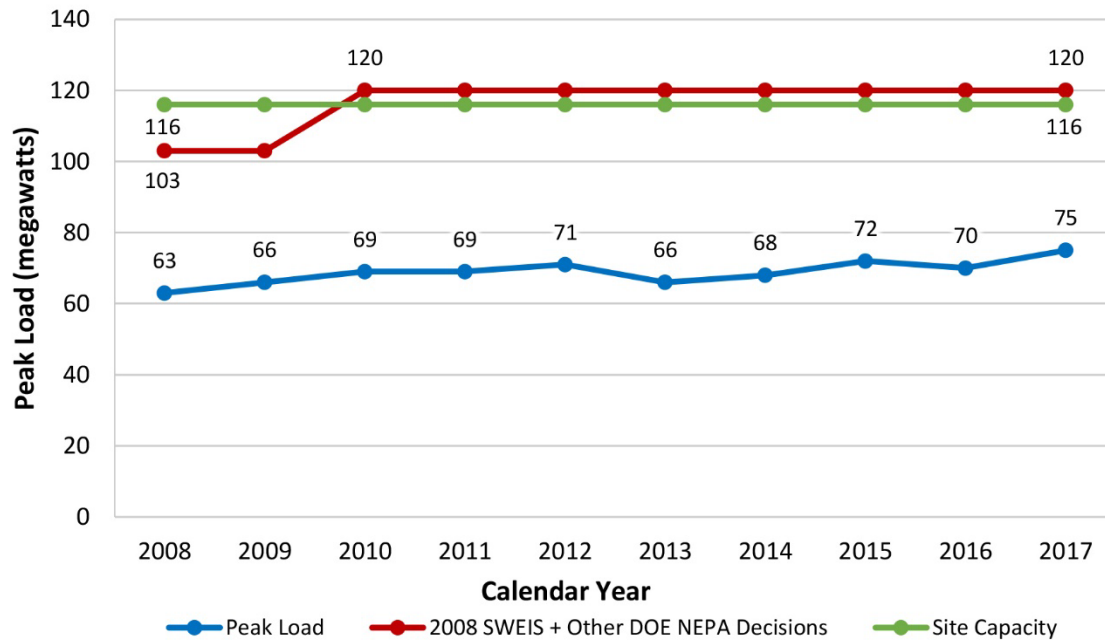


Figure 3-9. Electrical peak load at LANL from 2008 through 2016

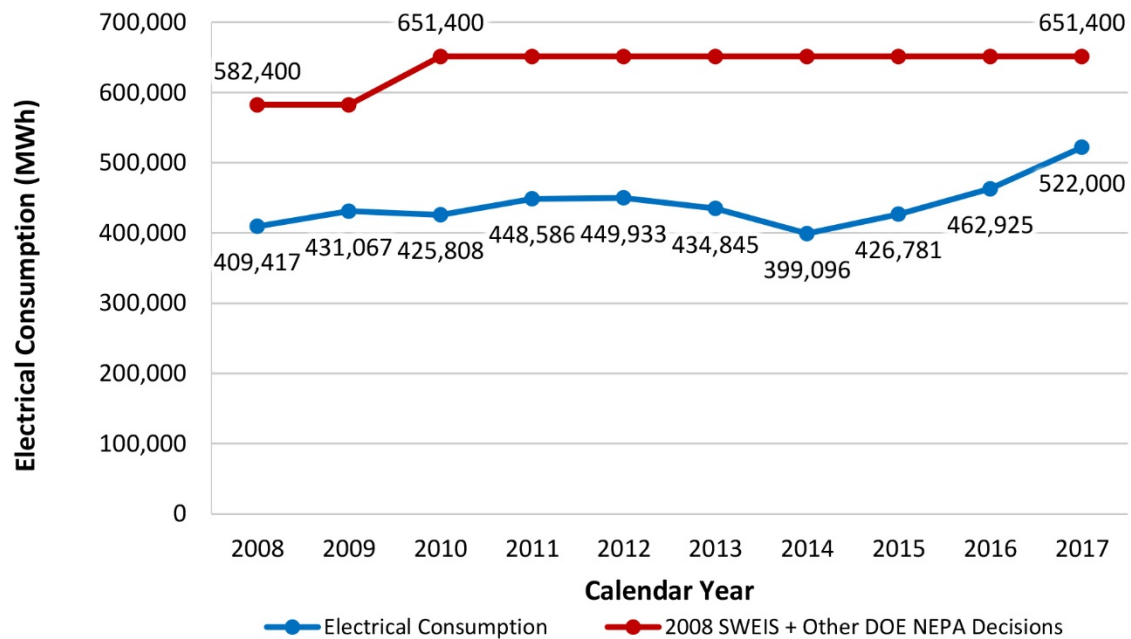


Figure 3-10. Electricity consumption at LANL from 2008 through 2017

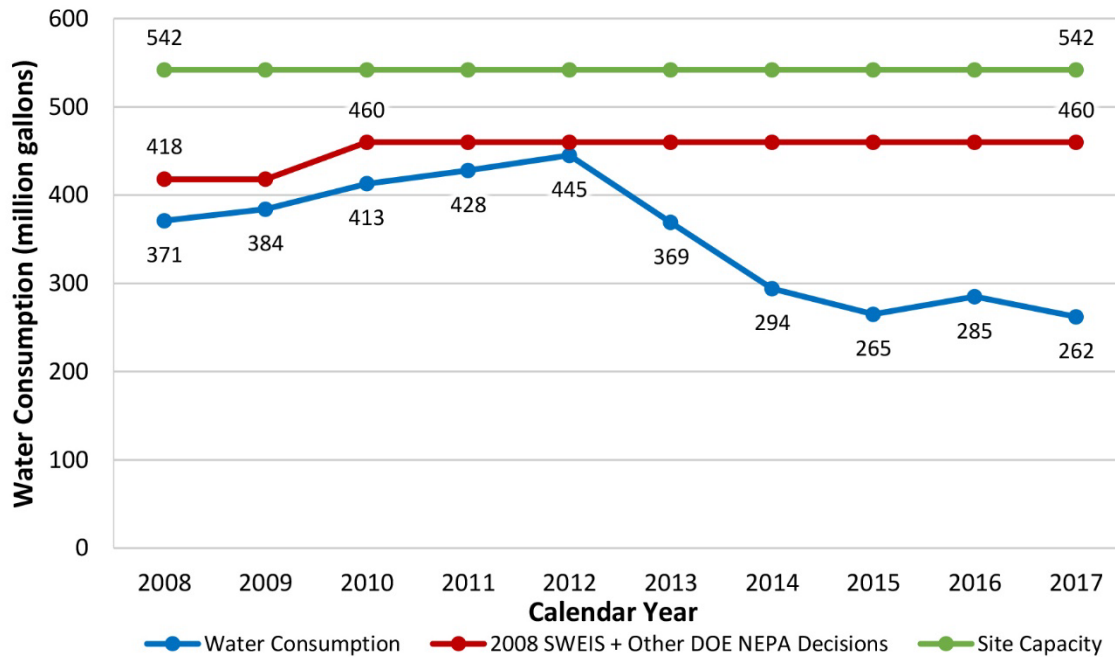


Figure 3-11. Water consumption at LANL from 2008 through 2017

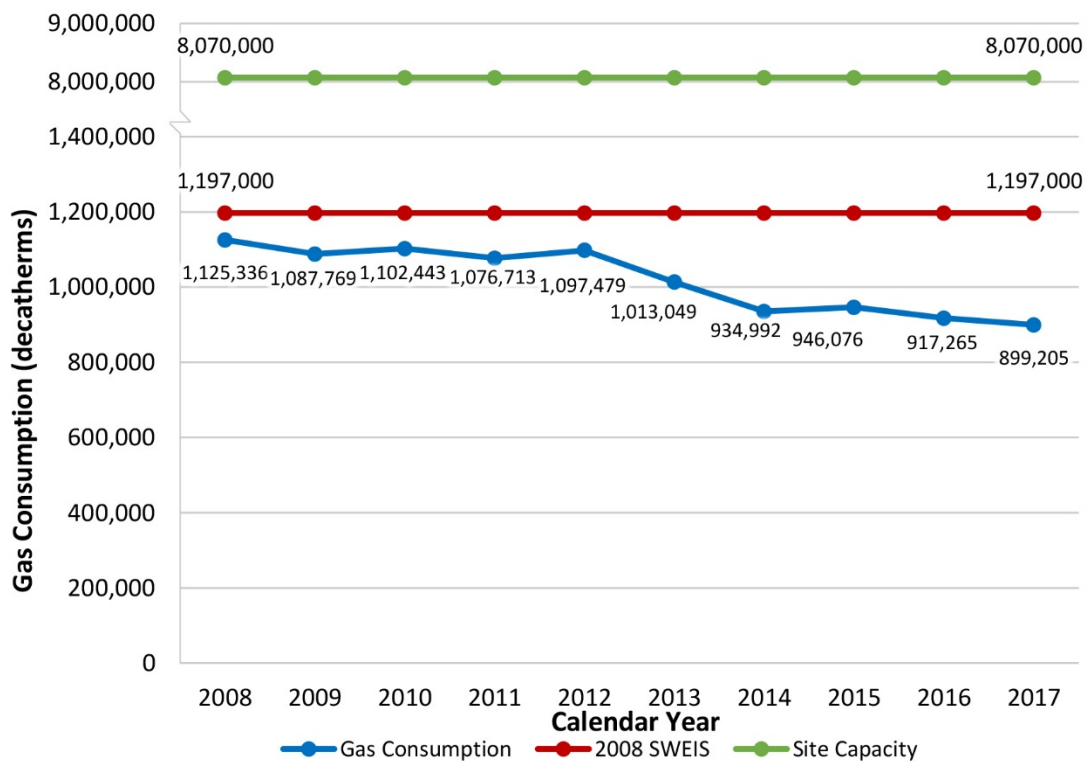


Figure 3-12. Natural gas consumption at LANL from 2008 through 2016

Water conservation efforts at LANL include a cost-effective life-cycle approach that emphasizes energy efficiency and minimal regional impacts associated with water use.

In addition to water conservation efforts, DOE is implementing the following projects to reduce water consumption.

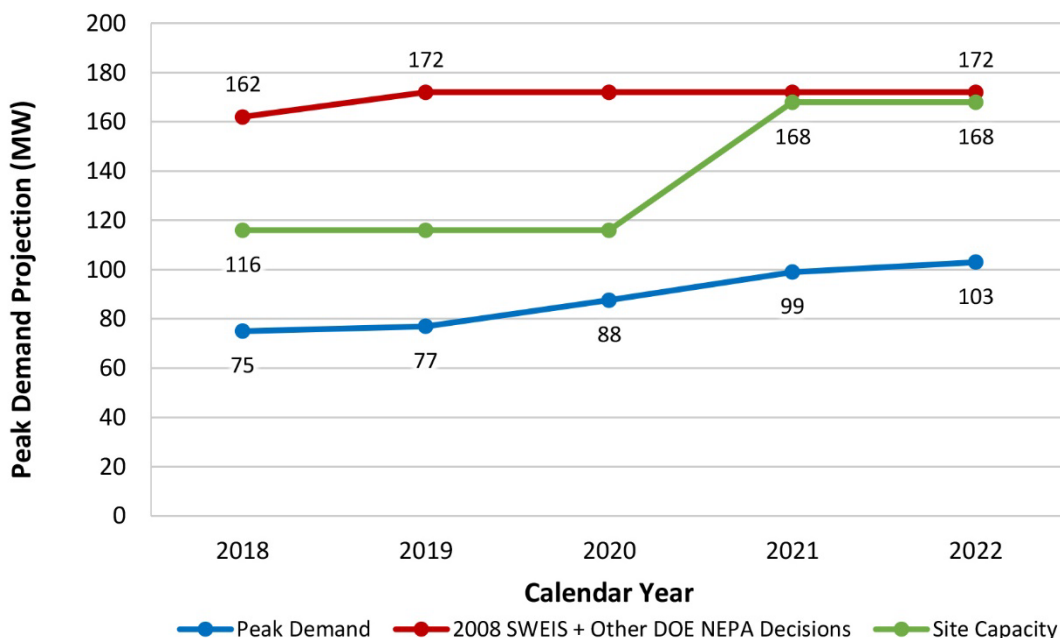
- Effluent reuse projects through the Sanitary Effluent Reclamation Facility expansion project. The effluent capacity of the Sanitary Effluent Reclamation Facility is currently estimated to be 72 million gallons (270 million liters) per year.
- Replacement of a once-through cooling system at the TA-3 Power Plant.
- Pilot project to reduce the amount of water discharged from cooling towers to prevent silica scale. The pilot project demonstrated that the cycles of concentration in cooling towers could be increased from 2.0 to 3.5. Full implementation new treatment technology would reduce water consumption by approximately 35 percent.
- Leak detection and repair of waterlines across the LANL site.
- Installation of water meters at facilities that are large consumers (e.g., the TA-3 Power Plant, cooling towers, and satellite steam plants) to measure water use at LANL.
- Replacement of the over-60-year-old water distribution system.
- Native grass and landscaping, which requires less water (LANL 2001).

Additional information is available in the annual site sustainability plans (LANL 2017c).

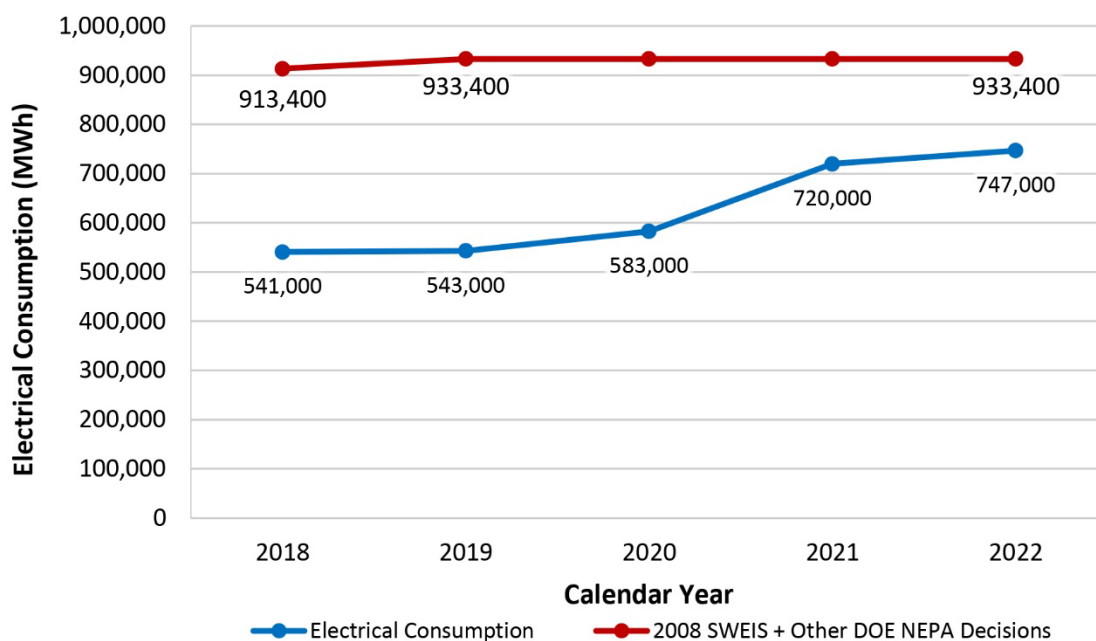
### **3.11.3 Analysis of Projected Changes (2018 through 2022)**

New, modified, or continuing projects (Table 3-1) considered for utility use and related infrastructure needs include: 1) the parking structure at TA-50 and support office building(s) along Pajarito Corridor, 2) the Energetic Materials Characterization Facility, 3) the Scorpions Integrated Test Stand, 4) the DARHT Vessel Cleanout Facility, 5) High-Power Beam Delivery at Area A, 6) Hot-Cell Work in Area A, 7) the Radiochemistry Laboratory Hot-Cell Facility, 8) the Electron Beam Test Facility, 9) the Materials Science and Technology Fuel Fabrication Facility, 10) the Nuclear Counterproliferation Building, 11) the TA-72 Firing Range Upgrade, 12) the Protective Force Training Facility, 13) infrastructure modernization including electrical transmission and distribution and the Photovoltaic Array, and 14) Environmental Management Legacy Contaminant Cleanup Program Activities including Mortandad Canyon and Cañon de Valle.

LANL energy needs are not projected to exceed the 2008 SWEIS peak load of 120 megawatts during this period. Projected peak demand is shown in Figure 3-13 for both LANL and Los Alamos County (Rodriguez 2017a, 2017b). Energy needs during this supplement analysis review period (2018 through 2022) are within the site capacity. Figure 3-9 shows that the 2008 SWEIS evaluated 120 megawatts for 2017. This value increases in 2018 to 162 megawatts and to 172 megawatts in 2019. There are two projects being planned, the 42-megawatt power plant (Section 2.5.1.1) and the 10-megawatt photovoltaic array (Section 2.1.2.3) that are currently planned to begin operations during this review period. These two projects will provide capacity for future energy consumption. Figure 3-14 shows projected data for LANL and Los Alamos County (Rodriguez 2017a).



**Figure 3-13. Peak demand projection from 2018 through 2022**



**Figure 3-14. Projected energy use from 2018 through 2022**

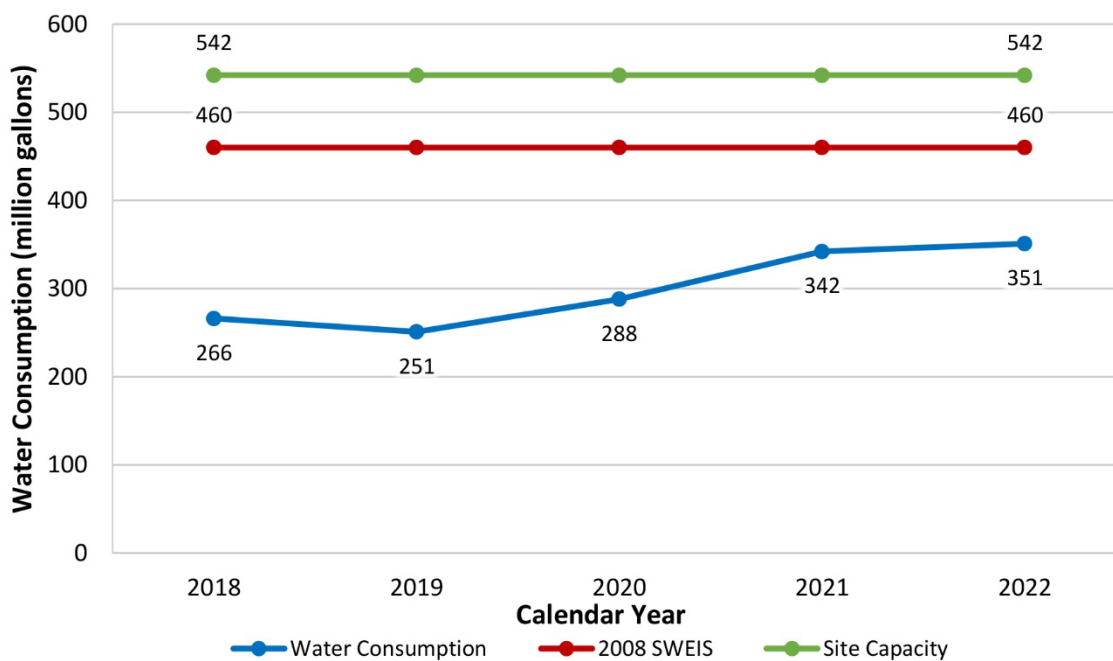
DOE Order 436.1, "Departmental Sustainability," requires that LANL be certified to or conform with the International Organization for Standardization 14001 standard for establishing an Environmental Management System. The Order also requires that LANL's Site Sustainability Plan be integrated with the Environmental Management System. LANL's Environmental Management System establishes objectives and targets to improve compliance, reduce environmental impacts, increase operational capacity, and meet both short- and long-term site

sustainability goals. Environmental risk is evaluated and environmental goals are documented annually in environmental action plans.

DOE is committed to reducing energy and water consumption while planning for future energy and water requirements for mission growth. Several long-range planning efforts have been prepared to better understand future utility demands. These planning efforts include the Site Sustainability Plan, the Long-Term Strategy Plan, the Ten-Year Site Plan, the Power Plan, and the Enduring Waste Management Plan. These planning efforts contribute to the Environmental Management System to assist DOE in managing environmental impacts at LANL and demonstrating to the public that DOE is protective of human health and the environment.

In addition, DOE, LANL, and Los Alamos County work closely to better understand the future energy and water consumption needs of the community. This information is documented in the Los Alamos National Laboratory and Los Alamos County Power Plan (LANL 2017i) and the Long-Range Water Supply Plan (City of Santa Fe 2008).

Water consumption and natural gas use are projected to increase over the 2018 to 2022 time period and to remain bounded by the 2008 SWEIS. Water consumption at LANL is projected to increase from 2017 by roughly 100 million gallons (379 million liters) per year by 2022 (Figure 3-15) (Rodriguez 2017a). These increases are projected from changing mission needs.



**Figure 3-15. Water consumption projections at LANL from 2018 through 2022**

Under Executive Order 13514, “Federal Leadership in Environmental, Energy, and Economic Performance,” and subsequently Executive Order 13693, “Planning for Federal Sustainability in the Next Decade,” DOE set goals for water, electrical, and natural gas use; established greenhouse gas emission goals; and has required alternative fuel use and renewable energy use at all of its sites. The Sustainability Program at LANL strives to integrate energy and water conservation and cleaner production measures into everyday business practices at LANL. The

program manages, implements, and tracks progress toward meeting goals set by Executive Order 13693 and the DOE Strategic Sustainability Performance Plan, including:

- Planning, executing, evaluating, and continually improving operations to maximize sustainable use of energy and water
- Developing cost-effective energy-efficiency and renewable energy projects
- Improving the performance of existing facilities and planning for net-zero energy, water, and waste in facilities
- Using low-greenhouse gas-emitting energy sources to replace existing grid energy
- Preventing pollution and reducing or eliminating the generation of waste
- Planning for climate resiliency

The annual LANL site sustainability plans (LANL 2017c, 2010b, 2011d, 2012e, 2013e, 2014e, 2015g) provide information about how LANL is meeting the established goals.

#### **3.11.4 Conclusion**

Electrical, water and gas consumption are anticipated to remain within the bounds of the 2008 SWEIS during this review period of 2018 through 2022. Additional electrical infrastructure is anticipated to be required after 2022, along with potential new solutions for the increasing water demand.

### **3.12 Waste Management**

This section discusses waste generation trends from 2008 to 2017, projected waste generation for the next 5 years, LANL's enduring waste strategy, and proposed new waste facilities. DOE's NNSA and Environmental Management programs have different waste management scopes that in some cases are reported together in this supplement analysis. Newly generated waste and demolition waste is owned by NNSA and in this supplement analysis is referred to as "NNSA waste." NNSA waste is typically from facilities that contain routine operations. Waste from environmental remediation sites and legacy waste is owned by Environmental Management. This waste is referred to as "Environmental Management waste" in this supplement analysis.

#### **3.12.1 2008 SWEIS Waste Management Scope**

The 2008 SWEIS projected annual radioactive waste (low level, mixed low level, and transuranic) and chemical waste generated by research, production, maintenance, construction, and environmental remediation activities from 2008 through 2016. The 2008 SWEIS projections compared with actual waste generation amounts for each waste type are detailed below (DOE 2008a).<sup>32</sup>

---

<sup>32</sup> Waste projections for non-Environmental Management wastes were obtained from the 2008 SWEIS, Chapter 5 (page 5-139), Table 5-39, Radioactive and Chemical Waste Projections from Routine Operations – No Action Alternative. Environmental Management waste projections were obtained from the 2008 SWEIS, Appendix I (I-185), Table I-70, Removal Option Annual Waste Generation Rates (Implementation of the Consent Order for 2008), and the schedule for removal of material disposal areas in Appendix I, Table I-61.

The 2008 SWEIS also projected waste generated from construction and decontamination, demolition, and decommissioning activities. Construction and decontamination, demolition, and decommissioning projects are projected and included in the impacts analysis for each of the alternatives presented in the 2008 SWEIS. The 2008 SWEIS projected 151,382 cubic meters (5.3 million cubic feet) of waste generated from 2008 through 2016 from construction and decontamination, demolition, and decommissioning projects under the No Action Alternative (DOE 2008a). Several projects analyzed in the Expanded Operations Alternative were also selected under the second record of decision (DOE 2009a). These expanded operations projects include:

- Radioactive Liquid Waste Treatment Facility Upgrades project
- TA-55 Reinvestment Project
- TA-18 decontamination, demolition, and decommissioning
- TA-21 decontamination, demolition, and decommissioning
- Waste Management Facilities Transition

### **3.12.2 Changes since the 2008 SWEIS (2008 through 2017)**

While annual waste generation trends fluctuated between 2008 and 2017, overall waste generation remained below the 2008 SWEIS projections. Several waste management updates have occurred since the 2008 SWEIS and are described below.

#### **3.12.2.1 2016 Consent Order**

The 2008 SWEIS and the 2005 Compliance Order on Consent projected that remediation would be completed by 2015 and that existing facilities at TA-54 would be closed. However, remediation activities continue and in 2016, the Laboratory entered into an updated Consent Order (NMED 2016b).

#### **3.12.2.2 Waste Isolation Pilot Plant Event**

On February 14, 2014, an airborne radiological release occurred underground at the Waste Isolation Pilot Plant involving improperly treated transuranic wastes generated at LANL. These improperly treated transuranic wastes contained nitrate salts. Waste Isolation Pilot Plant operations were temporarily suspended, resulting in transuranic wastes being stored on-site at LANL. Operations were suspended at two LANL facilities involved in the processing and packaging of waste: the Waste Characterization Reduction and Repackaging Facility and the Radioassay and Nondestructive Testing Facility. The Waste Characterization Reduction and Repackaging Facility received upgrades such as a new roof, new bay door, a large refrigerator to keep the waste cool, and an electrical upgrade. The Radioassay and Nondestructive Testing Facility is undergoing seismic upgrades and roof replacement.

Existing facilities at TA-54 and TA-50 are being used to store, remediate, and process additional improperly treated transuranic nitrate salt waste containers. These facilities will remain active for an undetermined period of time while the backlog of transuranic waste, due to the Waste Isolation Pilot Plant temporary shutdown, is managed (DOE 2016c, 2016d).



### **3.12.2.3 TA-55 Waste Storage Operations**

As a result of the Waste Isolation Pilot Plant temporary shutdown, additional waste storage space is required at TA-55. Although the Waste Isolation Pilot Plant has restarted operations, storage relief at LANL will not be immediate because there are also backlogs at other DOE facilities. Additional storage at LANL has been proposed at PF-4 and may also be required at RLUOB.

The construction of the new Transuranic Waste Facility is on schedule for completion and will enhance LANL's capability to manage new transuranic wastes generated at LANL. This facility is expected to be operational in 2018.

### **3.12.2.4 Hazardous Waste Permit Modification**

In 2016, DOE and the Laboratory submitted a draft Hazardous Waste Facility Permit modification request to the New Mexico Environment Department to treat nitrate salt waste containers (LANL 2016f). This permit modification allows for the treatment necessary to remove the Resource Conservation and Recovery Act hazardous waste characteristics of ignitability and corrosivity. Nitrate salt waste is being treated at the Waste Characterization, Reduction, and Repackaging Facility at TA-50. The permit modification also states that a refrigeration unit (less than 12 feet by 12 feet [3.7 meters by 3.7 meters]) at the Waste Characterization, Reduction, and Repackaging Facility will be used to store remediated nitrate-salt-bearing waste containers, as needed, before treatment to lower the chemical reactivity and minimize the risk of an exothermic reaction (LANL 2016f).

### **3.12.2.5 Outfall Changes**

The number of outfalls has been reduced at the Laboratory since 2009 (see the "Industrial Outfalls" in Section 3.4.2.1.1, National Pollutant Discharge Elimination System Permits). Much of this water is now first treated at the wastewater treatment plant and the Sanitary Effluent Reclamation Facility, which has led to increased byproduct waste from these facilities.

### **3.12.2.6 Waste Generation Trends (2008 through 2016)**

The annual SWEIS yearbooks track wastes generated from all operations annually by waste type. The cumulative total for newly generated waste and legacy waste generated from 2008 through 2016 remained below the cumulative totals projected in the 2008 SWEIS for all radioactive and chemical waste types for this period. Waste generation was below projections for all waste types (Table 3-13).

The 2008 SWEIS projected waste generated annually from remediation activities in order to comply with the Consent Order. These activities include the removal of material disposal areas and remediation of potential release sites. A schedule for the removal of material disposal areas is presented in Table I-61 of Appendix I of the 2008 SWEIS (DOE 2008a). The 2008 SWEIS waste projection for Environmental Management waste is based on this schedule so quantities change each year.

**Table 3-13. Projected LANL Cumulative Waste Generation—2008 through 2016**

Waste Type	Units <sup>a</sup>	2008 SWEIS <sup>b</sup> 2008 through 2016	Actual 2008 through 2016 Totals
Chemical	10 <sup>3</sup> kilograms	46,774	15,901
Low-level waste	cubic meters	885,306	86,383
Mixed low-level waste	cubic meters	137,774	1,715
Transuranic + mixed transuranic <sup>c</sup>	cubic meters	20,887	2,139

<sup>a</sup> Multiply kilograms by 2.2046 to get pounds; multiply cubic meters by 35.314 to get cubic feet.

<sup>b</sup> Includes waste from NNSA and Environmental Management. Waste projections for each waste type were obtained from the 2008 SWEIS, Chapter 5 (page 5-139), Table 5-39, Radioactive and Chemical Waste Projections from Routine Operations – No Action Alternative. DOE waste projections were obtained from the 2008 SWEIS, Appendix I (I-185), Table I-70, Removal Option Annual Waste Generation Rates (Implementation of the Consent Order for 2008) (DOE 2008a).

<sup>c</sup> The 2008 SWEIS combines transuranic and mixed transuranic wastes into one waste category since they are both managed for disposal at the Waste Isolation Pilot Plant (DOE 2008a).

### **Sanitary Effluent Reclamation Facility Expansion**

The largest annual waste exceedance over 2008 projections was due to hazardous/chemical waste generated from 2013 through 2016 associated with the expansion of the Sanitary Effluent Reclamation Facility; the expansion was not analyzed in the 2008 SWEIS. The expansion was analyzed in the 2010 “Final Environmental Assessment for the Expansion of the Sanitary Effluent Reclamation Facility and Environmental Restoration of Reach S-2 of Sandia Canyon” (DOE 2010a). In the associated finding of no significant impact, DOE determined that the project would not pose a significant impact to the environment (DOE 2010b). The environmental assessment projected waste generated by the Sanitary Effluent Reclamation Facility to increase with the expansion (Table 3-14). These streams are from a filter press step where solid materials are squeezed out of the water into a “filter cake” (classified as New Mexico Special Waste), and a reverse osmosis step where very clean water passes through membranes while contaminated water is rejected (reverse osmosis reject water).

**Table 3-14. Waste Volumes from the Sanitary Effluent Reclamation Facility**

Waste Type	Projected average increase in waste from the 2010 Sanitary Effluent Reclamation Facility Expansion Environmental Assessment	Actual Waste Average (2013 through 2016)
Waste generated from filter cakes	165,710 kilograms <sup>a</sup> per year	814,500 kilograms <sup>a</sup> per year
Waste generated from reject water	15,768,999 <sup>b</sup> liters per year	3,452,600 <sup>c</sup> liters <sup>b</sup> per year

<sup>a</sup> Multiply kilograms by 2.2046 to get pounds.

<sup>b</sup> Multiply liters by 0.26418 to get gallons.

<sup>c</sup> Reject water was not disposed of until 2016. This number represents the total shipped off-site in 2016.

Beginning in 2013, when the Sanitary Effluent Reclamation Facility expanded, the waste generated from filter cakes exceeded projections in the 2010 environmental assessment. The reverse osmosis reject water was first disposed of in 2016 and volumes did not exceed the 2008 SWEIS projections.

### **Material Disposal Area B Remediation**

The major Environmental Management remediation project that was completed during this time period was the Material Disposal Area B remediation at TA-21 (2010–2011). Total waste volumes resulting from this project were below volumes projected in the 2008 SWEIS under the Removal Option.

#### **3.12.2.7 Chemical Waste**

Overall, total chemical waste generation from 2008 through 2016 was below 2008 SWEIS projections for both Environmental Management and NNSA operations (Figure 3-16) (DOE 2008a, LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b, Tozer 2017). The Environmental Management portion of chemical waste is shown in Figure 3-17 (DOE 2008a, LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b, Tozer 2017). Figure 3-18 shows the NNSA portion of chemical waste, which in calendar year 2010 was mostly friable-asbestos-contaminated material from the decontamination, decommissioning and demolition of the former Administration Building at TA-3, and which exceeded 2008 SWEIS projections (DOE 2008a, LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b, Tozer 2017). In 2013, NNSA chemical waste also exceeded the 2008 SWEIS projections because of the disposal of filter cakes produced from treating effluent from sanitary wastewater systems. The NNSA chemical waste exceeded the 2008 SWEIS projections again in 2016, which then caused the total 2016 chemical waste to exceed 2008 SWEIS projections. This was due to Sanitary Effluent Reclamation Facility wastewater byproduct (reverse osmosis reject water). The Sanitary Effluent Reclamation Facility processes sanitary wastewater effluent for the removal of unwanted constituents, primarily silica and polychlorinated biphenyls. The byproduct of this process is water containing the dissolved solids, which is shipped off-site for disposal. As stated in the 2010 Sanitary Effluent Reclamation Facility Environmental Assessment, this reject water was intended to be discharged into evaporation ponds at TA-60; however, the reject water volume is higher than was anticipated and has exceeded pond capacity.

#### **3.12.2.8 Low-Level Waste**

Total low-level waste (Figure 3-19), Environmental Management low-level waste (Figure 3-20), and NNSA low-level waste (Figure 3-21) generation from 2008 to 2012 fell below 2008 SWEIS record of decision projections (DOE 2008a, 2008b, 2009a, LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b, Tozer 2017).

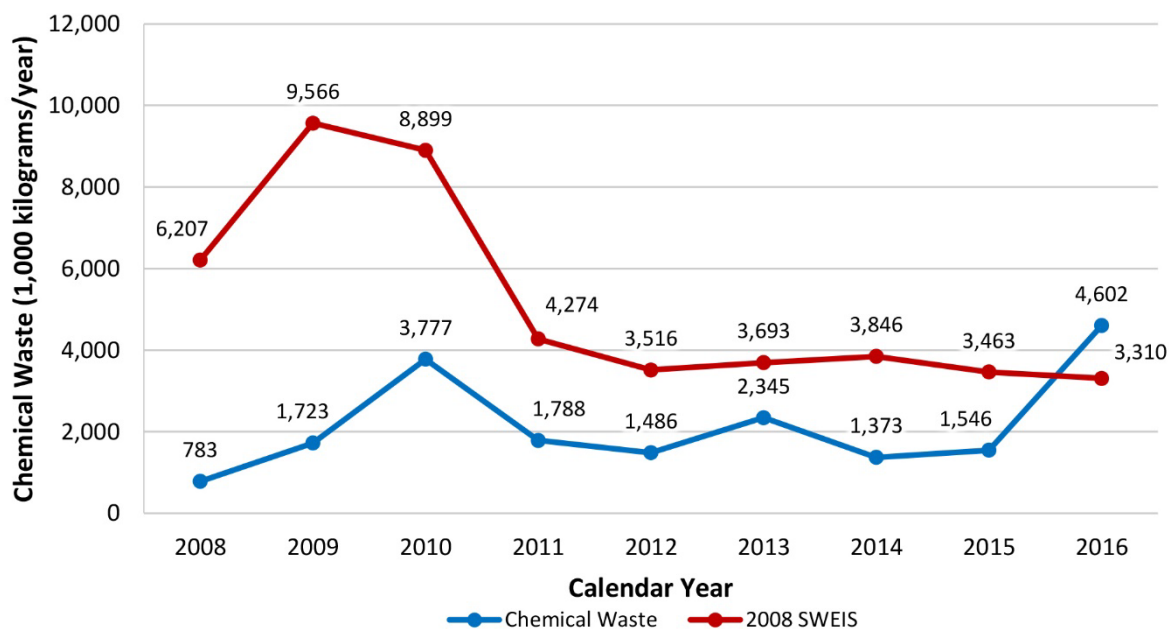


Figure 3-16. Total LANL annual chemical waste generation (2008 through 2016) <sup>33</sup>

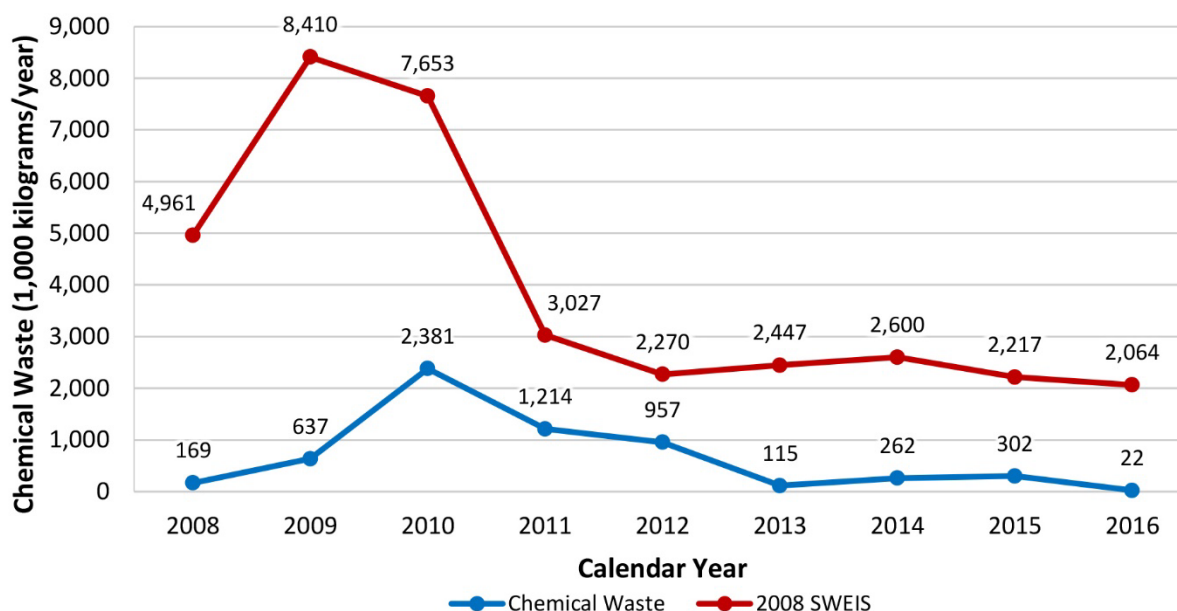


Figure 3-17. Environmental Management annual chemical waste generation (2008 through 2016) <sup>34</sup>

<sup>33</sup> Includes waste from NNSA and Environmental Management. Waste projections for each waste type were obtained from the 2008 SWEIS, Chapter 5 (page 5-139), Table 5-39, Radioactive and Chemical Waste from routine operations, No Action Alternative. Environmental Management waste projections were obtained from the 2008 SWEIS, Appendix I (I-185), Table I-70, Removal Option Annual Waste Generation Rates (Implementation of the Consent Order for 2008).

<sup>34</sup> Environmental Management waste projections were obtained from the 2008 SWEIS, Appendix I (I-185), Table I-70, Removal Option Annual Waste Generation Rates (Implementation of the Consent Order for 2008).

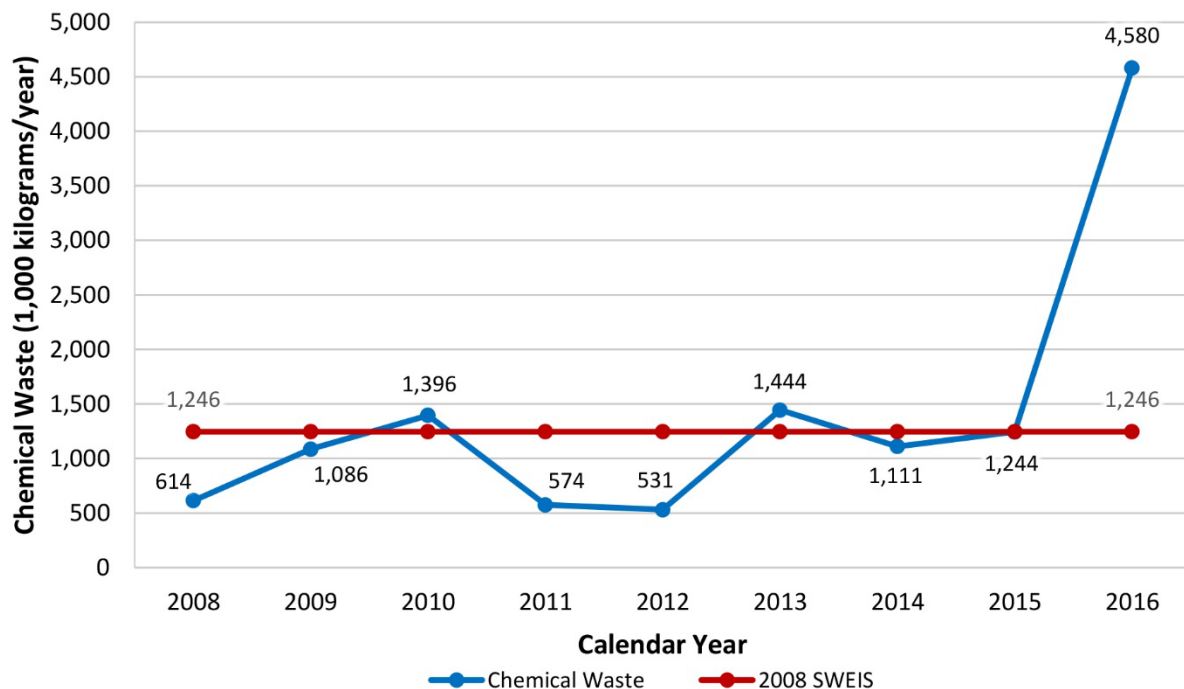


Figure 3-18. NNSA annual chemical waste generation (2008 through 2016)

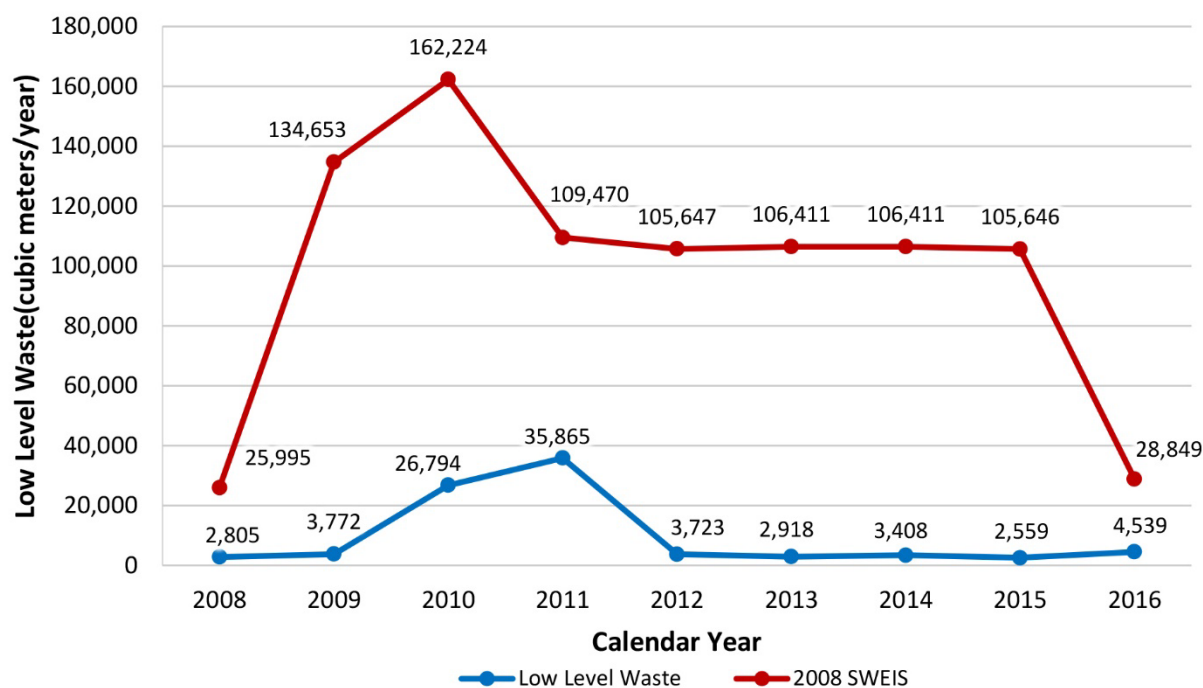
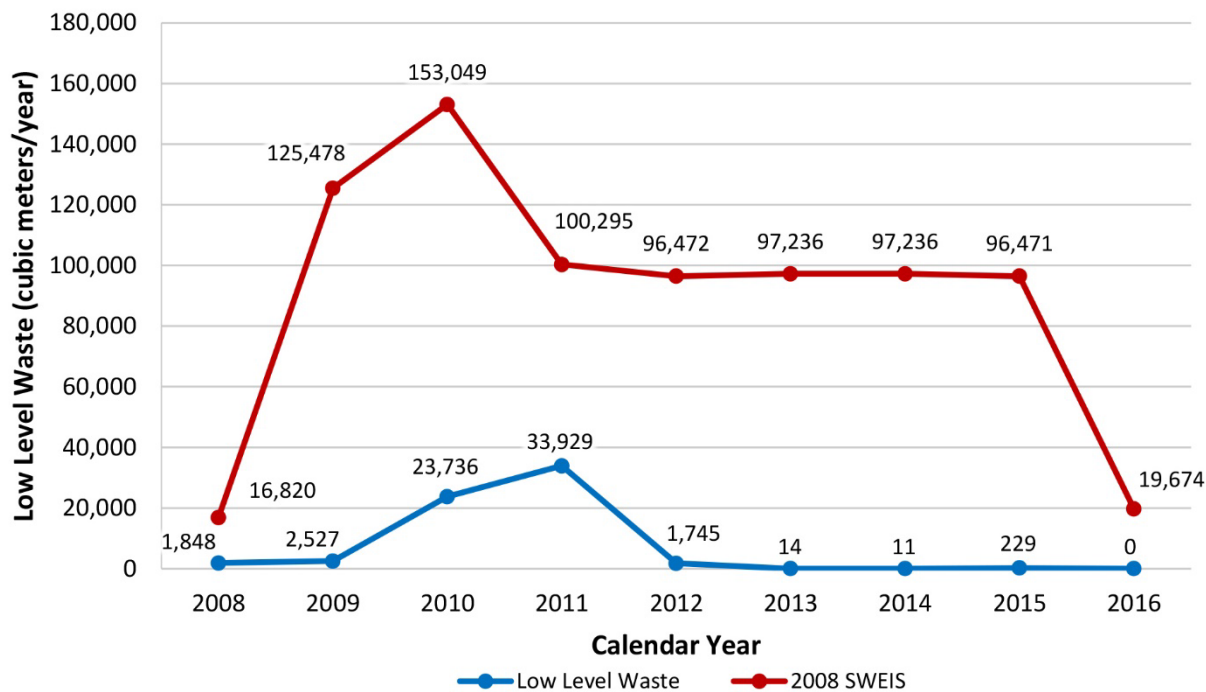
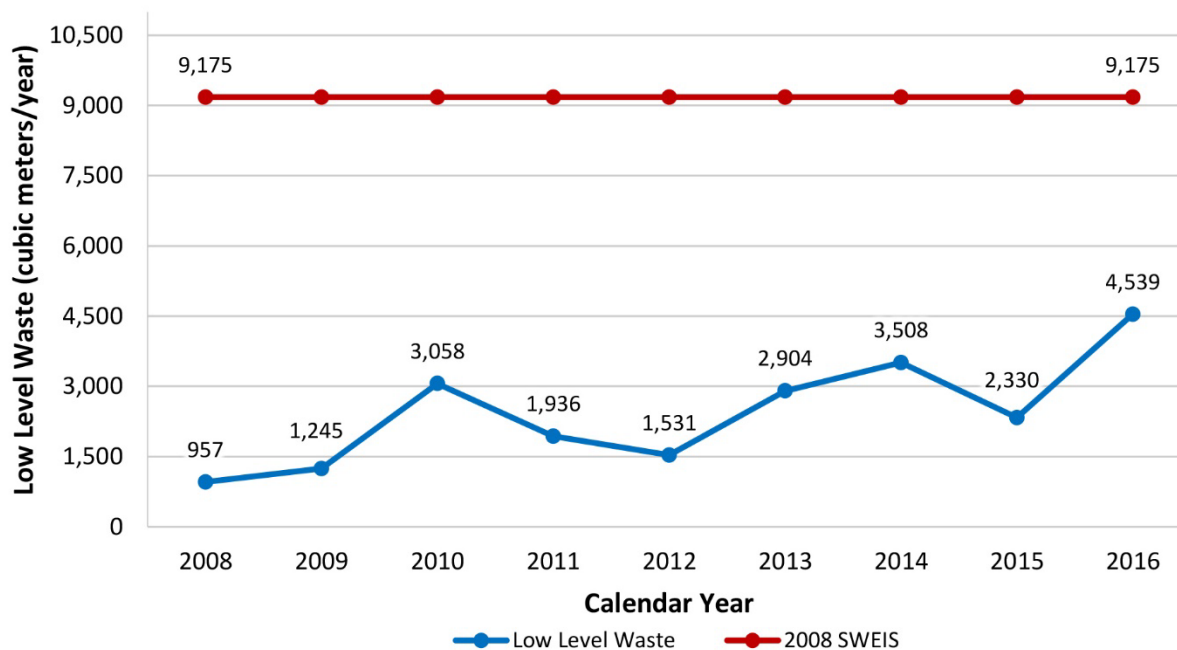


Figure 3-19. Total LANL annual low-level waste generation (2008 through 2016)



**Figure 3-20. Environmental Management annual low-level waste generation (2008 through 2016)**



**Figure 3-21. NNSA annual low-level waste generation (2008 through 2016)**

### 3.12.2.9 Mixed Low-Level Waste

Total mixed low-level waste and Environmental Management mixed low-level waste generation for 2008 to 2017 fell below 2008 SWEIS projections (Figures 3-22 and 3-23) (DOE 2008a, 2008b, 2009a, LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b, Tozer 2017). The largest annual volume of total mixed low-level waste generated was 864 cubic meters in 2013. This was due to the reclassification and repackaging of legacy transuranic waste at the Solid Radioactive and Chemical Waste Facilities. The NNSA mixed low-level waste also exceeded the 2008 SWEIS projections in 2014, again due to the reclassification and repackaging of legacy transuranic waste at the Solid Radioactive and Chemical Waste Facilities. In 2010, 2008 SWEIS projections were exceeded by 1.94 cubic meters (68.5 cubic feet) for NNSA mixed low-level waste generation from decommissioning of TA-3-0016 (Figure 3-24) (DOE 2008a, 2008b, 2009a, LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b, Tozer 2017).

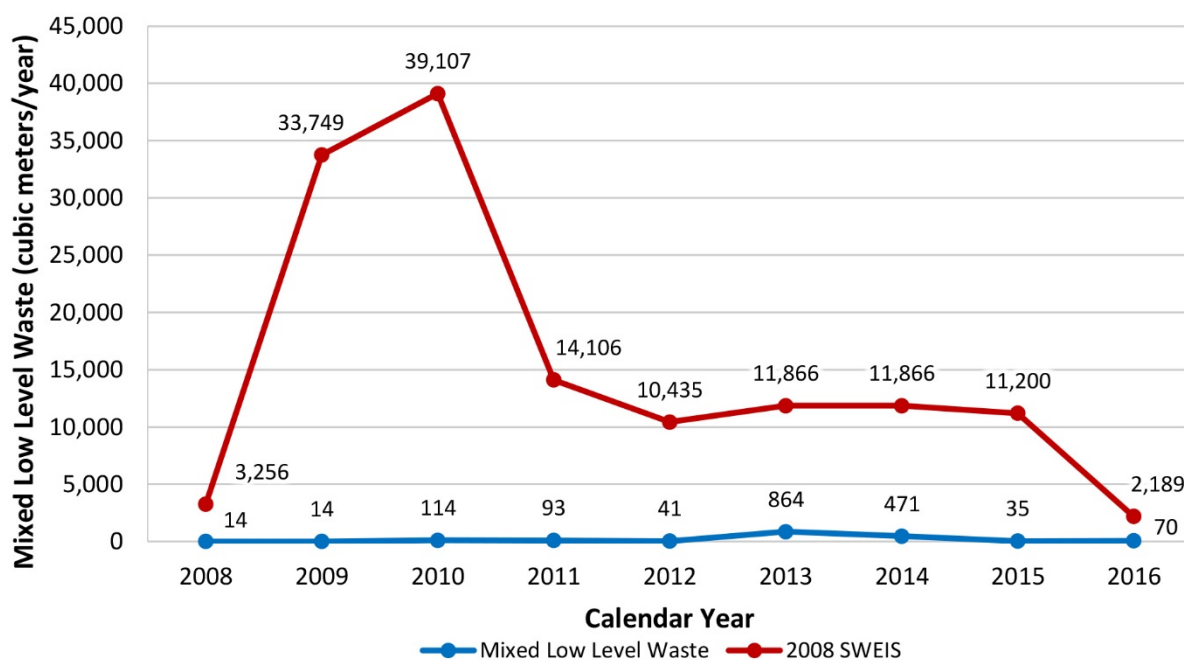
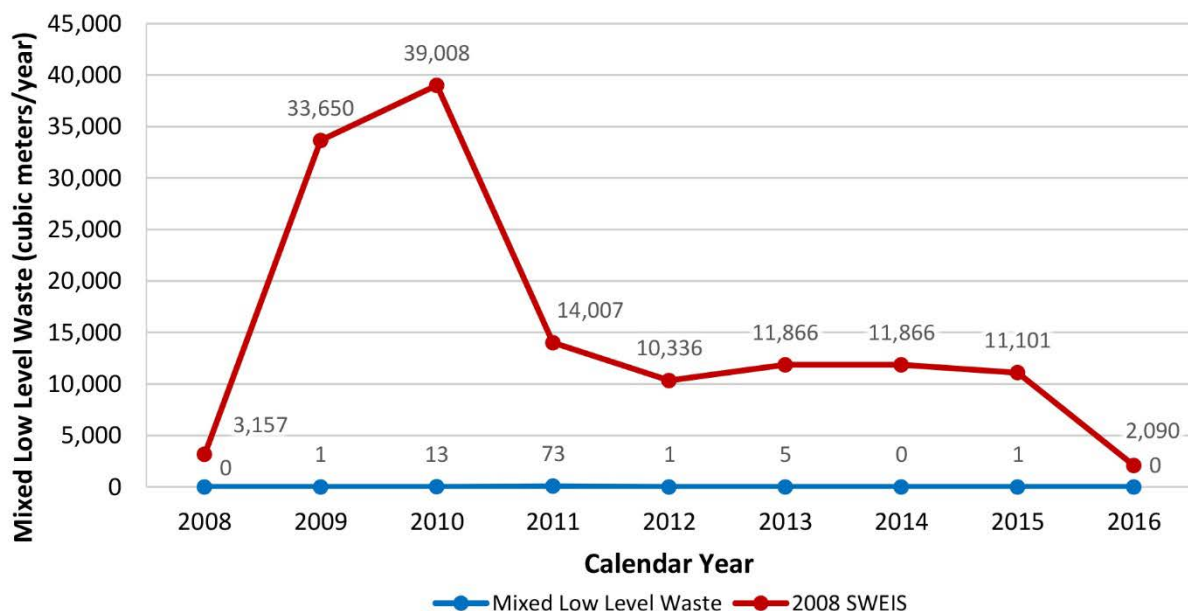
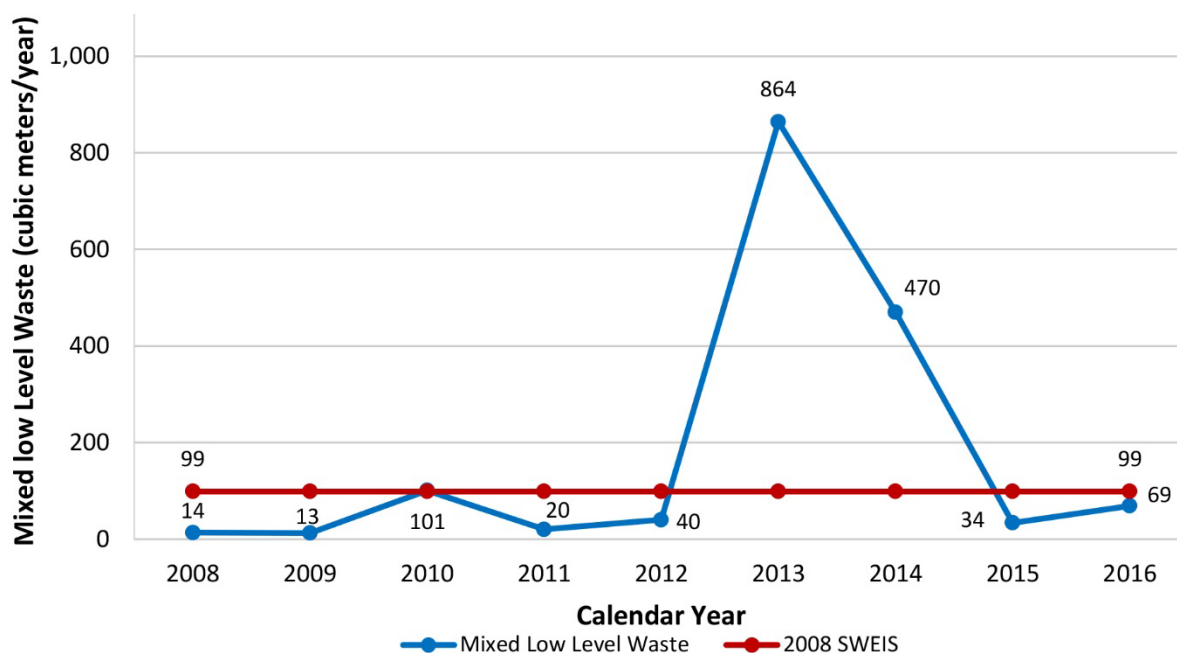


Figure 3-22. Total LANL annual mixed low-level waste generation (2008 through 2016)





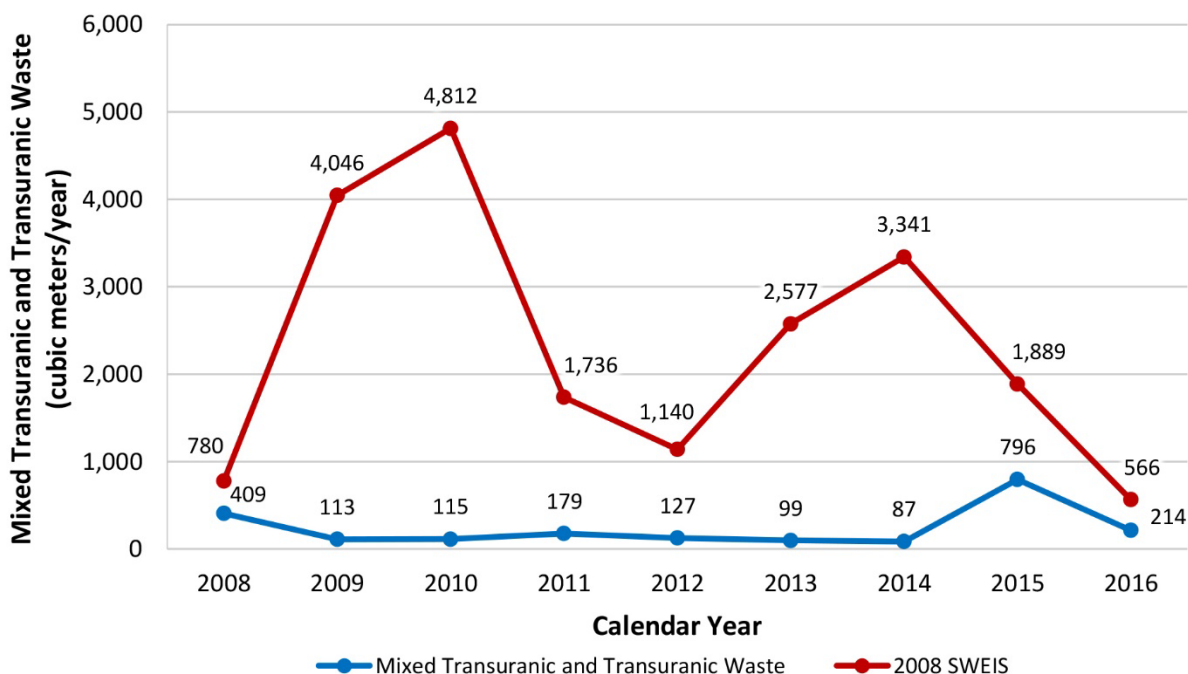
**Figure 3-23. Environmental Management annual mixed low-level waste generation (2008 through 2016)**



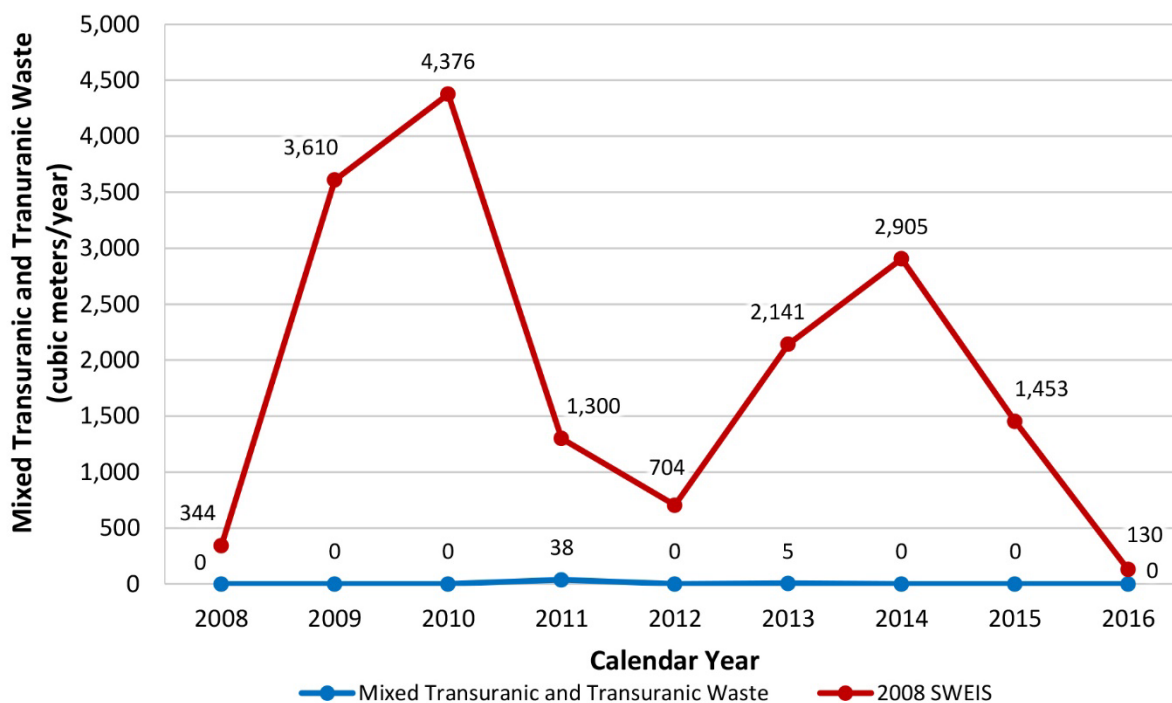
**Figure 3-24. NNSA annual mixed low-level waste generation (2008 through 2016)**

### 3.12.2.10 Transuranic and Mixed Transuranic Waste

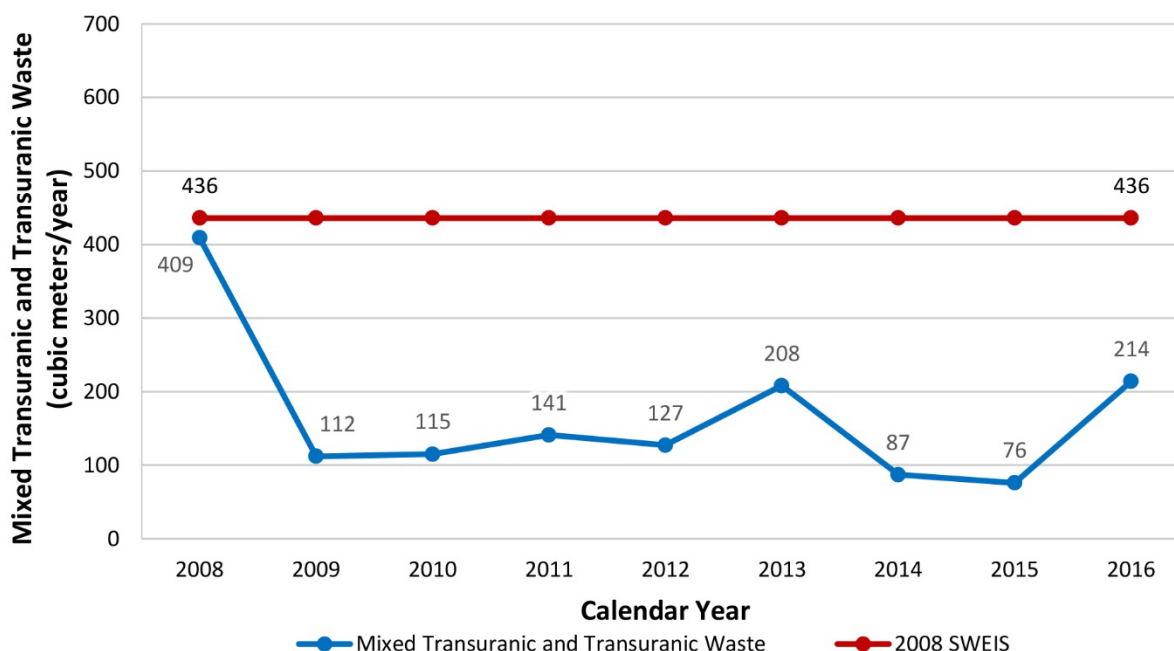
Total (Figure 3-25), Environmental Management (Figure 3-26), and NNSA (Figure 3-27) transuranic and mixed transuranic waste generation remained within the projections of the 2008 SWEIS during 2008 through 2016 (DOE 2008a, 2008b, 2009a, LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b, Tozer 2017).



**Figure 3-25. Total LANL annual transuranic and mixed transuranic waste generation (2008 through 2016)**



**Figure 3-26. Environmental Management transuranic and mixed transuranic waste generation (2008 through 2016)**



**Figure 3-27. NNSA transuranic and mixed transuranic waste generation (2008 through 2016)**

### 3.12.2.11 Construction and Demolition Debris

In the 2008 SWEIS, DOE proposed to remove aging structures as part of its Footprint Reduction Program. Demolition of structures at TA-21 and TA-18 has been largely completed and a number of older transportable buildings were removed. As part of the footprint reduction, 1,015,561 square feet (94,350 square meters) were removed from 2008 through 2016. The total cumulative waste from construction and demolition debris was approximately 30,600 cubic meters (1,081,000 cubic feet) and was less than 15 percent of that projected in the 2008 SWEIS, 246,409 cubic meters (8,702,000 cubic feet) (LANL 2016d, Liechty 2017)<sup>35</sup>.

### 3.12.2.12 Radioactive Liquid Waste

Radioactive liquid waste volumes treated at the Radioactive Liquid Waste Treatment Facility remained below the 2008 SWEIS levels 20,000 cubic meters (5.3 million gallons per year) from 2008 through 2016 (LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b, Del Signore 2017). In 2016, the Radioactive Liquid Waste Treatment Facility treated approximately 3,300 cubic meters [870,000 gallons] of radioactive liquid waste).

<sup>35</sup> Construction/demolition debris includes uncontaminated wastes such as steel, brick, concrete, pipe, and vegetation from land clearance. This number represents 151,382 cubic meters (5.3 million cubic feet) from the No Action Alternative, 2,293 cubic meters (605,700 gallons) from the Radioactive Liquid Waste Treatment Facility upgrade, 2,133 cubic meters (75,300 cubic feet) from the Plutonium Refurbishment, 35,934 cubic meters (1.3 million cubic feet) from the TA-21 Decontamination, Decommissioning, and Demolition Option, 12,998 cubic meters (460,000 cubic feet) from the TA-18 Decontamination, Decommissioning, and Demolition Option, and 41,669 cubic meters (1.5 million cubic feet) from the Waste Management Facilities Transition.

### 3.12.3 Analysis of Projected Changes 2018 through 2022

New, modified, or continuing projects (Table 3-1) considered for waste generation and management include: 1) Increased Pit Disassembly/Conversion and Disposition, 2) the parking structure at TA-50 and support office building(s) along Pajarito Corridor, 3) CMR Wing 9 Hot Cell, 4) Large-Vessel Handling, 5) the DARHT Vessel Cleanout Facility, 6) High-Power Beam Delivery at Area A, 7) Hot-Cell Work in Area A, 8) Radiochemistry Laboratory Hot-Cell Facility, 9) shockwave experiments at the Proton Radiography Facility, 10) the Electron Beam Test Facility, 11) the Materials Science and Technology Fuel Fabrication Facility, 12) the Biosafety Level 2 Radiological Laboratory, 13) Alternatives Analysis and Strategy for Certain Shafts at TA-54, 14) Difficult Waste Streams, 15) the Nuclear Counterproliferation Building, 16) the TA-72 Firing Range Upgrade, 17) the Protective Force Training Facility, 18) infrastructure modernization, and 19) the Environmental Management Legacy Contaminant Cleanup Program Activities.

Environmental Management activities will be consistent with projects analyzed in the 2008 SWEIS and waste volumes will remain bounded by the 2008 SWEIS. NNSA projects are anticipated to either continue in their current project status or accelerate. However, waste generation will stay within the bounds of the 2008 SWEIS. The projects identified at the beginning of Chapter 3 that may contribute to waste generation are identified in Table 3-15.

**Table 3-15. Projects with Contributions to Waste Volumes**

Increased Pit Disassembly/Conversion and Disposition
Parking structure at TA-50 and support office building(s) along Pajarito Corridor
CMR Wing 9 Hot-Cell move
Large-Vessel Handling
DARHT Vessel Cleanout Facility
High-Power Beam Delivery at Area A
Hot-Cell Work in Area A
Radiochemistry Laboratory Hot-Cell Facility
Shockwave Experiments at the Proton Radiography Facility
Electron Beam Test Facility
Biosafety Level 2 Radiological Laboratory
Alternatives Analysis and Strategy for Certain Shafts at TA-54
Difficult Waste Streams (flanged tritium waste container, irradiators, LANSCE Cooling System Waste Water, LANSCE targets, Fort St. Vrain uranium, and animal tissues)
Nuclear Counterproliferation Building
TA-72 Firing Range Upgrade
Supplemental Environmental Projects – watershed enhancement

The generation forecast for construction and demolition debris for 2018 through 2022 is approximately 6,249 tons (17,695 cubic meters).

The LANL Enduring Mission Waste Management Plan (LANL 2017j) identifies the most urgent needs for managing waste: transuranic waste storage, on-site disposal, radioactive liquid waste

and facilities, centralized waste management, relocation of enduring waste operations from TA-54, site cleanup and metals moratorium, permitting and compliance focusing on remediated nitrate salt operations and transuranic storage, waste minimization, and remediation of nitrate salt drums. Remediation of the nitrate salt drums will be completed by the spring of 2018.

Closure of Material Disposal Area G will require the relocation of all low-level waste storage, processing, and disposal operations within remediation areas of Material Disposal Area G. Long-term planning indicates Area L, the Laboratory treatment and storage facility for the majority of Enduring Mission chemical, hazardous, and other regulated wastes, will need to be replaced with a consolidated waste facility. For hazardous waste, a consolidation strategy will be pursued rather than investing in long-term upgrades to small-footprint facilities like Area L. Interim use of Area L will continue for the next 2 to 3 years. The area is covered under the current Resource Conservation and Recovery Act permit. The renewal process will begin in 2019, allowing time to develop a consolidated waste facility. Separate NEPA analyses will be prepared for the consolidation strategy when project planning is sufficiently defined.

### **3.12.4 Conclusion**

LANL will continue use of hazardous and radioactive materials and resultant wastes consistent with 2008 SWEIS record of decision projections. Fluctuations within the annual generation rates for the various waste types are anticipated, but average generation for most waste types is projected to remain within the 2008 record of decision projections.

Sanitary solid waste generation rates are projected to remain within 2008 SWEIS projections. LANL disposes of all solid non-hazardous waste off-site. While large demolition projects result in elevated generation rates, no additional waste storage, treatment, handling capacity, or security requirements will be needed.

Impacts to waste management are expected to remain within the 2008 SWEIS projections; therefore, further supplementation of the 2008 SWEIS for waste management is not needed.

## **3.13 Traffic and Transportation**

LANL is served by state highways from the east (to Santa Fe and the Española Valley) and west (to Jemez Springs). There is scheduled weekday bus service between Los Alamos, Santa Fe, and Española. The Los Alamos airport accommodates private, charter, and government aircraft but does not presently offer commercial air service. The closest rail lines are the Rail Runner commuter service in Santa Fe and the Burlington Northern Santa Fe that runs through Lamy, New Mexico, which is serviced by Amtrak. Freight rail travels through Albuquerque and Belen. Most road traffic at LANL is generated by commuters, material deliveries, and waste shipments.

### **3.13.1 2008 SWEIS Analysis**

Under the 2008 SWEIS, LANL traffic was expected to increase by up to 18 percent because of the projected increases in employment and construction; decontamination, decommissioning, and demolition; and remediation activities (DOE 2008a). Transportation of waste and fill material by truck for decontamination, decommissioning, and demolition and material disposal area remediation was anticipated to accelerate wear on local roads and exacerbate traffic problems. The 2008 SWEIS analyzed the highest risks to the public based on the assumptions that all of the material disposal areas were exhumed under the removal option and that the Nevada National

Security Site was the main option for disposal of low-level waste. This option was projected to result in 122,445 shipments of radioactive materials over a 10-year period<sup>36</sup>. The 2008 SWEIS concluded that transportation of radioactive materials would not likely cause a fatality as a result of radiation, either from incident-free operations or postulated accidents. The 2008 SWEIS projected the possibility of about three fatalities from traffic accidents associated with these transportation activities. For perspective, in 2016, there were 404 traffic fatalities in New Mexico, 26 of which occurred in the three counties neighboring LANL (Los Alamos, Rio Arriba, and Santa Fe).

### **3.13.2 Changes since the 2008 SWEIS (2008 through 2017)**

The total number of shipments bounded by the 2008 SWEIS is 122,445 over a 10-year projection period (DOE 2008a). From 2008 to mid-2017, the total number of shipments was 26,409. The distribution of shipment types for radioactive materials are low-level waste (9,058 shipments), mixed low-level waste (4,588 shipments), transuranic waste (11,808 shipments), and mixed transuranic waste (955 shipments) (Johnson 2017).

In December 2012, DOE directed that all vehicles entering LANL must stop at the East and West Jemez Road vehicle access portals for a vehicle check. Modifications were made to these portals to support this policy. Pajarito Road and the Pajarito Corridor, where most radiological facilities and the Plutonium Facility are located, remain open only to government badge holders. All vehicles are required to stop at the Pajarito Road vehicle access portals and only badge holders are allowed to proceed, thereby isolating most nuclear operations from the general travelling public and enhancing transportation safety and security on-site. In 2016, the State of New Mexico and DOE agreed to fund the Supplemental Environmental Projects to improve transport safety between LANL and the Waste Isolation Pilot Plant; among the improvements is the redesign of the East Jemez Road/New Mexico State Road 4 intersection with construction scheduled to begin in 2018.

### **3.13.3 Analysis of Projected Changes (2018 through 2022)**

New, modified, or continuing projects (Table 3-1) considered for traffic and transportation include: 1) Increased Pit Disassembly/Conversion and Disposition; 2) Difficult Waste Streams; 3) infrastructure modernization, including the Supplemental Environmental Projects for road improvements; and 4) the Manhattan Project National Historical Park.

The Supplemental Environmental Project for roads that would most likely have short-term effects would be reconstructing the New Mexico State Road 4/East Jemez intersection. Impacts would include delays and longer or staggered commute times during construction. When completed, the project would reduce congestion and delays and improve traffic safety. There are no other planned regional major roadway improvement projects affecting highways in or near Los Alamos.

Radioactive, hazardous, and commercial materials would continue to be transported on-site and to and from various off-site locations that are internal and external to the DOE Complex. From 2018 through 2022, all trucks carrying radioactive materials to or from LANL will continue to

---

<sup>36</sup> The projected number of 122,445 shipments is derived from Table K-5 in the 2008 SWEIS. It is the sum of maximum radiological shipments under the Expanded Operations Alternative.

travel the section of road from LANL to Pojoaque; many of these trucks will also travel the section of road from Pojoaque to Santa Fe. The radiological risks to the population along these two sections of road remain very small. No fatalities due to radiation exposure and zero worker fatalities or latent cancer fatalities would be expected from shipments of radioactive materials along these routes, even under the bounding material disposal area removal option.

The Supplemental Environmental Projects to improve the East Jemez Road/New Mexico State Road 4 intersection, and other roadway pavement upgrades, will cause temporary congestion and delays; however, once completed, these projects will make the LANL roadway system safer and more efficient.

### **3.13.4 Conclusion**

The new, modified, and continuing projects and modifications in site operations would not significantly impact traffic and transportation at LANL and are consistent with the analysis in the 2008 SWEIS; therefore, further supplementation of the 2008 SWEIS for potential impacts to traffic and transportation is not needed.

## **3.14 Environmental Justice**

Environmental Justice is 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. DOE developed and issued its original Environmental Justice Strategy in 1995 in response to the February 11, 1994, Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.” The 2008 SWEIS included an analysis of environmental justice as required by NEPA.

### **3.14.1 2008 SWEIS Analysis**

The environmental justice analysis in the 2008 SWEIS anticipated there would be no adverse impacts from the continued operation of LANL under any of the alternatives. For all alternatives, the radiological dose from emissions associated with normal operations would be slightly lower for members of Hispanic, Native American, total minority, and low-income populations than for members of the population that are not in these groups. This situation is primarily based on distance of minority and low-income communities to the Laboratory.

### **3.14.2 Changes since the 2008 SWEIS (2008 through 2017)**

The 2008 SWEIS noted that employment at LANL and in the surrounding region would be expected to increase, thus creating additional employment opportunities for low-income and minority populations. However, the increase in employment at the Laboratory has been less than expected.

Santa Clara Pueblo challenged the 2008 SWEIS analysis that indicated exposure through special pathways would not present disproportionately high and adverse impacts on minority or low-income populations. The 2008 SWEIS records of decision (DOE 2008b, 2009a, 2011a) and mitigation action plan (DOE 2008e) addressed the concerns raised by the Pueblo. Consequently, DOE committed to two approaches in the 2008 SWEIS mitigation action plan:



- Continue consultations and both formal and informal public meetings.
- Improve upon and implement effective communications strategies to provide fair and equitable sharing of information about LANL operations to surrounding minority and low-income communities.

During this time, DOE and the Laboratory continued consultations and formal and informal public meetings regarding proposed projects at LANL. The Laboratory continued to implement Executive Order 12898 through the Community Commitment Plan and associated programs, the Regional Purchasing Plan, the Small Business Plan, and the Diversity Plan, as stipulated in the Laboratory Prime Contract. The Laboratory was formally assessed for implementation of the DOE Environmental Justice Program in 2012. A favorable final report was published that details many environmental justice-related activities that support the intent of Executive Order 12898.

In 2013, the Laboratory worked with the DOE Los Alamos Field Office to provide recommendations on ways to improve DOE Legacy Management Environmental Justice outreach tools for communicating data to the public about site activities.

### **3.14.3 Analysis of Proposed Changes (2018 through 2022)**

New, modified, or continuing projects (Table 3-1) considered for environmental justice at LANL include: 1) Increased Pit Disassembly/Conversion and Disposition, 2) Alternatives Analysis and Strategy for Certain Shafts at TA-54, 3) the Supplemental Environmental Projects for watershed enhancement under Infrastructure, and 4) the Environmental Management Legacy Contaminant Cleanup Program Activities at Mortandad Canyon and Cañon de Valle.

LANL projects and operations that may be implemented between 2018 and 2022 are likely to have effects equivalent to those analyzed in the 2008 SWEIS. None of the projected projects described in Chapter 2 of this supplement analysis are likely to negatively affect environmental justice.

### **3.14.4 Conclusion**

The Laboratory has an ongoing commitment to environmental justice and implementation of Executive Order 12898 through the Community Commitment Plan and associated programs, formal and informal consultations, public meetings, and communication strategies. The new, modified, and continuing projects and modifications in site operations would not significantly impact environmental justice and are consistent with impacts analyzed in the 2008 SWEIS; therefore, further supplementation of the 2008 SWEIS for environmental justice is not needed.

## **3.15 Environmental Remediation**

Environmental remediation at LANL involves the investigation and cleanup of sites previously used for historical (legacy) operations. Projects include investigation, retrieval, and removal of contaminated soils, as well as surface and ground water protection and monitoring.

### **3.15.1 2008 SWEIS Analysis**

The 2008 SWEIS (DOE 2008a) analyzed two principal options for remediating legacy, Manhattan Project-era contamination including material disposal areas at LANL: 1) retrieval and removal of wastes and 2) stabilization-in-place. These two options bound the impacts of a wide

variety of remedies. The 2008 SWEIS projected that the Consent Order would be complete by December 2015. The two records of decision (DOE 2008b, 2009a, 2011a) for the 2008 SWEIS state that under all options, DOE will implement the 2005 Consent Order.

### 3.15.2 Changes since the 2008 SWEIS (2008 through 2017)

Since the completion of the 2008 SWEIS, DOE has undertaken cleanup efforts across the Laboratory, including remediation of material disposal areas, installation of erosion and sediment controls to prevent and or limit the transport of sediments off-site, and installation of a system of wells to monitor groundwater for constituents of concern. All of these actions were prescribed by the 2005 Consent Order. Associated storm water best management practices met all National Pollutant Discharge Elimination System requirements as required by the Individual Permit (LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b).

In June 2016, the New Mexico Environment Department and DOE entered into a new Consent Order that superseded the 2005 Consent Order. The fixed corrective action schedules contained in the 2005 Consent Order were replaced with an annual work prioritization and planning process with enforceable milestones established annually. The 2016 Consent Order provides for increased communication and collaboration between the New Mexico Environment Department and DOE during planning and execution of work. The 2016 Consent Order placed an emphasis in implementation of interim and corrective measures, sampling and monitoring, risk assessments, and excavation of contaminated areas (NMED 2016b). Corrective actions implemented since the issuance of the 2008 SWEIS are listed in Table 3-16 (LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b).

**Table 3-16. Consent Order Actions Initiated since the 2008 SWEIS**

Year	Consent Order Projects
<b>2009</b>	<ul style="list-style-type: none"> <li>✓ Upper Los Alamos Canyon Aggregate Area</li> <li>✓ Guaje, Barranca, and Rendija Canyon Aggregate Areas</li> <li>✓ TA-16-340 Complex, Consolidated Unit 16-021 (c)-99</li> <li>✓ Bayo Canyon Aggregate Area</li> <li>✓ Middle Cañada del Buey Aggregate Area</li> <li>✓ Upper Mortandad Canyon Aggregate Area</li> <li>✓ North Ancho Canyon Aggregate Area</li> <li>✓ Material Disposal Area C</li> <li>✓ Material Disposal Area G</li> <li>✓ Material Disposal Area H</li> <li>✓ Los Alamos and Pueblo Canyons</li> <li>✓ Pajarito Canyon</li> <li>✓ Sandia Canyon</li> <li>✓ Cañada del Buey</li> <li>✓ North Canyons</li> <li>✓ Material Disposal Area V</li> <li>✓ Material Disposal Area T</li> <li>✓ Material Disposal Area B</li> <li>✓ DP Site Aggregate Area</li> </ul>

Year	Consent Order Projects
<b>2010</b>	<ul style="list-style-type: none"> <li>✓ Upper Sandia Canyon Aggregate Area</li> <li>✓ S-Site Aggregate Area</li> <li>✓ Upper Cañada del Buey Aggregate Area</li> <li>✓ Pueblo Canyon Aggregate Area</li> <li>✓ Threemile Canyon Aggregate Area</li> <li>✓ TA-49, Consolidated Units 16-007(a)-99 and 16-008(a)-99</li> <li>✓ Material Disposal Area L</li> <li>✓ Potrillo and Fence Canyons Aggregate Area</li> </ul>
<b>2011</b>	<ul style="list-style-type: none"> <li>✓ Ancho, Chaquehui, and Indio Canyons</li> <li>✓ Lower Sandia Canyon Aggregate Area</li> <li>✓ Middle Los Alamos Canyon Aggregate Area</li> <li>✓ Solid waste management unit 01-001(f)</li> <li>✓ Water and Cañon de Valle Aggregate Areas</li> <li>✓ Lower Mortandad and Cedro Canyons Aggregate Area</li> <li>✓ DP East Building Footprints</li> </ul>
<b>2012</b>	✓ Solid waste management unit 21-015
<b>2013</b>	✓ Ongoing corrective actions
<b>2014</b>	✓ Fenton Hill Aggregate Area
<b>2015</b>	✓ Ongoing corrective actions
<b>2016</b>	✓ Ongoing town site solid waste management unit

Note: Reference information (LANL 2016d, 2011a, 2015c, 2012a, 2013a, 2013b).

Since 2005 and through the end of 2016, the New Mexico Environment Department issued 202 Certificates of Completion without Controls and 77 Certificates of Completion with Controls. These certificates of completion reduced the number of corrective actions remaining to 1,147.

In 2012, the New Mexico Environment Department and DOE negotiated a non-binding framework agreement that prioritized removal of waste from TA-54 over other Consent Order activities, partly in response to the 2011 Las Conchas fire. This agreement resulted in over 4,000 aboveground transuranic waste containers being shipped from LANL (see Section 3.12.2.2).

Two incidents at the Waste Isolation Pilot Plant resulted in the suspension of operations in February 2014. The first incident was an underground salt haul truck that caught fire and temporarily suspended operations. During that time, a release of radioactive materials from a ruptured LANL remediated nitrate salts drum occurred and Waste Isolation Pilot Plant operations were suspended. The remediation of a LANL nitrate salt drum using an organic absorbent created the incompatibility that resulted in the exothermic reaction at the Waste Isolation Pilot Plant.

DOE met 93 percent of the transuranic waste removal goals for LANL by June 2014 but was unable to meet the ultimate goals because of these incidents. DOE is now treating remediated nitrate salt and unremediated nitrate salt waste (DOE 2016c, 2016d), as described in Section 3.12, Waste Management.

### **3.15.2.1 Groundwater**

In response to the Consent Order, DOE has focused on watershed-specific investigations to identify groundwater contamination and contaminant transport mechanisms. Groundwater compliance work including groundwater monitoring, groundwater investigations, and the installation of monitoring wells continues pursuant to the Consent Order. Since the 2008 SWEIS, 34 regional aquifer wells, 14 perched-intermediate aquifer monitoring wells, 10 alluvial monitoring wells, three regional aquifer piezometers wells, and one chromium extraction well have been installed.

In 2005 and 2006, groundwater samples collected from a groundwater monitoring well in the regional aquifer beneath Mortandad Canyon indicated the presence of chromium contamination. Chromium contamination has not been detected in water-supply wells (DOE 2008a). DOE initiated a pilot study to test various methods of removing hexavalent chromium from groundwater. These initial phase project activities were analyzed as general Consent Order actions within the 2008 SWEIS. In 2014, DOE proposed well pump tests in Sandia and Mortandad canyons. The scope of activities for the well pump tests included tracer studies, replacement of existing well pumps, extended pumping and treating of monitoring wells, and land application of treated water. DOE determined the following actions met the criteria for a categorical exclusion (DOE 2014e). These actions included installation of:

- Chromium Extraction well 1, with well pad
- Five chromium corehole wells with pads and five chromium piezometer wells with pads
- Eighteen 20,000-gallon (75,700-liter) portable storage tanks
- Three portable treatment units
- Eight lined water storage basins
- One 4-inch- (10.2-centimeter-) diameter pipeline, approximately 1,070 feet (326 meters) from Chromium Extraction well 1 to the water treatment system
- New unpaved road into Mortandad Canyon and unpaved roads to the new infrastructure
- 13.2-kilovolt power lines
- Monitoring wells
- Intermediate-level groundwater wells in Mortandad Canyon: MCOI-5, MCOI-6
- Regional aquifer wells in Mortandad Canyon: R-1, R-13, R-15, R-28, R-42, R-44, R-45
- Wells R-50, R-61, R-62
- Intermediate-level groundwater wells in Sandia Canyon: SCI-1, SCI-2
- Regional aquifer wells in Sandia Canyon: R-11, R-35a, R-35b, R-36, R-43
- Irrigation system for treated effluent

In 2015, DOE prepared the “Final Environmental Assessment for Chromium Plume Control Interim Measure and Plume-Center Characterization, Los Alamos National Laboratory” (DOE 2015b). The purpose of the environmental assessment was to analyze the environmental impacts associated with implementing the chromium plume control interim measure. Groundwater extraction would occur in Mortandad Canyon. The total groundwater extraction volume would be up to 230 million gallons (871 million liters) (707 acre-feet) annually over a potential 8-year

duration. The water will be treated to ensure that all constituents meet New Mexico Environment Department Ground Water Quality Bureau permit requirements before it was either injected into the aquifer through the injection wells or land applied using the spray irrigation/evaporation system or water trucks along unpaved access roads and/or mechanically evaporated (DOE 2015b).

Groundwater characterization and monitoring beneath Cañon de Valle in TA-16 indicates that RDX, primarily associated with historical machining of high explosives, infiltrated into perched intermediate groundwater and locally exceeds the Environmental Protection Agency's regional screening level for tap water. In 2008, DOE submitted a corrective measures evaluation report to address this issue, but received a notice of disapproval from the New Mexico Environment Department indicating that more information was needed before a final remedy selection. Since 2008, several monitoring wells have been installed in the perched-intermediate and regional groundwater aquifers. Data collected to date indicate that characterization of nature and extent of RDX contamination in the perched-intermediate and regional groundwater is incomplete. Additional information will be provided by ongoing tracer studies, aquifer tests, and bench-scale testing to evaluate potential remedies.

### **3.15.3 Analysis of Projected Changes (2018 through 2022)**

Completion of remaining Consent Order work is projected to continue through 2022. A work plan for completing the investigation of five remaining TA-57 Fenton Hill sites is being prepared and will require New Mexico Environment Department approval. Implementation of the work plan and the associated characterization data will determine the scope of remediation required to complete corrective actions.

DOE will continue implementing the chromium plume control interim measure until a final remedy is proposed (DOE 2015b). Additional NEPA analyses will assess potential impacts associated with the chromium final remedy.

DOE will continue groundwater tests to understand the nature and extent of RDX contamination. A corrective measures evaluation will be sent to the New Mexico Environment Department in the next 5 years. A final remedy for RDX will also be evaluated for NEPA compliance.

DOE will continue implementing the Supplemental Environmental Projects and the forest health actions, which will have a beneficial impact of reduced soil erosion and contaminant transport.

### **3.15.4 Conclusion**

The impacts associated with implementation of the Consent Order from 2018 through 2022 will generally be less than projected in the 2008 SWEIS. New and more stringent National Pollutant Discharge Elimination System permit requirements will result in improved surface water quality and better retention of contaminated sediments and soils in place. More than 70 corrective action controls (earthen berms, run-on diversion, and drop inlets) have been installed under the Individual Permit (Section 3.4.2.1.1). Watershed enhancement Supplemental Environmental Projects will also reduce sediment transport in watersheds that currently have higher potential contamination and higher flow volume. Remediation of groundwater under the Consent Order will continue into the foreseeable future. Future decisions on the chromium and RDX final remedies will be subject to NEPA analyses. DOE will continue to implement the 2016 Consent Order; these corrective actions were analyzed in the 2008 SWEIS. Therefore, supplementation of the 2008 SWEIS for environmental remediation is not needed.

### **3.16 Facility Accidents**

This section discusses changes in potential impacts on accident analysis conducted for the 2008 SWEIS including the classified appendix from the proposed new and modified projects and operations likely to be implemented through 2022.

#### **3.16.1 2008 SWEIS Analysis**

In the 2008 SWEIS (DOE 2008a), facility accidents are grouped into the following categories: radiological releases, chemical releases, seismic impacts, and wildfire accidents. In general, releases to the environment may occur through fire (e.g., lightning strike, wildfire, fires started by seismic activity) or as a result of seismic activity.

##### **3.16.1.1 Radiological Releases**

###### ***No Action and Reduced Action Alternatives***

Under these alternatives, the accident with the highest estimated consequences to off-site populations results from a lightning strike fire at the Radioassay and Nondestructive Testing Facility. The annual risk of an increased likelihood of a latent cancer fatality for this accident is 0.059 (about 1 in 17 years) for the maximally exposed individual. The off-site population annual risk of additional latent cancer fatalities is estimated to be 0.76 for a latent cancer fatality in any one member of the total off-site population. The annual risk of an increased likelihood of a latent cancer fatality for a non-involved worker for this accident is 0.12 (about 1 in 8 years). If this accident occurred, there could be six additional latent cancer fatalities in the off-site population. The second largest consequence in all of LANL nuclear facility safety bases is a fire outside of the Plutonium Facility that engulfs the staging areas. This fire would result in 73 rem dose to the maximally exposed individual and could result in 5.4 latent cancer fatalities (DOE 2008a).

There are no operational accidents in the current safety bases governing LANL nuclear facilities that exceed the consequences for the lightning-initiated fire at the Radioassay and Nondestructive Testing Facility (DOE 2008a). In the current Radioassay and Nondestructive Testing Facility Basis for Interim Operation (LANL 2012f), the largest fire is a fuel pool fire ensuing after a vehicle crash and resulting in a dose to the maximally exposed individual of 133.3 rem. This accident could result in two additional latent cancer fatalities in the off-site population. In the documented safety analysis for the Plutonium Facility (LANL 2016g), the comparable accident to the staging area fire at PF-4 in the 2008 SWEIS is a pool fuel fire involving the waste storage pad. This potential accident would result in a relatively small dose of 6.6 rem to the maximally exposed individual. These potential PF-4 and the Radioassay and Nondestructive Testing Facility accidents are bounded by the 2008 SWEIS analysis.

The two additional accident scenarios at PF-4 are included in the documented safety analysis (LANL 2016g). One involves a room fire involving heat source plutonium and a loss of coolant accident in the heat source plutonium storage vault. Both have unmitigated consequences that could exceed the bounding scenario included in Chapter 5 of the 2008 SWEIS, but not that included in the classified appendix. The Surplus Plutonium Disposition SEIS (DOE 2015a) provided an important perspective on accident analysis for the purposes of assigning safety classification, as in the safety bases, and for the purposes of providing a perspective on risk. The Surplus Plutonium Disposition SEIS did not analyze accidents that involve heat-source plutonium because that type of material at risk was not within the scope of that analysis.

However, the analyses presented in the SEIS are relevant because they acknowledge the presence of the building and the ventilation system for an accident that has no potential to challenge those barriers. The Surplus Plutonium Disposition SEIS applies a leak path factor<sup>37</sup> of 0.05 to accidents that occurred in PF-4. By applying a conservative leak path factor of 0.05 to the dose estimate of 655 rem from the documented safety analysis, consistent with the methodology in the Surplus Plutonium Disposition SEIS, the bounding loss of coolant accident has an unmitigated consequence of 33 rem to the maximally exposed individual and could result in two latent cancer fatalities in the off-site population. The LANL Documented Safety Analysis (LANL 2016g) analyzes this accident as being prevented by existing controls. The 2008 SWEIS analysis is more conservative and provides a bounding analysis.

In the 2008 SWEIS, the accident with the highest estimated consequences to the individual (maximally exposed individual and a non-involved worker) is a waste storage dome fire at TA-54 Area G. If this accident were to occur as modeled, the non-involved worker and maximally exposed individual would receive large radiation doses of 2,000 and 420 rem, respectively. Depending on the specific radionuclides released and the route of human exposure, radiation doses of this magnitude would result in near-term health effects or even death from causes other than cancer. In addition to the conservative assumptions used to develop the source term (amount of radioactive material released) for this accident, the calculated doses are based on the assumptions that no protective action is taken during the entire time of exposure and that no subsequent medical intervention occurs. The maximally exposed individual for all of the scenarios is located at the nearest site boundary.

The analysis in the 2008 SWEIS considers a source term of 127,000 plutonium-equivalent curies in the six storage domes. In the currently implemented Basis for Interim Operation for TA-54 Area G (LANL 2016h), the entire site inventory is 57,000 plutonium-equivalent curies. The site inventory is further restricted by an Evaluation of the Safety of the Situation (LANL 2016i) that reduces the inventory allowed at Area G to 39,000 plutonium-equivalent curies. The latter document evaluates a bounding storage dome fire with a release that results in a dose to the maximally exposed individual of 63.3 rem, considered to occur with an annual frequency of significantly less than 1. The 2008 SWEIS remains bounding with a dose to the maximally exposed individual of 420 rem.

The Transuranic Waste Facility has been constructed since the issuance of the 2008 SWEIS and has an approved documented safety analysis (LANL 2016j). The Transuranic Waste Facility will eventually replace TA-54 Area G for receipt and temporary storage of transuranic waste before off-site shipment. As anticipated, risks from accidents at the Transuranic Waste Facility are substantially reduced when compared with the equivalent accident at TA-55 or TA-54. A fire at the Transuranic Waste Facility results in a dose to the maximally exposed individual of 19 rem and the risk to the off-site public is bounded by the 2008 SWEIS analysis.

The 2008 SWEIS analyzes a HEPA fire at the CMR Building that results in a dose to the maximally exposed individual of 0.77 rem and 0 latent cancer fatalities. However, the documented safety analysis for the CMR Building (LANL 2016k) postulates a fire in Wing 7 and Wing 9 that results in 7.4 rem to the maximally exposed individual is bounding. If this accident

---

<sup>37</sup> Leak protection factor—a factor that accounts for the action of removal mechanisms (e.g., containment systems, filtration, deposition) to reduce the amount of airborne radioactivity ultimately released to the environment.



happened, 1.2 latent cancer fatalities could occur in the off-site population. The current risk from accidents at the CMR Building is underrepresented in the 2008 SWEIS in an operational fire. However, the 2008 SWEIS analyzes a performance category 1 seismic event, which provides a bounding analysis for the documented safety analysis operational event at the CMR Building (62 rem to the maximally exposed individual and four latent cancer fatalities). The operational life of the CMR Building is limited; efforts to deinventory the CMR Building are ongoing. The actual risk presented by the reduced operations for a few more years is small.

### ***Expanded Operations Alternative***

From the 2008 SWEIS analysis, the accident with the largest consequences to the off-site population was a fire at the CMR Building involving sealed sources. This accident could result in seven latent cancer fatalities in the off-site population. Since the issuance of the 2008 SWEIS, the sealed sources have been moved to TA-54 and TA-55 or shipped for disposal, eliminating the potential for the accident occurring at the CMR Building. The sources are now stored at TA-54 and TA-55 as part of the local inventories and any potential accidents are bounded by the 2008 SWEIS. The highest consequence accident is the same as that for the No Action Alternative.

The 2008 SWEIS was conservative in the methodology for estimating risk from accidents in the following ways: 1) an assumption that an individual is always downwind of the plume, 2) the individual lies directly in the path of the plume centerline where the release concentration is greatest, 3) the individual remains at the nearest site boundary to the release for the duration of the event, 4) no deposition, 5) no plume meander, and 6) use of an annual meteorology dataset, which maximizes downwind plume concentrations.

The conservative analysis for the Expanded Operations Alternative in the 2008 SWEIS bounds current radiological risks from accidents at LANL facilities. Reductions in radioactive material inventories at the CMR Building and TA-54 substantially reduced the risks.

### **3.16.1.2 Chemical Releases**

From the 2008 SWEIS analysis, the chemicals of concern at LANL facilities were selenium hexafluoride, sulfur oxide, chlorine gas, and helium (Table 3-17) (DOE 2008a). These chemicals were selected from a database of chemicals used on-site based on their quantities, chemical properties, and human health effects. Emergency Response Planning Guideline<sup>38</sup> values for planning levels 2 and 3 are the concentrations that, if an accident occurred, could result in serious health effects or life-threatening implications for exposed individuals. The cause of a chemical release could be mechanical failure, corrosion, mechanical impact, or natural phenomena (e.g., fire, seismic). Waste cylinders from TA-54-216 have been removed, eliminating two of the most hazardous chemicals. Therefore, the risk from chemicals has been reduced since the issuance of the 2008 SWEIS.

---

<sup>38</sup> In 2007, after data had been collected for the 2008 SWEIS, DOE began using Protective Action Criteria to identify health effects of chemical exposure through the combination of any three criteria that were previously established. The three criteria were Acute Exposure Guideline Levels published by the National Academy of Sciences (NRC 2008), the Emergency Response Planning Guidelines published by the American Industrial Hygiene Association (AIHA 2016), and the Temporary Emergency Exposure Levels published by DOE (DOE 2016f). The use of Protective Action Criteria provided clarity for contractors for compliance requirements.

**Table 3-17. Chemicals of Concern<sup>a</sup> at LANL Facilities and their Potential Impacts**

Chemical	Frequency of Chemical Accidents (per year)	Quantity Released	Emergency Response Planning Guideline-2 <sup>b</sup>		Emergency Response Planning Guideline-3 <sup>c</sup>		Concentration	
			Value (parts per million)	Distance to Value (feet/meters)	Value (parts per million)	Distance to Value (feet/meters)	Noninvolved Worker at 328 feet/ 100 meters	Maximally Exposed Individual at Site Boundary
Selenium hexafluoride from waste cylinder storage TA-54-216	0.0041	20 gallons (75 liters)	0.6 <sup>c</sup>	9,200/2,800	5 <sup>d</sup>	2,900/880	140 parts per million	12 parts per million at 1,610 feet (491 meters)
Sulfur dioxide from waste cylinder storage TA-54-216	0.00051	300 pounds (136 kilograms)	3	5,400/1,650	15	2,300/690	310 parts per million	27 parts per million at 1,610 feet (491 meters)
Chlorine gas released outside of Plutonium Facility	0.063	150 pounds (68 kilograms)	3	3,540/1,080	20	1,250/380	170 parts per million	3.4 parts per million at 3,333 feet (1,016 meters)
Helium at TA-55-41	0.063	9,23,0000 cubic feet (261,366 cubic meters) (at standard temperature and pressure)	280,000 <sup>d</sup>	610/186	500,000 <sup>d</sup>	456/139	greater than Emergency Response Planning Guideline-3	10,000 parts per million at 3,438 feet (1,048 meters)

<sup>a</sup> Waste cylinders from TA-54-216 have been removed, eliminating two of the most hazardous chemicals.

<sup>b</sup> Emergency Response Planning Guideline-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their ability to take protective action.

<sup>c</sup> Emergency Response Planning Guideline-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

<sup>d</sup> The Temporary Emergency Exposure Limit value is used. Emergency Response Planning Guidelines have not been issued for this substance.

Material disposal area cleanup also includes a potential for accidental releases of toxic chemicals. A fire during removal operations that breaches any material disposal area enclosure and bypasses the HEPA filtration was chosen for analysis. There is a great deal of uncertainty regarding how much of the chemical inventory and which chemicals were disposed of in the material disposal areas. For the most conservative analysis, Material Disposal Area B, the material disposal area closest to the public, was chosen to represent the chemical accident impacts of material disposal area cleanup. Two chemicals, sulfur oxide (a gas) and beryllium (assumed to be in powder form), were chosen based on their restrictive Emergency Response Planning Guideline values to bound the impacts of an extensive list of possible chemicals disposed of in the material disposal areas. Material Disposal Area B has been remediated. Other material disposal areas, as part of the Nuclear Environmental Sites system, present less risk because of lower chemical inventories and greater distance from the public, so the 2008 SWEIS analysis remains bounding.

### **3.16.1.3 Seismic Accidents**

For many facilities involved in the 2008 SWEIS Seismic 1 and 2 accident scenarios, a conservative assumption was made that there was complete failure of structures, systems, and components, resulting in the maximum possible radioisotope or chemical release. Higher seismic accelerations at the same annual frequency of exceedance would result in identical consequences for these facilities. Therefore, the larger seismic peak ground accelerations associated with the updated probabilistic seismic hazard analysis would not increase the consequence of these accident scenarios (URS 2007).

#### ***Seismic 1 – Radiological***

The facility with generally the highest contribution to worker and public risk in the 2008 SWEIS is the CMR Building. In the case of this seismic event, it is estimated that there would be four latent cancer fatalities in the off-site population from a CMR Building release. As a result of such a release, the non-involved worker would receive a large radiation dose, 2000 rem. Since the writing of the 2008 SWEIS, significant reductions in the inventory at the CMR Building have occurred. The current CMR Documented Safety Analysis (LANL 2016k) estimates the release from the beyond-design-basis<sup>39</sup> seismic event (Seismic 1), which has the same consequence at the CMR Building as the Seismic 1 event in the 2008 SWEIS, to be a third of that estimated in the 2008 SWEIS, with a proportionate reduction in the risk to the off-site public. The next highest consequence for the Seismic 1 event was from the Radioassay and Nondestructive Testing Facility with a maximally exposed individual dose of 64 rem and 1,100 person-rem to the public. The Basis for Interim Operation for that facility currently estimates the consequence to the maximally exposed individual as 68 rem. Although both analyses assumed the same inventory at the Radioassay and Nondestructive Testing Facility, the Basis for Interim Operation estimates 68 rem to the maximally exposed individual, whereas the 2008 SWEIS estimates 64 rem to maximally exposed individual. The difference is due to minor differences in the way the

---

<sup>39</sup> Beyond-design-basis—this term is used as a technical way 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, and explosion] that a nuclear facility must be designed and built to withstand.) As 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.

event was modeled. With a conversion factor of 0.0006 latent cancer fatality/person-rem, the increased risk to the off-site public is 0.0024 latent cancer fatalities or a 0.0.4 percent increase. This is well within the uncertainty of the analysis.

### ***Seismic 2 – Radiological***

The facility with the highest contribution to public consequence is PF-4 at TA-55. In the case of a seismic event at PF-4, it is estimated that there would be nine latent cancer fatalities in the off-site population from the resulting Plutonium Facility release and a dose to the maximally exposed individual of 150 rem. The current documented safety analysis estimates a higher dose to the maximally exposed individual of 218 rem. However, the Surplus Plutonium Disposition SEIS addendum (DOE 2015a) argues that, except for the beyond-design-basis accident, the analyses in the 2008 SWEIS and in subsequent documented safety analyses for PF-4 are intended to provide conservative designations of safety-related equipment and are unnecessarily conservative for the purposes of presenting actual risk to workers and the public. The source term estimates in the Surplus Plutonium Disposition SEIS addendum take into account a range of responses of facility features and materials containers and typical operating practices employed at DOE's plutonium facilities. For design-basis-type accidents, a damage ratio of 1 would not normally be realistic if the required safety systems function as expected during the accident and operational procedures are followed. Similarly, the building confinement, including HEPA filters, is expected to continue functioning, although perhaps at a degraded level, during and after the accident. The resulting estimate of the release from a bounding seismic event at PF-4 results in a dose to the maximally exposed individual of 18 rem, with proportionate decrease in risk from the 2008 SWEIS estimate to workers and the off-site public. The beyond-design-basis accident (analogous to seismic 2) could result in three latent cancer fatalities off-site, but the frequency is estimated to be significantly less than one annually, presenting a very low risk for a latent cancer fatality on an annual basis. The risk of additional latent cancer fatalities from the Plutonium Facility release would be estimated at 0.00003 per year in the off-site population. The Surplus Plutonium Disposition SEIS is bounding for this event.

In the 2008 SWEIS, the waste storage domes at TA-54 Area G holding transuranic waste would result in the highest contribution to the maximally exposed individual's radiological consequences with a dose of 460 rem. This accident has the potential to produce five latent cancer fatalities in the off-site population. The increased risks of a latent cancer fatality for the maximally exposed individual and non-involved worker are estimated at 1 in 3600 (0.00028) and 1 in 2000 (0.0005) per year, respectively. The Evaluation of the Safety of the Situation under enforcement at TA-54 Area G, which determines the allowable site material at risk, estimates the consequence of a seismic event as 53.2 rem to the maximally exposed individual and less than one latent cancer fatality in the off-site population (LANL 2016i). The seismic event in the 2008 SWEIS is bounding.

In the 2008 SWEIS analysis, a Plutonium Facility release would result in the highest contribution to the non-involved worker's radiological consequences with a dose of 2,700 rem. As discussed above for the Seismic 1 scenario, depending on the specific radionuclides released and the route of human exposure, radiation doses calculated for the maximally exposed individual and the non-involved worker would result in near-term health effects or even death from causes other than cancer. However, the Surplus Plutonium Disposition SEIS addendum estimates the maximum dose to a non-involved worker from a seismic event at PF-4 to be a maximum of

620 rem and an estimated latent cancer fatality of 1, but with a frequency significantly lower than 1 per year. Since the issuance of the 2008 SWEIS, the Transuranic Waste Facility was constructed. The estimated dose to the maximally exposed individual from a seismic event at the operational Transuranic Waste Facility is 41.1 rem (LANL 2016j). The Transuranic Waste Facility is farther from public receptors than PF-4 or TA-54 Area G. The risk to all receptors from a seismic event at the Transuranic Waste Facility is bounded by the 2008 SWEIS.

The very conservative analysis in the 2008 SWEIS bounds the radiological risk from a seismic event at LANL facilities. The continued effort to deinventory the CMR Building and the substantially reduced radioactive material inventory at TA-54 Area G helps reduce the risk from a seismic event.

### ***Seismic 1 – Chemical***

The chemicals of concern under site-wide Seismic 1 conditions are hydrogen cyanide, phosgene, and formaldehyde. There are numerous chemicals in small quantities on-site that may be released under these conditions. The listed chemicals were selected from a complete set of chemicals used on-site, based on their larger quantities, chemical properties, and human health effects. Exposure to concentrations in excess of the Emergency Response Planning Guideline values could result in serious health effects or life-threatening implications to the exposed individuals (LANL 2017k).

In the event of an accidental release of each chemical, the annual frequency of this accident is 0.001 based on the 1995 seismic hazards evaluation of LANL. Based on the 2007 update of the seismic hazard analysis (URS 2007), the annual frequency is estimated to be 0.0015. Because this accident is a site-wide seismic event, all of the chemicals listed above would be released almost simultaneously. The annual risk of exposure to workers and the public to chemical concentrations in excess of values for Emergency Response Planning Guideline levels 2 and 3 are 1 in 1,000 based on the previous seismic hazard analysis and 1 in 700 based on the 2007 update of the seismic hazard analysis. For some chemicals, the nearest public access point is beyond the distance at which concentrations would be at Emergency Response Planning Guideline values. In these instances, there would likely be no serious health affects to the public in the event of an accident. For formaldehyde, the nearest public access point is closer than the distance at which concentrations would be at the Emergency Response Planning Guideline values. If this accident were to occur, members of the public could be exposed to harmful and possibly fatal concentrations of formaldehyde.

### ***Seismic 2 – Chemical***

The chemicals of concern under site-wide Seismic 2 conditions are hydrogen cyanide, phosgene, formaldehyde, chlorine gas, nitric acid, hydrochloric acid, and beryllium. There are numerous chemicals in small quantities on-site that could be released under these conditions. The listed chemicals were selected from a complete set of chemicals used on-site based on their larger quantities, chemical properties, and human health effects. In the event of an accidental release of each chemical, the annual frequency of this accident is 0.0005 based on the 1995 seismic hazards evaluation for LANL. Based on the 2007 update of the seismic hazard analysis (URS 2007), the annual frequency is estimated to be 0.0008. As this accident is a site-wide seismic event, all of the chemicals listed above would be released almost simultaneously. The annual risk of exposure to workers and the public to chemical concentrations in excess of values for Emergency Response Planning Guideline levels 2 and 3 are 1 in 2,000 based on the previous seismic hazard

analysis and 1 in 1,250 based on the 2007 update of the seismic hazard analysis. For some chemicals, the nearest public access point is beyond the distance at which concentrations would be at Emergency Response Planning Guideline values. In these instances, there would likely be no serious health effects to the public in the event of an accident. For formaldehyde at the Bioscience facilities and chlorine gas at the Plutonium Facility Complex, the nearest public access points are closer and if these accidents occurred, members of the public could be exposed to harmful and possibly fatal concentrations of these chemicals.

#### **3.16.1.4 Wildfire Accidents**

Wildfire accident scenarios were postulated as a method of evaluating potential impacts to on-site workers and the off-site population. For wildland fire, a fire at TA-54 Area G was estimated to present the greatest risk to the maximally exposed individual and to the off-site public. The maximally exposed individual could receive a dose of 1,900 rem, given the extremely conservative assumption that the individual would remain in place for the duration of the release. The overall health risk to the general population is 55 latent cancer fatalities (DOE 2008a).

The Basis for Interim Operation for TA-54 Area G substantially reduced the risk from wildland fire from the 2008 SWEIS analysis (LANL 2016h). The dose to the maximally exposed individual is estimated at 150 rem, proportionately reducing the overall health risk to the general public by a factor of 100. The Evaluation of the Safety of the Situation, which governs the radioactive material inventory at Area G further reduces the potential dose to the maximally exposed individual to 88.5 rem (LANL 2016i) and is bounded by the 2008 SWEIS.

The facility presenting the second highest risk from wildland fire in the 2008 SWEIS is the Waste Characterization, Reduction, and Repackaging Facility with a dose to the maximally exposed individual of 27 rem and four latent cancer fatalities. The Waste Characterization, Reduction, and Repackaging Facility Basis for Interim Operation (LANL 2011e) estimates a dose from wildland fire similar to that estimated in the 2008 SWEIS and is bounded.

The documented safety analysis for the Transuranic Waste Facility analyzes a wildland fire as potentially impacting only the radioactive inventory at the characterization trailers, with an extremely low off-site consequence.

Wildland fire is an anticipated event at LANL and in the areas surrounding LANL. While the Cerro Grande fire had a significant impact on LANL operations, neither it nor the 2011 Las Conchas fire jeopardized the LANL nuclear facilities. The analysis in the 2008 SWEIS is highly conservative and bounds risks from wildland fires at LANL.

Details of these scenarios are provided in Chapter 5 and Appendix D of the 2008 SWEIS (DOE 2008a), including a discussion of the LANL buildings that could be affected by wildfire, an inventory of hazardous radiological materials, and the source-term factors and estimated source terms.

#### **3.16.1.5 Terrorist Incidents**

As stated in the 2008 SWEIS, an analysis of impacts associated with a potential terrorist incident at LANL was described in a classified appendix (DOE 2008a:5-176). Some potential incidents have similar impacts to those associated with the accidents described in the previous sections, others could have more severe impacts. Details regarding the impacts associated with a potential

terrorist attack are not released to the public because disclosure of the information could be exploited by terrorist organizations. The 2008 SWEIS terrorist analysis remains valid.

### **3.16.2 Changes since the 2008 SWEIS (2008 through 2017)**

Since the issuance of the 2008 SWEIS, there have been no notable changes to seismic impacts or wildfire accidents analyses. Further discussion of radiological and chemical accidents analyses since the 2008 SWEIS are described below.

#### **3.16.2.1 Radiological**

There were no large-scale construction or renovation projects or additions of new, or expanded, analytical or research and development capabilities during the last 5 years that were not analyzed in the 2008 SWEIS or through individual NEPA analyses. Numerous projects received categorical exclusions from 2008 through 2017. Other projects were analyzed in the 2008 SWEIS and bounded by the accident analyses therein. Although some facilities have reduced inventory limits since 2008, as is the case for the CMR Building, the accident analysis in the 2008 SWEIS still bounds the range of potential accidents that could be expected through 2022.

#### **3.16.2.2 Chemical**

The Sanitary Effluent Reclamation Facility underwent an expansion to improve wastewater treatment to meet effluent limitations while reducing the use of potable water at large cooling towers. All appropriate best management practices were implemented before and during construction. The newly expanded Sanitary Effluent Reclamation Facility was operational in August 2012. During construction, the chemicals that were encountered included soil tackifiers, chromium, polychlorinated biphenyls, and polycyclic aromatic hydrocarbons. During operations, the Sanitary Effluent Reclamation Facility uses magnesium silicates and iron oxy-hydroxides, antibacterial and antiscaling chemical additives to clean the sanitary effluent for reuse. Even a catastrophic accident at Sanitary Effluent Reclamation Facility would release only nonhazardous chemicals to the environment, workers, and the public. Therefore, any accident at the Sanitary Effluent Reclamation Facility is bounded by the accident analyses in the 2008 SWEIS.

### **3.16.3 Analysis of Projected Changes (2018 through 2022)**

A proposed project discussed in Section 2.1 that may affect the accident analysis releases is the relocation of CMR Building activities to RLUOB, the Plutonium Facility, and other radiological facilities. Because the risk calculated for the CMR Building is the bounding case, relocation of materials and activities is bounded by that analysis. Anticipated large-scale projects will receive individual NEPA coverage with their own accident analyses.

As described in Section 2.1, certain activities will move from the CMR Building to RLUOB, the Plutonium Facility, and other radiological facilities. The chemical and radiological materials and inventories associated with these activities will either remain the same or decrease when moved to a new location. Activities will move to facilities with the same or more stringent safety requirements, thus, the hazards and possible accident scenarios will decrease. Since none of the proposed activity relocations will result in an increase over current hazard levels and accident scenarios, all proposed relocations are bounded by the accident analyses in the 2008 SWEIS.



Other planned changes include the transition of TA-54 Area G management from the NNSA to DOE Environmental Management. The facility will operate under a new documented safety analysis that will be evaluated against existing NEPA documentation. The facility is not expected to increase the risk profile. Under the 2016 Consent Order, TA-54 Area G will be remediated.

The Transuranic Waste Facility will become operational in 2018. This facility provides safety features and is further from public access points, which decreases the risk from comparable inventory stored at TA-54 Area G or at PF-4. The buildings are constructed of non-flammable material (metal) and combustible loading is extremely limited, which essentially eliminates the potential for a combustible fuel fire. The concrete pad that underlies the Transuranic Waste Facility is sloped, which, together with an external and internal vehicle barrier system, prevents fuel from pooling underneath waste areas. Among the safety features is a seismic switch that turns off electrical power during a seismic event to help prevent a fire. Risk from the wildland fire is reduced via a combination of design features, primarily consisting of the fire-resistant design of the buildings (i.e., noncombustible roofs and walls) and the physical locations of the buildings.

A non-nuclear, low-level liquid waste treatment facility is under construction and expected to be operational within the next fiscal year. A transuranic liquid waste treatment facility, which will be a nuclear facility with inventory restricted to a level with the potential to present only a local hazard, has been designed and is expected to begin construction shortly. These two facilities will replace the current Radioactive and Liquid Waste Treatment Facility. These facilities are equipped with modern safety features. For example, the transuranic liquid waste treatment facility has double-walled pipes and leak detection to mitigate chemical risks. The more modern design and construction will improve the safety of radioactive liquid waste treatment at LANL.

In the 2008 SWEIS, increased risk from pit production was due to risk from accidents primarily at the CMR Building. However, the CMR function is being moved to more secure facilities located farther from the public and adjacent to the Plutonium Facility. Maintaining pit production at 20 pits annually at the Plutonium Facility is not expected to increase the risk from accidents at this facility because operations are governed by the safety basis, which provides reasonable assurance of safety operations. Substantial upgrades have been made to the Plutonium Facility in response to concerns from the Defense Nuclear Facilities Safety Board. These include improvements in the fire-suppression systems and the ability of the facility structure and confinement system to withstand design-basis earthquakes. PF-4 has also dramatically reduced combustibles since 2009; implemented stringent combustible controls, ignition source controls, and fire barrier upgrades and maintenance; and made other relevant improvements. Modifications currently in design are anticipated to increase the facility's seismic safety margin to avoid collapse.

The Radioassay and Nondestructive Testing Facility has been in standby mode due to the inability of the building (TA-54-69) structure to meet the seismic criteria for a nuclear facility. Options are under development to bring this facility into compliance with seismic criteria, including a new design package for replacement of the roof. A seismic upgrade of the Radioassay and Nondestructive Testing Facility will ensure that the facility will perform as analyzed in the safety basis.

### **3.16.4 Conclusion**

New and modified projects and modifications in site operations are not expected to result in more significant potential consequences in the event of an accident than those that were previously analyzed in NEPA documents including the 2008 SWEIS; therefore, accident analysis and terrorism incidents remain bounded by the 2008 SWEIS.

### **3.17 Climate Trends and Greenhouse Gases**

The study, identification, and tracking of variation in the climate are vital to DOE in order to protect the mission conducted at LANL. Trends in climate may represent a vulnerability in the conduct of operations if it results in limitations of consumption of resources or utilities provided to LANL.

The United Nations established the Intergovernmental Panel on Climate Change in 1988 to assess the science of a changing climate. The Panel prepared five assessment reports identifying increases in atmospheric concentrations of certain gases as a cause of changes in the Earth's atmospheric energy balance (global warming) and an influence on global climate. These gases are transparent to incoming solar (short-wave) radiation but can trap outgoing long-wave (infrared) radiation. This effect reduces the long-wave thermal radiant energy discharged from the Earth's surface that provides natural nighttime cooling. The net effect over time is a trapping of absorbed radiation and a warming of the planet's surface and the boundary layer of the Earth's atmosphere. In general, global warming is defined as the increase in Earth's average surface temperature due to rising levels of greenhouse gases (NASA 2017). Another commonly used term, climate change, is the long-term change in the Earth's climate that, in this case, results from global warming. The Panel states "Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia" (IPCC 2014b). The Panel concludes that human influence on the climate system is clear. It is extremely likely (95 to 100 percent probability) that human influence was the dominant cause of global warming between 1951 and 2010 (IPCC 2014b).

Water vapor (approximately 1 percent of the atmosphere) is the most common and dominant greenhouse gas; only small amounts of water vapor are produced as the result of human activities. The principal greenhouse gases resulting from human activities are carbon dioxide<sup>40</sup>, methane, nitrous oxide, and halocarbons. Halocarbons include chlorofluorocarbons; hydrofluorocarbons, which are replacing chlorofluorocarbons as refrigerants; and perfluorocarbons, byproducts of aluminum smelting. Other gases of concern include sulfur hexafluoride, which is widely used in insulation for electrical equipment. These gases have different global warming potentials depending on their ability to absorb energy and how long they stay in the atmosphere.

---

<sup>40</sup> Carbon dioxide—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 anthropogenic greenhouse gas that may affect the Earth's radiative balance and is the reference gas against which other greenhouse gases 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).

### **3.17.1 2008 SWEIS Analysis**

#### ***Climate Trends***

Climate trends were not specifically analyzed in the 2008 SWEIS, although effects of regional drought and local catastrophic wildfires were analyzed.

#### ***Greenhouse Gases***

Greenhouse gases were not analyzed in the 2008 SWEIS.

### **3.17.2 Changes since the 2008 SWEIS (2008 through 2017)**

#### ***Climate Trends***

This supplement analysis will consider a timeframe greater than that associated with the 2008 SWEIS since climate-related trends take several years or decades to distinguish and to identify averages in a given time period.

The average combined land and ocean surface temperature has increased by 1.5° Fahrenheit 0.85° Celsius from 1880 to 2012 and the global mean sea level rose by 0.6 feet (0.19 meters) from 1901 to 2010. For the southwest United States, temperatures from 2001 to 2010 were nearly 2° Fahrenheit (1.1° Celsius) above normal (LANL 2017b).

Climate-related trends across the globe include rising air and sea temperature; reduced ice mass at Greenland and Antarctic; reduced glaciers, snow cover, and sea ice; and an increase in sea level (IPCC 2015). Changes in frequency and intensity of extreme weather conditions (decrease in cold temperature extremes, increase in warm temperature extremes, heavy downpours, floods, heat waves, and droughts) have been observed since 1950. Climate variability leaves some ecosystems exposed to heat waves, droughts, floods, and wildfires (IPCC 2015).

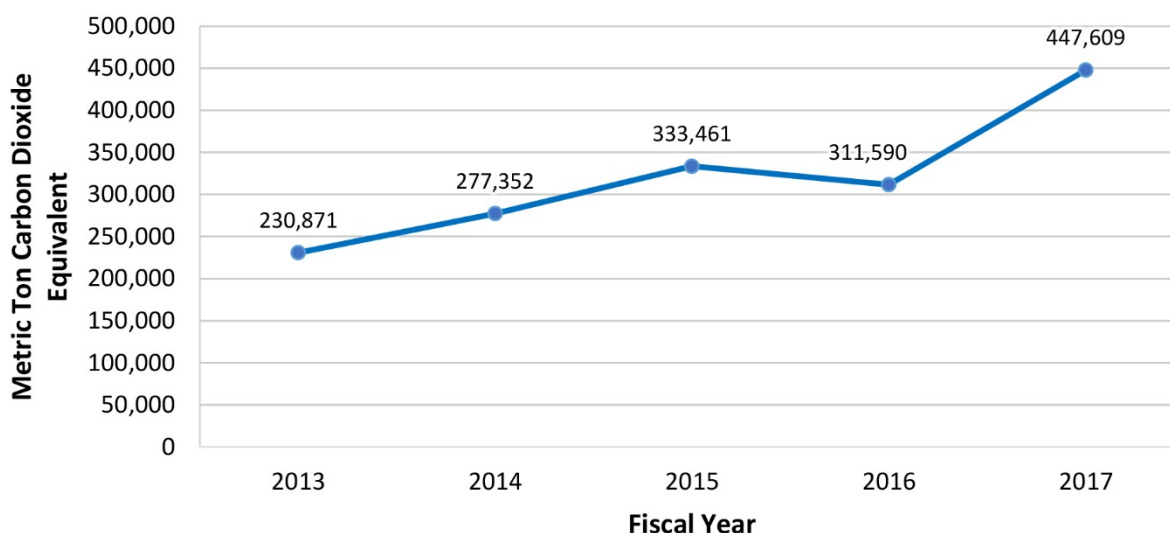
Since 1990, the average annual precipitation over the United States has increased by about 5 percent, but there were regional differences, e.g., increases mostly in the Northeast, Midwest, and southern Great Plains and a mix of increases and decreases in much of the Southeast and Southwest (Melillo et al. 2014). The global climate variability model predictions indicate that in the southwestern United States, drier or prolonged drought conditions could appear in the spring, whereas Northern areas could become wetter. In the southwestern United States, conditions of variability in climate include:

- Models project warming in all cases, from ~2.0° Fahrenheit to 4.0° Fahrenheit (1.1° Celsius to 2.2° Celsius). These results are consistent with the National Climate Assessment projections of increasing temperature for the 2050s for the Southwest United States (Garfin et al. 2014)
- Stresses of severe heat, heavy precipitation, and declining snowpack (IPCC 2015)
- Marked reduction in spring snow accumulation in mountain watersheds across the southwestern United States that becomes more pronounced over the decades of the twenty-first century (Seager and Vecchi 2010)
- Decreases in water quality are also projected (IPCC 2014a)
- More winter-time precipitation falling as rain rather than snow with an overall decline in snow (IPCC 2014b)

- More frequent low-snow years and shifts toward earlier snowmelt runoff
- More intense droughts and increased precipitation variability lead to increased stresses in water, agriculture, and economic activities
- Pest and disease outbreaks in forest, increased tree mortality, and associated forest dieback (IPCC 2015)
- Drying of soil and drought (IPCC 2014b)

### Greenhouse Gases

In 2007, the U.S. Supreme Court ruled in *Massachusetts versus the Environmental Protection Agency* that greenhouse gases are air pollutants covered by the Clean Air Act. In 2009, the Environmental Protection Agency issued a mandatory greenhouse gas reporting rule (40 CFR 98) followed by an endangerment finding stating that six greenhouse gases (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride) threaten the public health and welfare of the American people. DOE initiated planning and implementation for sustainability goals to reduce these six greenhouse gases. Figure 3-28 shows results of LANL greenhouse gas calculations. Emissions of carbon dioxide equivalent total emissions in 2016 were 311,590 metric tons (343,500 tons) (LANL 2017c). Nitrogen trifluoride was added as a seventh gas to monitor. Executive Order 13693 confirms the federal government's continued commitment to reduce these seven greenhouse gases.



**Figure 3-28. LANL greenhouse gas emissions**

Greenhouse gas emissions are stated in terms of equivalent emissions of carbon dioxide based on their global warming potential. Overall greenhouse gas emissions in the United States during 2015 totaled about 6,587 million metric tons (7,261 million tons) of carbon dioxide equivalent (EPA 2017).

### **3.17.3 Analysis of Projected Changes (2018 through 2022)**

#### ***Climate Trends***

During the decades between 1960 and 2000, the annual average temperatures in Los Alamos varied only slightly from 48° Fahrenheit (8.9° Celsius). During the 2001 to 2010 decade, the annual average temperature increased to above 49° Fahrenheit (9.4° Celsius); a statistically significantly higher value than previous decades. The annual average temperatures from 2011 to 2015 continued to demonstrate a warmer climate for Los Alamos (LANL 2017b). This is consistent with predictions for a warming climate in the southwestern United States (IPCC 2014b).

Average annual precipitation exhibits a downward trend for 1981 to the present, and snowfall exhibits a downward trend for 1951 to the present. This is consistent with the impact of the most recent drought years. In addition to the total amount of snowfall decreasing over the past 70 years, there has been a decrease in the length of the snow season, the number of days between the average first measureable snowfall in the fall and the last measureable snowfall in the spring. In the early 1980s, the first day of snow for the year was about November 4 and the final snowfall of the year was about April 18. Most recently, the first snowfall of the year occurs in late November and the final snowfall of the year occurs at the end of March. The snow season has decreased by about 6 weeks over the past 46 years (LANL 2017b).

Higher ambient temperatures will cause an increase in energy and water consumed for cooling. Changes in precipitation, drought, and forest dieback have resulted in greater rates of erosion and potential damage to cultural resources. Mitigative measures have already been employed to protect LANL facilities from continued wildfire risks.

#### ***Greenhouse Gases***

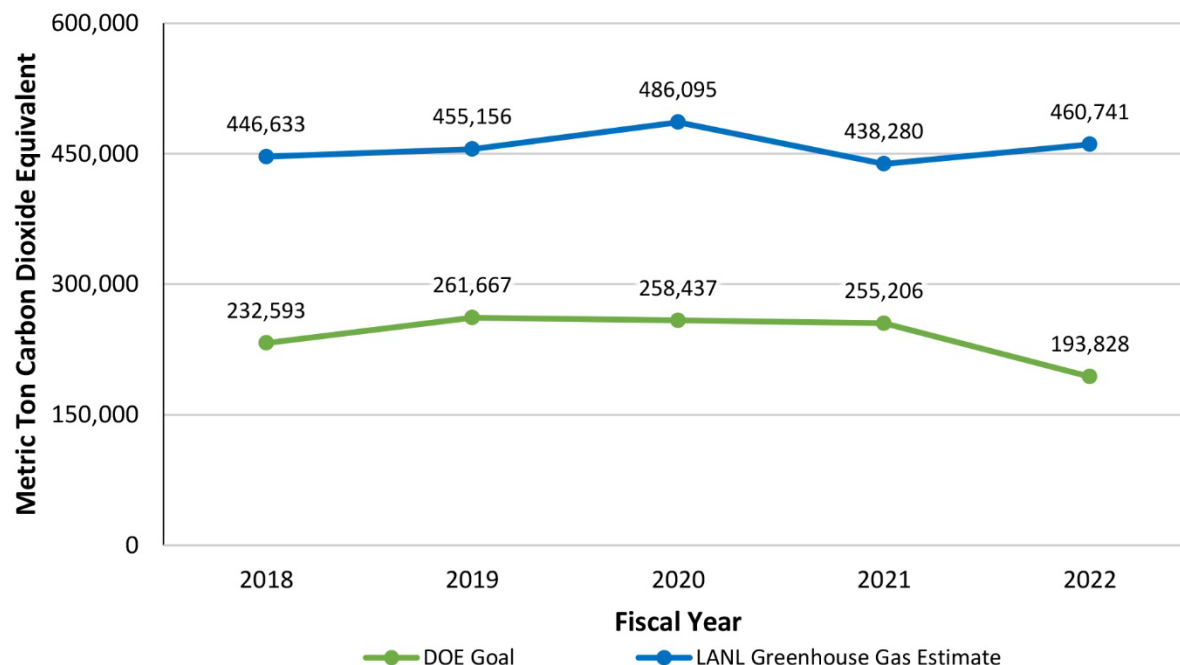
DOE missions in the next 5 years are anticipated to require an increasing amount of electrical power and, thus, emit a greater amount of greenhouse gases. This trend is expected to continue into 2026. Figure 3-29 shows LANL estimated greenhouse gases and the DOE goal. The purchase of renewable energy credits<sup>41</sup> (DOE 2010c) are used to achieve the DOE goal.

DOE proposes to construct a 10-megawatt photovoltaic array at a previously disturbed area in TA-16. This project would reduce overall LANL greenhouse gas emissions. A reduction of greenhouse gases from this project would continue over the life expectancy of 20 to 30 years for photovoltaic modules. Several sites were considered in a site selection evaluation that considered environmental and project-related factors. The TA-16 site provided the best opportunity. This system would have photovoltaic arrays that convert light energy to direct current electricity, and inverters that convert direct current to alternating current.

DOE anticipates a growth in the demand for electrical power and an increase in the greenhouse gases generated to meet that demand (Figure 3-13) (Rodriguez 2017a, 2017b).

---

<sup>41</sup> Renewable energy credits are purchased by LANL to offset some of its generation of greenhouse gases and to meet DOE sustainability goals. The concept of renewable energy credits is that location of the emissions reduction is immaterial. Reduction of greenhouse gases in a location different from the emissions source results in the same atmospheric impact as a reduction on site by a mitigating entity.



**Figure 3-29. LANL greenhouse gas emissions and projections**

### 3.17.4 Conclusion

Climate trends and impacts are anticipated to continue. Greenhouse gas emissions from the proposed LANL activities are anticipated to increase as missions change. NNSA will evaluate the potential impacts and plan accordingly.

## 3.18 Forest Health and Wildland Fire Preparedness

This section discusses the potential impacts on forest health from environmental conditions and modifications in site operations that are likely to be implemented at LANL through the year 2022.

Most of LANL is undeveloped grassland, shrubland, woodland, and forests that serve as security and safety buffer zones and lands for future expansion.

LANL is surrounded by other federal agency lands (National Park Service, U.S. Forest Service, and Bureau of Land Management), Santa Clara Pueblo, and the Pueblo de San Ildefonso. The Laboratory supports and participates in interagency working groups that address regional issues of wildfire preparedness and response and land management. The New Mexico Joint Powers Agreement between the New Mexico Forestry Division, DOE, U.S. Department of Interior, and U.S. Department of Agriculture, provides a mechanism for sharing resources when needed for fighting wildfires.

### **Forest Cover Types at LANL**

**Piñon-Juniper**—Fire-sensitive communities dominated by piñon and juniper that have expanded in range in the Southwest, becoming established in areas formerly occupied by open grassland, mixed woodland, and/or ponderosa pine savanna communities (Allen 1989).

**Ponderosa Pine**—Occurs at elevations ranging from 6,000 to 7,500 feet (1,829 to 2,286 meters) occupying warmer and drier sites within the montane forest life zone. The zone is characterized by a relatively frequent historic fire regime resulting in surface fire effects. Ponderosa pine is the dominant tree species in this forest type, but other tree species may be present, including Gambel oak, piñon pine, and juniper species. This forest type often has a shrubby understory mixed with grasses and forbs but sometimes occurs as savannah with extensive grasslands interspersed between widely spaced clumps or individual trees (Reynolds et al. 2013).

**Dry Mixed Conifer**—Occurs in warmer and drier sites between elevations of 5,000 and 10,000 feet (1,524 to 3,048 meters) and is characterized by a relatively frequent historic fire regime (<5 years fire return interval), resulting in surface fire and infrequently, mixed-severity fire effects. This forest type is typically dominated by shade-intolerant species such as ponderosa pine, with minor association of aspen, Douglas fir, and Southwestern white pine during early seral stages. More shade-tolerant conifers such as Douglas fir, white fir, and blue spruce are dominant at climax stages (Reynolds et al. 2013).

### **3.18.1 2008 SWEIS Analysis**

In 2008, LANL occupied about 40 square miles (25,600 acres [10,360 hectares]) spread across 48 technical areas. Drought and wildland fire were identified as potential impacts to large forested areas. The Cerro Grande fire in 2000 directly impacted biological resources, including a reduction in habitat and the loss of wildlife. Fire mitigation work, such as flood-retention structures, affected about 50 acres (20 hectares) of undeveloped land. Two years after the fire, a bark beetle outbreak resulted in 95 percent mortality of piñon pine trees and 12 percent mortality of ponderosa pine trees across the Pajarito Plateau. During this time period, at lower elevations of the Mixed Conifer Forest Vegetation Zone on north-facing slopes of the canyons, up to 100 percent of the Douglas fir trees were killed by drought in certain areas. Additionally, considerable forest thinning occurred before the 2008 SWEIS to reduce future wildfire potential.

In 2000, the Cerro Grande fire burned a heavily forested canyon area to within about 0.75 miles (1.2 kilometers) of the waste storage domes in TA-54; however, none of the domes burned and there were no radiological releases.

### **3.18.2 Changes since the 2008 SWEIS (2008 through 2017)**

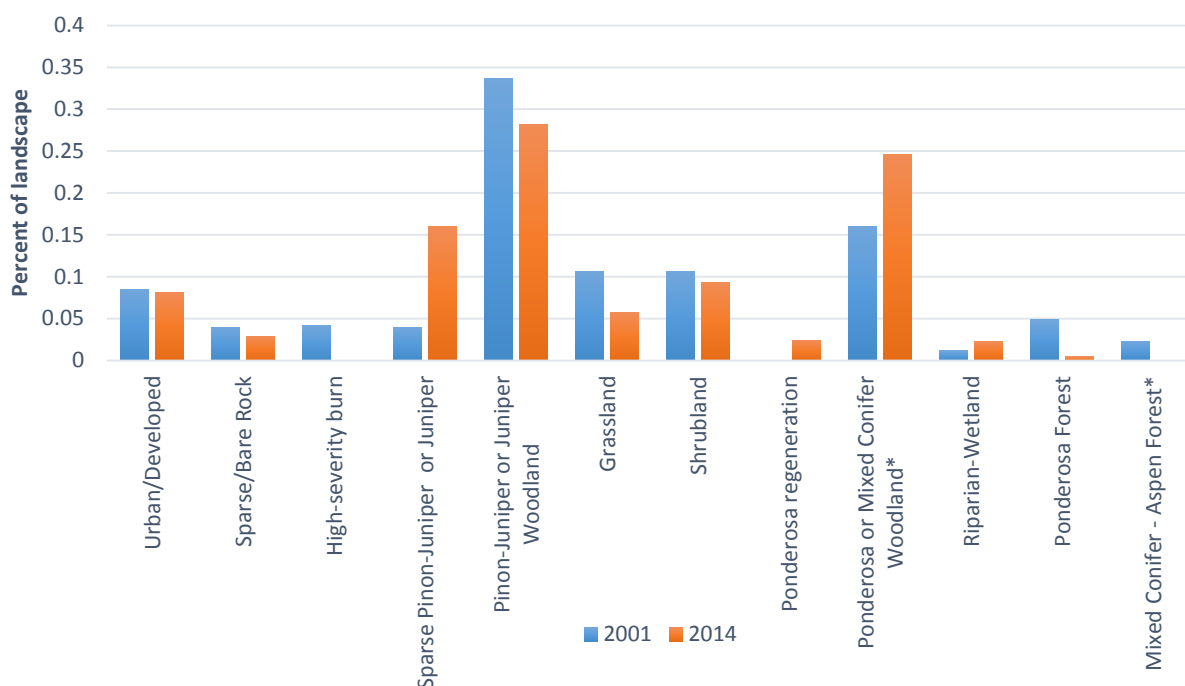
Tree mortality caused by drought stress and insect damage has continued since 2008. The loss of grassy understory and vegetation mortality increased erosion rates and resulted in bare ground patches that connect and accelerate water and sediment runoff. In 2011, the Las Conchas fire extensively burned watersheds above LANL, resulting in greatly increased flooding and soil erosion on Laboratory property.

Additional fuel reduction surrounding and inside the TA-54 area was conducted after the Las Conchas fire. Other defensible space and evacuation route thinning has also been conducted. In 2012, a multi-agency federal effort resulted in the construction of a permanent Interagency



Fire Center at TA-49. The Interagency Fire Center is operated by the National Park Service on land leased from LANL and also houses LANL's Wildland Fire Management Program.

In support of the Forest Management Plan and the Wildland Fire Program, LANL completed a new land cover map in 2016. Figure 3-30 shows the percent of the landscape within the current LANL boundaries in various land cover classes using the land cover maps developed from 2001 satellite imagery and 2014 satellite imagery (LANL 2015d).



\*For the 2014 mapping effort, woodland and forest areas were combined for mixed conifer and mixed conifer-aspen vegetation. Out of 16 field plots visited in mixed conifer and mixed conifer-aspen where we measured total canopy cover, four (25 percent) had greater than 50 percent total canopy cover.

**Figure 3-30. Land cover types in current LANL boundary, 2001 and 2014**

Since 2001, piñon juniper woodland area has decreased, due to piñon death. Vegetation plot data collected in 2015 to support the land cover map found that most mature piñon trees had died. Only four percent of potential piñon plots had more than 10 percent cover of piñon trees. Many areas that were classified as forests (greater than 60 percent canopy cover) in 2001 were classified as woodlands (less than 50 percent canopy cover) in 2014. Forested areas that experienced high-severity burns during the Cerro Grande and Las Conchas fires have grown back as shrubland cover types. Since 2001, grassland area is reduced and ponderosa regeneration areas (young trees) has increased.

### 3.18.3 Analysis of Projected Changes (2018 through 2022)

Anticipated increases in average annual temperatures will result in continued mortality of trees, continued high risks of severe wildfire, and higher soil erosion rates in the LANL region (LANL 2014a). Increasing temperature extends the length of the fire season, increasing opportunities for ignition. Increased fire season temperatures, drought, insect infestations, and accumulation of

woody fuels and non-native grasses make the Southwest vulnerable to increased wildfire (Garfin et al. 2013). A LANL study (McDowell et al. 2016) concluded that most conifer forests/communities in the southwestern United States will experience high tree mortality by 2050, suggesting that the currently observed trends in tree mortality will continue through 2022. LANL will continue to need an active wildland fire and forest management program, including annual tasks to reduce fuel loads across the Laboratory. Soil erosion could be mitigated by implementing the LANL Forest Management Plan and the Supplemental Environmental Projects for watershed enhancement.

#### **3.18.4 Conclusion**

Continued high risk of severe wildfire in the region is anticipated. Mitigation measures have been implemented to protect Laboratory facilities from wildfire. Forest health management plan activities would increase forest resilience under expected warmer temperatures. NNSA will continue to evaluate the potential impacts and plan accordingly.

## **4.0 CUMULATIVE IMPACTS**

The Council on Environmental Quality regulations (40 CFR 1508.7) defines cumulative impacts as “the incremental impacts 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.” This chapter reviews and updates the cumulative impacts analysis presented in the 2008 SWEIS (DOE 2008a). Cumulative impacts associated with an action can be evaluated in terms of the total effects on a resource, ecosystem, or human community associated with that action and all other activities affecting that resource regardless of what entity (e.g., federal, non-federal, or private) is undertaking those activities (EPA 1999). Cumulative effects can also result from crowding of environmental perturbations, spatially (geographically) and/or temporally (across time); in other words, concurrent human activities and the resulting environmental impacts are additive if there is insufficient time for the environment to recover.

The cumulative impacts analysis in the 2008 SWEIS considered 1) an examination of the cumulative impacts presented in the 1999 SWEIS (DOE 1999b); 2) impacts since the 1999 SWEIS was issued; 3) a review of the environmental impacts of past, present, and reasonably foreseeable actions for other federal and non-federal agencies in the region; 4) actions related to the CMRR Nuclear Facility; 5) infrastructure needs at LANL and the utility supply capability; 6) continued implementation of the Land Conveyance and Transfer Project; 7) operation of a biosafety level 3 facility at LANL (DOE 2014f); 8) consolidation of DOE plutonium-238 activities at the Idaho National Laboratory (DOE 2005b); 9) implementation of the NNSA complex transformation (DOE 2008c); and 10) the disposal facility for greater-than-class C waste; at the time of the 2008 SWEIS, LANL was one of eight facilities being considered for the facility (LANL 2016g). These impacts were added to the environmental impacts of other present and reasonably foreseeable future actions that were likely to occur at or near LANL as analyzed in Chapter 3 of the 2008 SWEIS to obtain cumulative impacts under normal conditions.

Because the potential impacts associated with the proposed projects described in this supplement analysis are equal to or similar to the impacts presented in the 2008 SWEIS, the cumulative impacts of continued operation of LANL, including the proposed projects likely to be implemented between 2018 and 2022, are bounded by the 2008 SWEIS analysis.

Chapter 5 of the 2008 SWEIS states that the SWEIS analysis is, because of its scope, an analysis of cumulative impacts (DOE 2008a). To analyze the effects of LANL operations, regions of influence were selected to identify the maximum extent of impacts while still providing a meaningful discussion and evaluation of the potential impacts. These potential impacts represent the effects from all LANL operations, some of which do not have contributors from other sources. DOE stated that there is little contribution to impacts from other sources in the same region of influence as LANL. This statement remains true for this supplement analysis. Reasonably foreseeable actions for the region of influence that includes LANL are included here.

## **4.1 Reasonably Foreseeable Actions in the Region of Influence**

### **4.1.1 CMR**

Since the 2008 SWEIS, DOE/NNSA has prepared two NEPA documents related to the CMR Facility, the “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 2011d) and a supplement analysis (DOE 2015c). DOE/NNSA subsequently cancelled the CMRR Nuclear Facility and constructed RLUOB. Construction of the RLUOB was completed in April 2014. Because the CMRR Nuclear Facility was not constructed, the potential cumulative impacts would be less than those that were identified in the 2008 SWEIS, which analyzed construction of both facilities.

### **4.1.2 Conveyances and Transfers of DOE Land and Properties**

In 1999, DOE prepared the “Environmental Impact Statement for the Conveyance and Transfer of Certain Land Tracts Administered by the U.S. Department of Energy and Located at Los Alamos and Santa Fe Counties, New Mexico” (DOE 1999d). That EIS addressed the potential environmental impacts associated with transferring up to 10 tracts of land with a total size of approximately 4,796 acres (1,941 hectares) to Los Alamos County and the Secretary of the Interior, in trust for the Pueblo de San Ildefonso. Three records of decision were issued (DOE 2012a, 2000c, 2005c). As a result of these records of decision, DOE has conveyed and transferred many of these lands (see Section 4.2.1). Many of the properties conveyed to Los Alamos County have been beneficially developed. Economic development associated with these conveyances has resulted in a new hotel, a new grocery store, a library, and other businesses. The cumulative impacts of these land conveyances and transfers were analyzed in the 1999 EIS, and the proposed projects, operations, and activities described in this supplement analysis, including future land conveyances, remain within the impacts of that cumulative analysis.

### **4.1.3 National Park Service Lands**

Bandelier National Monument sustained significant damage associated with the 2011 Las Conchas fire and subsequent flooding, most notably the September 2013 flood event. Since that time, Bandelier National Monument has undertaken projects to repair damaged roads, bridges, and other park infrastructure. Bandelier has also completed improvements to the Tsankawi Management unit up to the eastern boundary of TA-72 at LANL. An environmental assessment analyzing impacts associated with road upgrades adjacent to State Road 4 and realignment of public recreational trails at the Tsankawi Management unit was completed in 2015 (DOI 2014). Work to improve parking and access roads would likely improve traffic safety in the State Road 4 and East Jemez road area, which would provide a beneficial impact. The Valles Caldera National Preserve and the Manhattan Project National Historical Park were established as new National Park Service Units in 2014. Establishment of these new park units may contribute to cumulative impacts associated with socioeconomics, increased traffic associated with tourism into the area, and construction of new facilities. In 2011, the U.S. Department of Interior completed an environmental assessment for the Manhattan Project National Historical Park and issued a finding of no significant impact (DOI 2010a, 2010c). DOE adopted this environmental assessment and finding of no significant impact and selected DOE’s Office of Legacy Management to manage the Manhattan Project National Historical Park for

DOE. The finding of no significant impact determines that there are no anticipated impacts associated with implementation of this park; consequently, there is no need to update the analysis in this supplement analysis.

#### **4.1.4 Los Alamos County**

The Los Alamos County Department of Public Utilities was the lead agency for the rebuilding of the Los Alamos Canyon Reservoir in Los Alamos County just east of the DOE boundary. The project began in March 2011 but was suspended because of damage associated with the June 2011 Las Conchas fire. Originally scheduled to be completed on November 15, 2011, construction work on the reservoir was completed in 2013; however, the September 2013 floods damaged the road to the reservoir and filled the reservoir with sediment and debris (Erickson 2013, LADPU 2011). Los Alamos County continues to work on road repairs and dredging of the reservoir. The cumulative impacts associated with this work would be minor and negligible.

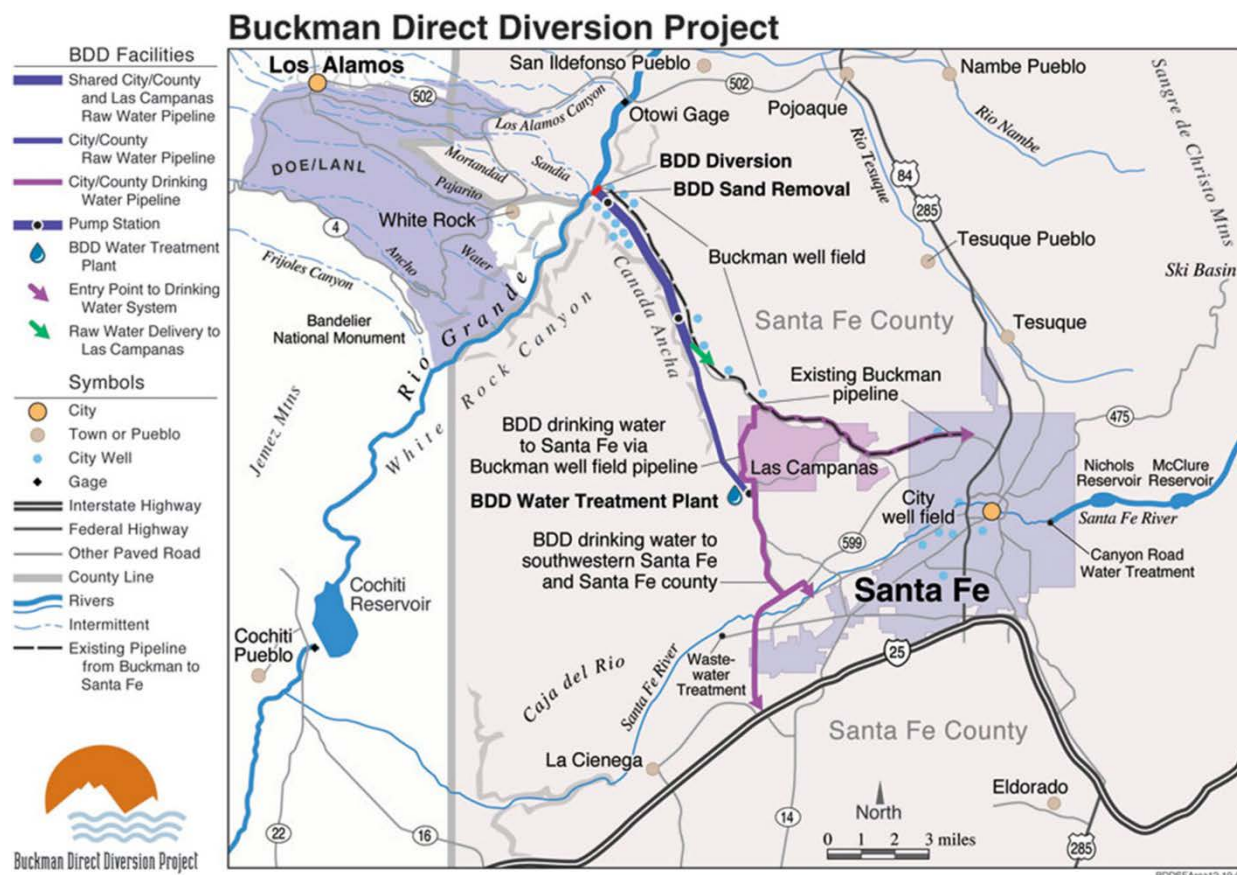
#### **4.1.5 U.S. Department of Agriculture**

In 2006, the U.S. Department of Agriculture issued the “Final Environmental Impact Statement for the Buckman Water Diversion Project” to divert water from the Rio Grande for use by the City of Santa Fe and Santa Fe County (BLM and USFS 2006). The project withdraws water from the Rio Grande approximately 3 miles (5 kilometers) downstream from where State Road 502 crosses the river (Figure 4-1). The pipelines used to divert the water largely followed existing roads and utility corridors. Potential impacts on fish and aquatic habitats below the proposed project due to changes in water flow have been minimal (BLM and USFS 2006, BDDP 2010a). A 2010 memorandum of understanding regarding water quality monitoring between the Buckman Direct Diversion Board and DOE established roles and responsibilities of each agency (BDDP 2010b). In accordance with the memorandum, DOE provides funding for continued sampling and analysis and data sharing (BDDP 2010b). The Buckman Direct Diversion Project is designed to provide up to 15 million gallons (57 million liters) per day of treated drinking water (BDDP 2013). The cumulative impacts associated with this project and the continued operation of the Buckman Diversion dam would continue to be minor and negligible.

#### **4.1.6 NNSA Complex Transformation**

Under the NNSA Complex Transformation, the DOE nuclear weapons complex would be made smaller, more efficient, more secure, and better able to respond to changes in national security requirements. The actions to support this goal are discussed in annual stockpile stewardship management plans. The current DOE/NNSA Complex consists of sites located in seven states (California, Missouri, Nevada, New Mexico, South Carolina, Tennessee, and Texas). Possible alternatives are to restructure special nuclear materials manufacturing and research and development facilities; consolidate special nuclear materials throughout the NNSA Complex; consolidate, relocate, or eliminate duplicate facilities and programs and improve operating efficiencies; and identify one or more sites for conducting NNSA flight test operations (DOE 2008c). In the December 19, 2008, record of decision for the Complex Transformation Supplemental Programmatic EIS (DOE 2008d), the NNSA stated its decision to continue conducting manufacturing and research and development activities involving plutonium at LANL. Because the potential impacts associated with continued implementation of the complex transformation were analyzed in the 2008 EIS and considered in the 2008 SWEIS, the

cumulative impacts associated with the proposed actions and projects for the complex transformation do not need to be updated in this supplement analysis.



**Figure 4-1. Buckman Water Diversion Project map**

#### 4.1.7 Santa Fe National Forest Lands

Actions associated with the Santa Fe National Forest lands have not notably changed and were adequately addressed in the 2008 SWEIS (DOE 2008a). Consequently, there is no need to update the analysis in this supplement analysis.

### 4.2 Continued Operation of LANL from 2018 through 2022

In this section, cumulative impacts are considered to include 1) the impacts of projects and operations implemented since the issuance of the 2008 SWEIS, 2) the impacts of proposed LANL projects and operations from 2018 through 2022, and 3) impacts from federal and non-federal projects that would affect the same resources during this same time.

#### 4.2.1 Land Resources and Visual Environment

None of the projects and operations reviewed in this supplement analysis would have impacts that exceed those analyzed in the 2008 SWEIS (DOE 2008a). These projects and operations are consistent with the Laboratory's land use plans. The DOE Land Conveyance and Transfer Project will continue to convey tracts to Los Alamos County. Potential impacts associated with

the conveyance of these tracts for economic development were analyzed in the “Final Environmental Impact Statement for the Conveyance and Transfer of Certain Land Tracts Administered by the U.S. Department of Energy and Located at Los Alamos National Laboratory, Los Alamos and Santa Fe Counties, New Mexico” (DOE 1999d) and considered in the cumulative impacts analysis in the 2008 SWEIS. The two new National Park Service parks, the Manhattan Project National Historical Park and the Valles Caldera National Preserve, are not anticipated to affect overall land resources in the region.

Ongoing footprint reduction goals and the costs associated with new construction have resulted in modernization of existing facilities across the Laboratory. There are no reasonably foreseeable significant changes to land uses on the federal lands that surround LANL, including those administered by the National Park Service and the U.S. Forest Service. Major land use changes are not anticipated to be undertaken by the Bureau of Indian Affairs at neighboring pueblos. Therefore, there are no new anticipated cumulative land use impacts that would require further supplementation of the 2008 SWEIS.

#### **4.2.2 Geology and Soils**

Construction and operations associated with facility modernization at LANL are expected to remain compatible with the geology, soils, and seismic analyses in the 2008 SWEIS (DOE 2008a). Seismic upgrades at the Plutonium Facility (PF-4) are ongoing, and the Radioassay and Nondestructive Testing Facility seismic upgrades are also expected to continue. No new federal or non-federal projects have been identified that would affect the availability of geological materials or increase the seismic risk at the LANL site. Therefore, further supplementation of the 2008 SWEIS for geology and soils is not necessary.

#### **4.2.3 Water Resources**

Continued droughts, wildfire, and flooding events will affect LANL and the surrounding northern New Mexico region. DOE has continued to implement measures and install engineered controls to reduce off-site sediment transport of legacy contamination associated with Manhattan Project era operations at LANL. DOE monitors surface water flows and sediment transport annually, and sampling results are published in LANL annual site environmental reports and on Intellus. The U.S. Department of Agriculture, the City of Santa Fe, and DOE implemented the Buckman Diversion Project to make Rio Grande water available for city use. DOE provides monitoring data to the Buckman Diversion Project to assist Santa Fe in decisions about using diverted water.

Water usage at LANL is projected to remain within the limits analyzed in the 2008 SWEIS during this 5-year evaluation period (2018 through 2022) (DOE 2008a). The Sanitary Effluent Recycling Facility will continue to reprocess water for cooling the Laboratory’s supercomputing facilities while also providing a source to maintain the Sandia Canyon wetland. DOE will continue enhance protection of watersheds through the Supplemental Environmental Projects. To increase the rate of return on water associated with the chromium plume pump and treat project at TA-5 in Mortandad Canyon, DOE will inject a majority of the water after it is treated (DOE 2015b).

The Los Alamos County Department of Public Utilities received approval from its Board of Public Utilities to explore the viability of drilling one to three groundwater wells along the edge



of White Rock Canyon to capture groundwater flowing into the Rio Grande. Water would then be conveyed through pipelines in White Rock and tied into the White Rock distribution system. The environmental analysis may begin in 2018 and if permitted, construction would be completed in 2025 (DOI 2017).

No other federal or non-federal projects have been identified that are likely to affect the quality of LANL surface water or groundwater through the period analyzed in this supplement analysis. No significant cumulative impacts are expected; therefore, further supplementation of the 2008 SWEIS for water quality is not necessary.

#### **4.2.4 Air Quality**

New and modified projects and modifications in site operations are not expected to exceed Environmental Protection Agency or New Mexico Environment Department requirements for air quality and are consistent with the impacts analyzed in the 2008 SWEIS (DOE 2008a). Radiological air emissions from LANL operations would remain within the 2008 SWEIS projections for the maximally exposed individual and the population dose and are thus expected to have no significant environmental impacts under normal operating conditions. Air emissions are subject to the Title V air permit and are expected to be within the bounds of the 2008 SWEIS analysis. No other federal or non-federal projects have been identified that are likely to affect regional air quality from 2018 through 2022. Therefore, no significant cumulative impacts are expected, and further supplementation of the 2008 SWEIS for air quality is not necessary.

#### **4.2.5 Noise**

New and modified projects and modification in site operations that are likely to be implemented through 2022 may contribute to noise generation for construction, environmental remediation activities, and traffic. Construction and operation of new facilities and introduction of new machinery and equipment would not be different from current operations and is not expected to be discernible in off-site areas. The impacts are consistent with the impacts analyzed in the 2008 SWEIS (DOE 2008a). No other federal or non-federal projects have been identified that are likely to affect noise from 2018 through 2022. Therefore, further supplementation of the 2008 SWEIS for potential noise impacts on the public is not necessary.

#### **4.2.6 Ecological Resources**

Temperature variations in the northern New Mexico region will likely result in reduced forest cover and other ecosystem changes at and around LANL (McDowell et al. 2016). These changes may reduce the availability for suitable habitat for some species and may create suitable habitat for new species in the region. In 2014, the Jemez Mountains salamander, the yellow-billed cuckoo, and the New Mexico meadow jumping mouse were added to the LANL Habitat Management Plan as federally listing threatened and endangered species (LANL 2015b). In 2011, the Las Conchas fire diminished forest habitat for areas surrounding and upstream from LANL. Proposed new and modified projects and modifications to operations at LANL are not likely to substantially impact ecological resources. The LANL Habitat Management Plan provides a framework from which DOE manages threatened and endangered species at LANL (LANL 2015b). Rehabilitation efforts in areas of the Santa Fe National Forest and the Santa Fe National Forest Plan Revision (USDA 2010) address habitat issues on lands adjacent to LANL. No other federal or non-federal projects have been identified that are likely to affect ecological

resources from 2018 through 2022. Therefore, no significant cumulative impacts are expected, and further supplementation of the 2008 SWEIS for ecological resources is not necessary.

#### **4.2.7 Human Health and Worker Health/Safety**

Impacts to the public, workers, and the environment associated with LANL operations from 2018 through 2022 are expected to be consistent with the impacts analyzed in the 2008 SWEIS (DOE 2008a). Radioactive discharges are expected to continue to be minimal, and the potential for radiation doses from Laboratory operations is expected to continue to be less than national dose standards and 2008 SWEIS projections. Operation of LANSCE is the predominant contributor to off-site dose to the population surrounding LANL. Remediation of material disposal areas at LANL is the predominant contributor to worker dose.

New and modified projects and modifications in site operations would not significantly change human and worker health and safety at LANL and are consistent with the impacts analyzed in the 2008 SWEIS (DOE 2008a). No other federal or non-federal projects have been identified that are likely to affect human health from 2018 through 2022. Therefore, further supplementation of the 2008 SWEIS for potential impacts to human health and safety is not necessary.

#### **4.2.8 Cultural Resources**

The variability in climate would likely result in increased erosion and sedimentation across the Pajarito Plateau, which could impact cultural resources at LANL. Flooding in September 2013 caused significant damage in canyons around LANL. Proposed new and modified projects and modifications to operations at LANL are not likely to substantially impact cultural resources. A programmatic agreement between DOE, the New Mexico State Historic Preservation Officer, and the Advisory Council on Historic Preservation implementing the LANL Cultural Resources Management Plan (LANL 2017g, DOE 2017c) provides a summary of the cultural resources situated on LANL lands and guidelines for the protection and management of these resources. No other federal or non-federal projects have been identified that are likely to affect cultural resources from 2018 through 2022. Therefore, no significant cumulative impacts are expected, and further supplementation of the 2008 SWEIS for cultural resources is not necessary.

#### **4.2.9 Socioeconomics**

The 2018 management and operating contract change and the ongoing Environmental Management transition may affect the LANL workforce and its demands upon the surrounding communities.

The new and modified projects and modifications noted in this supplement analysis would not significantly change the socioeconomic impacts bounded by the 2008 SWEIS (DOE 2008a); therefore, further supplementation of the 2008 SWEIS for potential environmental impacts to socioeconomics is not necessary.

#### **4.2.10 Infrastructure**

Electrical consumption at LANL is projected to exceed the 2008 SWEIS bounding limit of 120 megawatts by 2021 (DOE 2008a). Water and gas consumption should remain within the bounds of the 2008 SWEIS from 2018 through 2022. Additional electrical infrastructure is anticipated to be required after 2022, along with potential new solutions for the increasing water

demand. Reductions of potable water use from water reuse from the Sanitary Effluent Reclamation Facility from 2018 through 2022 will contribute to overall water reduction goals and sustainability at LANL.

Some projects that were analyzed in the 2008 SWEIS have not yet been undertaken, nor are they expected to be undertaken in the 2018 through 2022 time period. Those LANL facilities that are planned/proposed to be constructed would be designed to minimize energy and water consumption. The Long-Term Strategy for Environmental Stewardship and Sustainability (LANL 2014f), the Site Sustainability Plan (LANL 2017c), and the International Organization for Standardization 14001 certified Environmental Management System, which include goals for water and energy conservation, will continue to be implemented at LANL. Efficiency and conservation measures will continue to be implemented to minimize potential impacts to the environment. LANL will remain within its capacity to deliver electricity and water.

#### **4.2.10.1 TA-3 Substation**

The TA-3 substation has been in operation more than 50 years and will be replaced by a new substation. The new substation will have larger power transformers that will increase the capacity from 233 to 256 mega volt amperes and will supply redundant power to LANL and Los Alamos County.

#### **4.2.10.2 TA-3 Power Plant**

DOE would replace the 60-year-old TA-3 Power Plant with a new, more efficient combined heat and power plant. The new plant will be operated as a base-load machine and will provide up to 40 megawatts on average to LANL.

#### **4.2.10.3 Verde Transmission Line**

Verde Transmission, LLC, has submitted an application to the Bureau of Land Management for a right-of-way to construct, operate, maintain, and eventually decommission a 345-kilovolt overhead transmission line. The Verde Transmission Project is a proposed approximately 33-mile-long (53-kilometer-long), 345-kilovolt transmission line in southern Rio Arriba and Santa Fe counties. The project would interconnect the existing Public Service Company of New Mexico Ojo station on the north with the existing Public Service Company of New Mexico Norton station on the south (DOI 2017).

No other federal or non-federal projects have been identified that are likely to affect LANL's water, gas, and electrical consumption from 2018 through 2022; therefore, no adverse cumulative impacts are expected, and further supplementation of the 2008 SWEIS for water, gas, and electrical consumption is not necessary.

#### **4.2.11 Waste Management**

Waste generation at LANL is expected to remain within the bounds established by the 2008 SWEIS analysis (DOE 2008a). The Enduring Waste Management Plan for LANL describes existing off-site and on-site disposal capabilities for low-level waste, mixed low-level waste, and chemical waste streams (LANL 2017j). The DOE Office of Environmental Management will continue to address legacy wastes at LANL from 2018 through 2022 (Section 1.2.1). The 2008 SWEIS analyzed two principal options for remediating contaminated areas and material disposal

areas at LANL: 1) retrieval and removal of wastes and 2) stabilization-in-place (DOE 2008a). The Waste Isolation Pilot Plant reopened in 2017 and LANL will continue to process transuranic and mixed transuranic waste for disposal there as projected in the 2008 SWEIS. The Waste Isolation Pilot Plant has sufficient capacity to accept LANL waste through 2022. Other federal facilities also dispose of transuranic and mixed transuranic waste at the Waste Isolation Pilot Plant. At this time, there are no known federal or non-federal projects that are likely to affect waste management from 2018 through 2022; therefore, no cumulative impacts are expected and supplementation of the 2008 SWEIS for waste management is not necessary.

#### **4.2.12 Environmental Remediation**

Since the completion of the 2008 SWEIS, LANL has undertaken environmental remediation efforts across LANL, including remediation of material disposal areas, installation of erosion and sediment control barriers to prevent movement of sediment off-site, and installation of monitoring wells to monitor groundwater for the movement of contaminants. Remediation efforts emphasized under the 2016 Consent Order include installation of interim and corrective measures, sampling and monitoring, risk assessments, and excavation of contaminated wastes and soils. Remediation of remaining material disposal areas, canyon cleanup, and other actions related to the implementation of the Consent Order are projected to continue through 2022.

New and more stringent National Pollutant Discharge Elimination System permit requirements for LANL will result in improved surface water quality and reduce sediment transport. Remediation of groundwater under the Consent Order will continue into the foreseeable future. Final remedies for chromium and RDX will be evaluated for NEPA compliance. No other federal or non-federal projects have been identified that are likely to affect environmental remediation from 2018 through 2022; therefore, no adverse cumulative impacts are expected, and further supplementation of the 2008 SWEIS is not necessary.

#### **4.2.13 Traffic and Transportation**

The 2008 SWEIS concluded that transportation of radioactive materials would not likely cause a fatality as a result of radiation, either from incident-free operations or postulated accidents (DOE 2008a). The 2008 SWEIS projected about 122,000 shipments of radioactive materials and approximately three associated fatalities from traffic accidents. Roadway safety upgrades will be accomplished through the Supplemental Environmental Projects.

The National Park Service is developing alternatives for improved public access and facilities for the parking area near Tsankawi Loop Trail at Bandelier National Monument. Construction upgrades to the parking area would have moderate impacts to traffic along State Road 4 and East Jemez Road. The Tsankawi Loop Trail parking area upgrades would likely affect traffic and transportation within the next 5 years; these impacts are temporary and bounded within the analysis of the 2008 SWEIS; therefore, no cumulative impacts are expected, and supplementation of the 2008 SWEIS for traffic and transportation is not needed.

#### **4.2.14 Environmental Justice**

The Laboratory has an ongoing commitment to environmental justice and implementation of Executive Order 12898 through the Community Commitment Plan and associated programs, formal and informal consultations, public meetings, and communication strategies. The new and

modified projects and modifications in site operations would not significantly change environmental justice and are consistent with impacts analyzed in the 2008 SWEIS (DOE 2008a). There are no known federal or non-federal projects that are likely to affect environmental justice from 2018 through 2022; therefore, no cumulative impacts are expected, and further supplementation of the 2008 SWEIS for environmental justice is not necessary.

#### **4.2.15 Facility Accidents**

In the 2008 SWEIS, accident analyses are grouped into the following categories: radiological releases, chemical releases, seismic impacts, and wildfire accidents (DOE 2008a). In general, releases to the environment occur through fire (lightning strike, wildfire, fires started by seismic activity, etc.) or by collapse of facilities because of seismic activity. New and modified projects and modifications in site operations are not expected to create scenarios that could result in more significant potential consequences in the event of an accident than those that were analyzed in the 2008 SWEIS. At this time, there are no known federal or non-federal projects that are likely to affect facility accidents from 2018 through 2022; therefore, no cumulative impacts are expected, and further supplementation of the 2008 SWEIS for accident analysis is not needed.

#### **4.2.16 Climate Trends and Greenhouse Gases**

Climate trends were not analyzed in the 2008 SWEIS. However, all subsequent NEPA evaluations have included discussions of trends in climate and greenhouse gases. Executive Order 13693, “Planning for Federal Sustainability in the Next Decade,” requires federal facilities to calculate and lower greenhouse gas emissions. Chapter 3 of this supplement analysis provides a detailed discussion of climate trends and greenhouse gases. Greenhouse gas emissions from proposed LANL activities will be offset by facility modernization, specifically replacement of the TA-3 power plant, pollution prevention projects focused on elimination of greenhouse gases, and the goals associated with the LANL Site Sustainability Plan (LANL 2017c). All current and proposed projects must meet the limits established in the Title V and Title VI operating permit for the Laboratory. Emissions are monitored and reported annually to the Environmental Protection Agency. Ongoing federal and non-federal activities in the region include oil and gas extraction, agriculture, mining, and forest and rangeland management. These activities, combined with nearly all human economic activities in the region, nationally and globally, are likely to affect the climate from 2018 through 2022 and beyond.

#### **4.2.17 Forest Health and Wildland Fire Preparation**

Tree mortality caused by drought stress and insect damage has been documented since 2008 (McDowell et al. 2016). The loss of grassy understory and vegetation mortality increases erosion rates, resulting in bare ground patches and accelerated water and sediment runoff (Allen 2007). In 2011, the Las Conchas fire extensively burned watersheds above LANL, resulting in greatly increased flooding and soil erosion on Laboratory property for some years.

A LANL study (McDowell et al. 2016) concluded that most conifer forests/communities in the southwest United States will experience high tree mortality by 2050, suggesting that the currently observed trends in tree mortality will continue through 2022. Neighboring federal agencies (U.S. Forest Service, National Park Service, Bureau of Land Management, and Bureau of Indian Affairs) administer adjacent forest lands in accordance with their missions and are subject to NEPA and other federal regulations. There are no non-federal projects that have been

identified that are likely to adversely affect forest health and wildland fire preparation from 2018 through 2022; Los Alamos County and the surrounding region have been proactive in addressing forest health and wildland fire preparation. Therefore, no adverse cumulative impacts are expected, and further supplementation of the 2008 SWEIS is not necessary.

### **4.3 Mitigations**

In 2008, DOE issued a mitigation action plan associated with the 2008 SWEIS (DOE 2008e), which describes the mitigation measures that will be implemented from the 2008 SWEIS and explains how the mitigation measures will be planned and implemented for those actions selected in the two records of decision (DOE 2008b, 2009a). Additionally, both 2008 SWEIS records of decision included commitments to Santa Clara Pueblo as part of ongoing government-to-government relations regarding the 2008 SWEIS. There are four types of mitigation measures included in the 2008 SWEIS mitigation action plan: 1) ongoing mitigation commitments established by the earlier 1999 SWEIS mitigation action plan and mitigation commitments that reflect NEPA decisions that have occurred since the issuance of the 1999 SWEIS record of decision (DOE 1999a); 2) detailed mitigation action commitments for specific projects analyzed in the 2008 SWEIS and included in a record of decision intended to minimize identified environmental impacts; 3) institutional resource management responsibilities, including Laboratory-wide commitments and mitigation; and 4) mitigation commitments that reflect NEPA decisions that have occurred since the issuance of the 2009 record of decision.

The 2008 SWEIS mitigation action plan has been revised and/or addended four times since the issuance of the 2008 SWEIS. An addendum to the 2008 SWEIS mitigation action plan was issued by DOE in September 2009 to include decisions contained in the second record of decision (DOE 2011a). In 2010, the mitigation action plan was revised and updated to include mitigations in the “2010 Final Environmental Assessment for the Expansion of the Sanitary Effluent Reclamation Facility and Environmental Restoration of Reach S-2 of Sandia Canyon at Los Alamos National Laboratory Los Alamos, New Mexico” and a mitigated finding of no significant impact (DOE 2010a, 2010b). In 2014, the mitigation action plan was revised to incorporate mitigations in the 2011 “Mitigation Action Plan for the Nuclear Facility Portion of the Chemistry and Metallurgy Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico” (DOE 2011i) and to formally close out those 2008 mitigations that have been completed or integrated into established LANL programs. The mitigation action plan was most recently revised in 2016 to incorporate the 2015 “Chromium Plume Control Interim Measure and Plume-Center Characterization, Los Alamos National Laboratory, Los Alamos, New Mexico (DOE/EA-2005) Mitigation Action Plan” (DOE 2015f) and to formally close out additional 2008 SWEIS mitigations that were cancelled, completed, or integrated into established LANL programs.

DOE continues to implement the mitigation action plan and the following mitigation action commitments have been completed to date:

- Preparation and implementation of a Trails Management Plan (LANL 2015h)
- Complete rehabilitation of cultural resources impacted by the Cerro Grande fire
- Preparation and implementation of the Wildland Fire Management Plan (LANL 2016b)

- Preparation of the LANL Forest Management Plan (LANL 2014a)
- Installation of one gas-fired combustion turbine generator to support peak demand and upgrade existing steam turbines
- Metering of major energy user facilities with high-end “Square-D” meters (as required), and sub-metering, when necessary, of all other facilities to quantify and evaluate electrical consumption
- Implementation of Energy Savings Performance Contract third-party financed retrofit projects to improve building efficiencies
- Enhancement of new building efficiencies by integrating Leadership in Energy and Environmental Design/High Performance Sustainable Building design for new construction in the engineering standards for LANL
- Purchase of additional renewable energy and/or renewable energy credits
- Expansion of the Sanitary Effluent Reclamation Facility to increase the amount of recycled water usage and reduce water consumption at LANL
- Establishment of an institutional clean fill yard to facilitate reuse of fill on-site at TA-60
- Development of a Decision Support Application to provide a user-friendly tool for integrated project planning
- Implementation of compliance assurance process on a sample of LANL projects

Each year, a mitigation action plan annual report is published to track the status of the mitigations (DOE 2012b, 2014d, 2015e, 2011j, 2009c, 2010d, 2013c, 2016g, 2017d). The SWEIS mitigation action plan will continue to be implemented and revised as necessary to integrate new records of decision issued by DOE/NNSA for the 2008 SWEIS.

#### **4.4 Conclusion**

Reasonably foreseeable future operations and projects at LANL discussed in this supplement analysis to be implemented from 2018 through 2022 have not substantially changed from those projected in the 2008 SWEIS analysis. For this reason, additional supplementation of the 2008 SWEIS or a new SWEIS is not required at this time, and the 2008 SWEIS provides a bounding NEPA analysis for a majority of projects planned in the next 5 years. Projects that do not fall into this category will be subject to additional NEPA analyses. The cumulative impacts of proposed projects described in this supplement analysis to be implemented from 2018 through 2022 are determined to be within the bounds of the 2008 SWEIS cumulative impacts analysis; therefore, no supplementation for cumulative impacts is necessary.



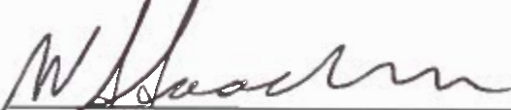
## 5.0 CONCLUSIONS AND DETERMINATION

This supplement analysis has considered changes in programs, projects, and operations since the 2008 SWEIS (2008 through 2017), new and modified plans, projects, and operations for the future (2018 through 2022), and new information that was not available when the 2008 SWEIS was prepared. This supplement analysis compared the projected environmental impacts of ongoing operations and new and modified projects, and modifications in site operations for the 2018 through 2022 period with the environmental impacts analyzed in the 2008 SWEIS for land resources and visual environment, geology and soils, water resources, air quality, noise, ecological resources, human health and worker health/safety, cultural resources, socioeconomics, infrastructure, waste management, traffic and transportation, environmental justice, environmental remediation, facility accidents, climate trends and greenhouse gases, forest health and wildland fire preparedness, and mitigations. This supplement analysis considered any new circumstances or information relevant to environmental concerns.

For most environmental resources, the projected environmental impacts for ongoing operations and new and modified projects, and modifications in site operations for the 2018 through 2022 period remain consistent with the impacts analyzed in the 2008 SWEIS. For the few instances where the 2018 through 2022 projections differ from the 2008 SWEIS analysis, the changes in environmental impacts are not substantial or may require a separate NEPA analysis.

Based on the results of this supplement analysis, and the recommendation of the DOE/NNSA Los Alamos Field Office Counsel and NEPA Compliance Officer, DOE has determined that the ongoing operations and new and modified projects and modifications in site operations at LANL do not constitute a substantial change in the actions previously analyzed in the 2008 SWEIS, and there are no significant new circumstances or information relevant to environmental concerns. Therefore, as Head of Field Organization (DOE Order 451.1B) and pursuant to DOE's Implementing Procedures (10 CFR 1021.314(c)), I have determined that no further NEPA documentation is required.

Approved in Los Alamos, New Mexico, on this 17 day of April, 2018.



Steve Goodrum  
Manager, DOE/NNSA Los Alamos Field Office

4-17-18

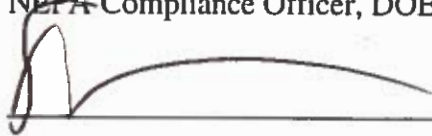
Date



Jane Summerson  
NEPA Compliance Officer, DOE/NNSA Los Alamos Field Office

3/7/18

Date



Silas DeRoma  
Legal Counsel, DOE/NNSA Los Alamos Field Office

3A/18

Date

## REFERENCES

- AEC 1972. "Environmental Statement Plutonium Facility Los Alamos Scientific Laboratory New Mexico," Atomic Energy Commission, WASH-1506, January 1972.
- AIHA 2016. "Emergency Response Planning Guidelines," American Industrial Hygiene Association, Handbook, 2016.
- Allen, C.D. 1989. "Changes in the landscape of the Jemez Mountains, New Mexico," University of California Berkley, 1989.
- Allen, C.D. 2007. "Interactions Across Spatial Scales among Forest Dieback, Fire, and Erosion in Northern New Mexico Landscapes." *Ecosystems* 10:797-808.
- ANSI 1999. "Sampling and Monitoring Releases of Airborne Radioactive Substances From the Stacks and Ducts of Nuclear Facilities," American National Standards Institute/Health Physics Society, ANSI/HPS N13.1-1999, Incorporated by reference into 40 CFR 61 Subpart H, the Radionuclide NESHAP, January 1999.
- BDDP 2010a. "Executive Summary of Results for the Buckman Direct Diversion Project Independent Peer Review," Buckman Direct Diversion Project, December 2010.
- BDDP 2010b. "Memorandum of Understanding Between the U.S. Department of Energy and the Buckman Direct Diversion Board Regarding Water Quality Monitoring, Santa Fe, New Mexico," Buckman Direct Diversion Project and Department of Energy, May 2010.
- BDDP 2013. "Updates: Drink up Santa Fe," [Website], Buckman Direct Diversion Project. Accessed November 2017, <http://bddproject.org>.
- BLM and USFS 2006. "Final Environmental Impact Statement for the Buckman Water Diversion Project," Bureau of Land Management and U.S. Forest Service, September 2006.
- Bruggeman, D., and J. Dewart 2013. "Meteorology Assessment of Historic Rainfall for Los Alamos During September 2013," Los Alamos National Laboratory, LA-UR-20869, February 2016.
- CDC 2010. "CDC's Los Alamos Historical Document Retrieval & Assessment, Final Report of the Los Alamos Historical Document Retrieval and Assessment (LAHDRA) Project," Centers for Disease Control and Prevention, National Center for Environmental Health, Division of Environmental Hazards and Health Effects, Radiation Studies Branch, November 2010.

City of Santa Fe 2008. "Long-Range Water Supply Plan," City of Santa Fe and Camp Dresser & McKee Inc., September 2008.

Del Signore, C. 2017. "RE: CYs 2015 and 2016 SWEIS Yearbook Data Request - 2.12 RLWTF and A-23," Email communication from Del Signore, C. (LANL) to Wright, M. (LANL), Los Alamos, New Mexico, March 20, 2017.

DOE 1994. "U.S. Department of Energy Radiological Control Manual," Department of Energy, DOE/EH-0256T, April 1994.

DOE 1995. "Dual Axis Radiographic Hydrodynamic Test Facility Final Environmental Impact Statement," Department of Energy, DOE/EA-0228, August 1995.

DOE 1996a. "Record of Decision Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," Department of Energy, DOE/EIS-0236, 61 FR 68014, December 1996.

DOE 1996b. "Dual Axis Radiographic Hydrodynamic Test Facility Final Environmental Impact Statement Mitigation Action Plan," DOE/EIS-0228, 1996.

DOE 1997a. "Environmental Assessment for the Lease of Land for the Development of a Research Park at Los Alamos National Laboratory," Department of Energy, DOE/EA-1212, October 7, 1997.

DOE 1997b. "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports," Department of Energy, DOE STD 1027-92, September 1997.

DOE 1997c. "Environmental Assessment for the Proposed CMR Building Upgrades at the Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/EA-1101, February 4, 1997.

DOE. 1997d. *Linking Legacies: Connecting the Cold War Nuclear Weapons Production Processes to Their Environmental Consequences*, Washington, D.C.: Department of Energy: Office of Environmental Management, F2002-00544.

DOE 1999a. "Record of Decision: Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory in the State of New Mexico," Department of Energy, DOE/EIS-0238, 64 FR 50797, September 20, 1999.

DOE 1999b. "Site-Wide Environmental Impact Statement for the Continued Operation of the Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/EIS-0238, January 1999.

- DOE 1999c. "Categorical Exclusion for the Nuclear Materials Safeguards and Security Upgrades Project (NMSSUP) – PIDAS, Alarms, and Access," Department of Energy, LAN-99-026, April 30, 1999.
- DOE 1999d. "Final Environmental Impact Statement for the Conveyance and Transfer of Certain Land Tracts Administered by the U.S. Department of Energy and Located at Los Alamos National Laboratory, Los Alamos and Santa Fe Counties, New Mexico," Department of Energy, DOE/EIS-0293, October 1999.
- DOE 2000a. "Environmental Assessment for the Wildfire Hazard Reduction and Forest Health Improvement Program at Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/EA-1329, August 2000.
- DOE 2000b. "Special Environmental Analysis for the Department of Energy, National Nuclear Security Administration, Actions Taken in Response to the Cerro Grande Fire at Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/SEA-03, September 2000.
- DOE 2000c. "Record of Decision: Conveyance and Transfer of Certain Land Tracts Administered by the Department of Energy and Located at Los Alamos National Laboratory, Los Alamos and Santa Fe Counties, New Mexico," Department of Energy, DOE/EIS-0293, 65 FR 14952, March 2000.
- DOE 2003a. "Final Environmental Impact Statement for the Chemistry and Metallurgy Research Building Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/EIS-0350, November 2003.
- DOE 2003b. "Supplement Analysis for the 1999 Site-Wide Environmental Impact Statement for Continued Operation of LANL for the Proposed Disposition of Certain Large Containment Vessels," Department of Energy, DOE/EIS-0238-SA-03, February 12, 2004.
- DOE 2004. "Record of Decision: Final Environmental Impact Statement for the Chemistry and Metallurgy Research Building Replacement Project, Los Alamos National Laboratory, Los Alamos, NM," Department of Energy, DOE/EIS-0350, 69 FR 6967, February 2004.
- DOE 2005a. "Environmental Assessment for the Transportation of Unirradiated Uranium in Research Reactor Fuel from Argentina, Belgium, Japan, and the Republic of Korea to the Y-12 National Security Complex," Department of Energy, DOE/EA-1529, June 2005.
- DOE 2005b. "Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems," Department of Energy, DOE/EIS-0373D, June 2005.

- DOE 2005c. "Amended Record of Decision: Conveyance and Transfer of Certain Land Tracts Administered by the Department of Energy and Located at Los Alamos National Laboratory, Los Alamos and Santa Fe Counties, New Mexico," Department of Energy, DOE/EIS-0293, 70 FR 48378, August 2005.
- DOE 2006. "Programmatic Agreement Between the U.S. Department of Energy, National Nuclear Security Administration, Los Alamos Site Office, the New Mexico State Historic Preservation Office, and the Advisory Council for Historic Preservation Concerning Management of the Historic Properties of Los Alamos National Laboratory, New Mexico," Department of Energy, June 2006.
- DOE 2008a. "Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/EIS-0380, May 2008.
- DOE 2008b. "Record of Decision: Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/EIS-0380, 73 FR 55833, September 26, 2008.
- DOE 2008c. "Complex Transformation Supplemental Programmatic Environmental Impact Statement," Department of Energy, DOE/EIS-0236-S4, October 2008.
- DOE 2008d. "Record of Decision for the Complex Transformation Supplement Programmatic Environmental Impact Statement-Operations Involving Plutonium, Uranium, and the Assembly and Disassembly of Nuclear Weapons," Department of Energy, DOE/EIS-0236, 76 FR 245, December 19, 2008.
- DOE 2008e. "Mitigation Action Plan for the Site-Wide Environmental Impact Statement for the Continued Operation of Los Alamos National Laboratory," Department of Energy, DOE/EIS-0380-MAP, December 2008.
- DOE 2009a. "Record of Decision: Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/EIS-0380, 74 FR 33232, July 10, 2009.
- DOE 2009b. "Supplement Analysis: Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory; Proposed Transport of Low Level Radioactive Waste by Truck and Rail from Los Alamos National Laboratory (LANL) for Disposal at EnergySolutions at Clive, Utah," Department of Energy, DOE/EIS-0380-SA-01, October, 2009.
- DOE 2009c. "Fiscal Year 2009 Mitigation Action Plan Annual Report for the 2008 Los Alamos National Laboratory Site-Wide Environmental Impact Statement," Department of Energy, ENV-RRO -0-077, DOE/EIS-0380 MAPAR, October 2009.

- DOE 2010a. "Final Environmental Assessment for the Expansion of the Sanitary Effluent Reclamation Facility and Environmental Restoration of Reach S-2 of Sandia Canyon at Los Alamos National Laboratory Los Alamos, New Mexico," Department of Energy, DOE/EA-1736, August 24, 2010.
- DOE 2010b. "Finding of No Significant Impact for the Proposed Expansion of the Sanitary Effluent Reclamation Facility and Environmental Restoration of Reach S-2 of Sandia Canyon at Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/EA-1736 E9 16343, July 10, 2009.
- DOE 2010c. "Strategic Sustainability Performance Plan – Discovering Sustainable Solutions to Power and Secure America's Future," Department of Energy, September 2010.
- DOE 2010d. "Fiscal Year 2010 Mitigation Action Plan Annual Report for the 2008 Los Alamos National Laboratory Site-Wide Environmental Impact Statement," Department of Energy, LA-UR-10-07245, DOE/EIS-0380 MAPAR, October 2010.
- DOE 2011a. "Amended Record of Decision: Site-Wide Environmental Impact Statement for the Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/EIS-0380, 76 FR 131, July 8, 2011.
- DOE 2011b. "National Environmental Policy Act Implementing Procedures; Proposed Rule," Department of Energy, DOE-HQ-2010-0002, January 3, 2011.
- DOE 2011c. "Technical Support Document for the National Environmental Policy Act Implementing Procedures Final Rule," Department of Energy, September 27, 2011.
- DOE 2011d. "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," Department of Energy, DOE/EIS-0350-S1, August 2011.
- DOE 2011e. "Supplement Analysis: Transport and Storage of High-Activity Sealed Sources from Uruguay and Other Locations," Department of Energy, DOE/EIS-0380-SA-02, April 2011.
- DOE 2011f. "Amended Record of Decision for the Nuclear Facility Portion of the Chemistry and Metallurgy Research Building Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/EIS-0350, 69 FR 6967 October 11, 2011.
- DOE 2011g. "Guidance on using Release Fraction and Modern Dosimetric Information consistently with DOE STD 1027-92, Hazard Categorization and Accident Analysis

Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis, Change Notice No. 1," Department of Energy, NA-1 SD G 1027, November 28, 2011.

DOE 2011h. "DOE Standard Derived Concentration Technical Standard," Department of Energy, DOE-STD-1196-2011, April 2011.

DOE 2011i. "Mitigation Action Plan for the Nuclear Facility Portion of the Chemistry and Metallurgy Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/EIS-0350-S1, November 1, 2011.

DOE 2011j. "Section 1021.331: Mitigation Action Plans," Department of Energy, 10 CFR 1021.331, October 2011.

DOE 2012a. "Amended Record of Decision for the Conveyance and Transfer of Certain Land Tracts Administered by the Department of Energy and Located at Los Alamos National Laboratory, Los Alamos and Santa Fe Counties, New Mexico," Department of Energy, DOE/EIS-0293, 77 FR 3257, January 2012.

DOE 2012b. "Fiscal Year 2011 Site-Wide Environmental Impact Statement Mitigation Action Plan Annual Report for the 2008 Los Alamos Site-Wide Environmental Impact Statement," Department of Energy, LA-UR-11-06159, DOE/EIS-0380 MAPAR April 2012.

DOE 2013a. "Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada," Department of Energy, DOE/EIS-0426, February, 2013.

DOE 2013b. "Endangered and Threatened Wildlife and Plants; Determination of Endangered Species Status for Jemez Mountains Salamander (*Plethodon neomexicanus*) Throughout Its Range," Department of Energy, 78 FR 55599, September 2013.

DOE 2013c. "Fiscal Year 2012 Mitigation Action Plan Annual Report for the 2008 Los Alamos National Laboratory Site-Wide Environmental Impact Statement," Department of Energy, LA-UR-12-26410, DOE/EIS-0380 MAPAR March 2013.

DOE 2014a. "Final Supplement Analysis Environmental Assessment for the Lease of Land for the Development of a Research Park at Los Alamos National Laboratory," Department of Energy, DOE/EA 1212-SA-01, October 2014.

DOE 2014b. "Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (*Coccyzus americanus*)," Department of Energy, 79 FR 59991, October 2014.



DOE 2014c. "Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the New Mexico Meadow Jumping Mouse Throughout Its Range," Department of Energy, 79 FR 33119, June 2014.

DOE 2014d. "Fiscal Year 2013 Mitigation Action Plan Annual Report for the 2008 Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory " Department of Energy, LA-UR-13-28416, DOE/EIS-0380 MAPAR, January 2014.

DOE 2014e. "Categorical Exclusion Determination Form: Well Pump Test Phase II in Sandia and Mortandad Canyons," Department of Energy, CX-012198, May 9, 2014.

DOE 2014f. "Draft Biosafety Level 3 Facility Environmental Impact Statement," Department of Energy, DOE/EIS-0388D,

DOE 2015a. "Final Surplus Plutonium Disposition Supplemental Environmental Impact Statement," Department of Energy, DOE/EIS-0283-S2, April 2015.

DOE 2015b. "Final Environmental Assessment for Chromium Plume Control Interim Measure and Plume-Center Characterization, Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/EA-2005, December 2015.

DOE 2015c. "Supplemental Analysis Chemistry and Metallurgy Research Building Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico, Supplement Analysis," Department of Energy, DOE/EIS 0350-SA-2, January 2015.

DOE 2015d. "FY 2016 Congressional Budget Request," Department of Energy, DOE/CF-0107, February 2015.

DOE 2015e. "Fiscal Year 2014 Mitigation Action Plan Annual Report for the 2008 Los Alamos National Laboratory Site-Wide Environmental Impact Statement," Department of Energy, LA-UR-14-28384, DOE/EIS-0380 MAPAR, January 2015.

DOE 2015f. "Mitigation Action Plan for Chromium Plume Control Interim Measure and Plume-Center Characterization, Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/EA-2005, December 2015.

DOE 2016a. "Fiscal Year 2017 Stockpile Stewardship and Management Plan, a Report to Congress," Department of Energy, DOE/NA-0041, March 2016.

DOE 2016b. "FY 2017 Congressional Budget Request," Department of Energy, DOE/CF-0119, February 2016.

DOE 2016c. "Supplement Analysis for a Proposal to Implement Safe Handling and Storage and to Conduct Processing Studies of 60 Transuranic Remediated Nitrate Salts Drums," Department of Energy, DOE/EIS-0380-SA-03, May 2016.

DOE 2016d. "Supplement Analysis for Treatment, Repackaging, and Storage of Nitrate Salt Waste Drums At Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/EIS-380-SA-04, December 2016.

DOE 2016e. "DOE Standard: Natural Phenomena Hazards Analysis and Design Criteria for Department of Energy Facilities," Department of Energy, DOE-STD-1020-2016, December 2016.

DOE 2016f. "DOE Handbook Temporary Emergency Exposure Limits For Chemicals: Methods and Practice," Department of Energy, DOE-HDBK-1046-2016, December 2016.

DOE 2016g. "Fiscal Year 2015 Mitigation Action Plan Annual Report for the 2008 Los Alamos National Laboratory Site-Wide Environmental Impact Statement," Department of Energy, LA-UR-15-28336, DOE/EIS-0380 MAPAR, May 2016.

DOE 2017a. "Supplement Analysis to the Environmental Assessment for Chromium Plume Control Interim Measure and Plume-Center Characterization," Department of Energy, DOE/EA-2005-SA-001, August 2017.

DOE 2017b. "Draft Environmental Assessment of Proposed Changes for Analytical Chemistry and Materials Characterization at the Radiological Laboratory/Utility/Office Building, Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, DOE/EA-2052, August 2017.

DOE 2017c. "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 Historic Preservation Concerning Management of the Historic Properties at Los Alamos National Laboratory, Los Alamos, New Mexico," Department of Energy, August 2017.

DOE 2017d. "Fiscal Year 2016 Mitigation Action Plan Annual Report for the 2008 Los Alamos National Laboratory Site-Wide Environmental Impact Statement," Department of Energy, LA-UR-16-28265, DOE/EIS-0380 MAPAR, February 2017.

DOI 2010a. "Special Resource Study/Environmental Assessment for Manhattan Project Sites," Department of the Interior, DOE/EA-1868, September 2010.

- DOI 2010b. "Adoption of Environmental Assessment and Finding of No Significant Impact; Determination of No Significant Impact: Manhattan Project Sites," Department of the Interior, National Park Service, DOE/EA-1868, February 2011.
- DOI 2010c. "Finding Of No Significant Impact Manhattan Project Sites: Los Alamos, New Mexico / Hanford, Washington / Oak Ridge, Tennessee / Dayton, Ohio. Special Resource Study / Environmental Assessment," Department of the Interior, DOE/EA-1868, September 2010.
- DOI 2014. "Tsankawi Unit Management Plan and Environmental Assessment," U.S. Department of the Interior, National Park Service, October 2014.
- DOI 2017. "Reclamation Managing Water in the West, Pojoaque Basin Regional Water System Draft Environmental Impact Statement," Department of the Interior, Bureau of Reclamation, January 2017.
- DNFSB 2009. "Letter to the Honorable Steven Chu, Secretary of Energy from John E. Mansfield, Ph.D., Vice Chairman," Defense Nuclear Facilities Safety Board, October 29, 2009.
- DNFSB 2017. "Letter to the Honorable Ernest J. Moniz, Secretary of Energy from Joyce L. Connery, Chairman," Defense Nuclear Facilities Safety Board, January 3, 2017.
- EPA 1999. "Consideration of Cumulative Impacts in EPA Review of NEPA Documents," U.S. Environmental Protection Agency, EPA 315-R-99-002, May 1999.
- EPA 2014. "Authorization to Discharge Under the National Pollutant Discharge Elimination System, NPDES Permit Number NM0028355," U.S. Environmental Protection Agency Region 6, NM0028355, October 1, 2014.
- EPA 2017. "Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990–2015," Environmental Protection Agency, EPA-430-P-17-001, April 2017.
- Erickson, A. 2017. "RE: SWEIS Yearbook: Utilities Info for CY 2015 and CY 2016 " Email communication from Erickson, A. (LANL) to Musgrave, K. (LANL), Los Alamos, New Mexico, June 20, 2017.
- Erickson, D. 2013. "LA Canyon Dam and Reservoir," Email communication from Erickson, D. (Public Works Department, Los Alamos County) to Roles, G. (Leidos) Germantown, Maryland, October 11, 2013.

- Fuehne, D.P. 2014. "Evaluation of DOE Technical Standard 1027 and Supplemental Guidance NA-1 SD G 1027. Examining Radionuclide NESHAP Impacts and Off-Site Dose Consequences," LA-UR-13-28472, January 2014.
- Gallegos, R.M. 2017. "Draft Side Wide Environmental Impact Statement Supplement Analysis – Five Year Review," Email communication from Gallegos, R.M. (LANL) to Sartor, K. (LANL), Los Alamos, New Mexico, August 17, 2017.
- Garfin, G., A. Jardine, R. Merideth, M. Black, and S. LeRoy. 2013. *Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment*, Washington, DC: Island Press, [A report by the Southwest Climate Alliance].
- Garfin, G., G. Franco, H. Blanco, A. Comrie, P. Gonzalez, T. Piechota, R. Smyth, and R. Waskom 2014. "Southwest: The Third National Climate Assessment in: Climate change impacts in the United States," U.S. Global Change Research Program, 2014.
- Hastings, B.K., F.M. Smith, and B.F. Jacobs. 2003. "Rapidly eroding pinon-juniper woodlands in New Mexico: Response to slash treatment." *Journal of Environmental Quality* 32 (4):1290-1298.
- Hathcock, C. 2014. "Threatened and Endangered Species Habitat Management Plan Area of Environmental Interest Site Plan for the Jemez Mountains Salamander," LA-UR-13-25061, February 19, 2014.
- Hathcock, C.D., D.C. Keller, B. Thompson, and M.A. Wright 2015. "Status of Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory," LA-UR-15-29002, 2015.
- Hoddeson, L., P.W. Henriksen, R.A. Meade, G. Baym, and C.L. Westfall. 2004. *Critical Assembly: A Technical History of Los Alamos During the Oppenheimer Years, 1943-1945*, Cambridge University Press, 9780521541176.
- Hoover, P. 2017. "RE: SWEIS Yearbook CY2015 and 2016 Data Request for Ionizing Radiation and Worker Exposures," Email communication sent to Musgrave, K. (LANL) from Hoover, P. (LANL), Los Alamos, New Mexico, April 7, 2017.
- ICRP 1995. "Age-dependent Doses to Members of the Public from Intake of Radionuclides," International Commission on Radiological Protection, 1995.
- IPCC. 2014a. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, V.R. Barros, C.B. Field, D.J. Dokken,

- M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. Kelley, R. 2017. "re: SWEIS SA Geology Update," Email communication from Kelley, R. (LANL) to Reddick, R. (LANL), Los Alamos, New Mexico, August 1, 2017.
- IPCC. 2014b. *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, T.F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley, Cambridge, United Kingdom and New York, New York, USA: Intergovernmental Panel on Climate Change, ISBN 978-1107661820.
- IPCC. 2015. *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, R.K. Pachauri and L.A. Myers, Geneva, Switzerland: Intergovernmental Panel on Climate Change, ISBN 9789291691432.
- ISCORS 2002. "A Method for Estimating Radiation Risk from Total Effective Dose Equivalent (TEDE)," Interagency Steering Committee on Radiation Standards, 2002-02, Final Report, 2002.
- Johnson, S. 2017. "Request for number of shipments," Email communication sent to Holtkamp, D.M. (LANL) from Johnson, S. (LANL), Los Alamos, New Mexico, August 1, 2017.
- Kelley, R. 2017. "re: SWEIS SA Geology Update," Email communication from Kelley, R. (LANL) to Reddick, R. (LANL), Los Alamos, New Mexico, August 1, 2017.
- LADPU 2011. "Los Alamos Reservoir Work Suspended," [Website]. Los Alamos Department of Public Utilities. Accessed September 13, 2017, <http://www.losalamosnm.us/news/Pages/LosAlamosReservoirWorkSuspended.aspx>.
- LANL 2001. "Site and Architectural Design Principles," Los Alamos National Laboratory, LA-UR-01-5383, September 2001.
- LANL 2006a. "Biological Assessment of the Continued Operation of Los Alamos National Laboratory on Federally Listed Threatened and Endangered Species," Los Alamos National Laboratory, LA-CP-06-0188, October 21, 2013.
- LANL 2006b. "A Plan for the Management of the Cultural Heritage at Los Alamos National Laboratory, New Mexico," Los Alamos National Laboratory, LA-UR-04-8964, March 2006.
- LANL 2007a. "Biological Resources Management Plan for Los Alamos National Laboratory," Los Alamos National Laboratory, LA-UR-07-2595, April 2007.

LANL 2007b. "1663 Los Alamos Science and Technology Magazine," LANL, August 2007.

LANL 2008. "Historic Preservation Assessment and Recommendation Report for the Gun Site Restoration Project," Los Alamos National Laboratory, LA-UR-08-05177, August 2008.

LANL 2009a. "Floodplain Assessment of the Proposed Grade Control Structure in Pueblo Canyon, TA-74, Los Alamos National Laboratory," Los Alamos National Laboratory, LA-UR-09-05780, 2009.

LANL 2009b. "Floodplain Assessment of the Proposed Grade Control Structure in DP Canyon, TA-21, Los Alamos National Laboratory," Los Alamos National Laboratory, LA-UR-09-06010, 2009.

LANL 2009c. "2008 LANL Radionuclide Air Emissions Report," Los Alamos National Laboratory, LA-14403, May 19, 2009.

LANL 2010a. "2009 LANL Radionuclide Air Emissions Report," Los Alamos National Laboratory, LA-14423, June 9, 2010.

LANL 2010b. "Fiscal Year 2011 Site Sustainability Plan," Los Alamos National Laboratory, LA-UR-11-01856, December 2010.

LANL 2011a. "SWEIS Yearbook 2009," Los Alamos National Laboratory, LA-UR-11-02392, May 2011.

LANL 2011b. "2010 LANL Radionuclide Air Emissions Report," Los Alamos National Laboratory, LA- 14441, June 22, 2011.

LANL 2011c. "Migratory Bird Best Management Practices Source Document for Los Alamos National Laboratory," Los Alamos National Laboratory, LA-UR-11-06629, revised November 16, 2011.

LANL 2011d. "Fiscal Year 2012 Site Sustainability Plan," Los Alamos National Laboratory, LA-UR-12-01337, December 2011.

LANL 2011e. "Basis for Interim Operation for the Waste Characterization, Size-Reduction and Repackaging Facility, Los Alamos National Laboratory, Los Alamos, New Mexico," Los Alamos National Laboratory, ABD-WFM-005, Rev. 2.1, December 2011.

LANL 2011f. "National Security Science: Pit Perfect," Los Alamos National Laboratory, Issue No. 3, 2011.

- LANL 2012a. "SWEIS Yearbook 2010," Los Alamos National Laboratory, LA-UR-12-01648, April 2012.
- LANL 2012b. "Floodplain Assessment for the Proposed Engineered Erosion Controls at TA-72 in Lower Sandia Canyon, Los Alamos National Laboratory," Los Alamos National Laboratory, LA-UR-12-24060, June 2012.
- LANL 2012c. "2011 LANL Radionuclide Air Emissions Report," Los Alamos National Laboratory, LA-14458, June 6, 2012.
- LANL 2012d. "2011 LANL Radionuclide Air Emissions," Los Alamos National Laboratory, LA-14458, July 2012.
- LANL 2012e. "Fiscal Year 2013 Site Sustainability Plan," Los Alamos National Laboratory, LA-UR-12-26715, December 2012.
- LANL 2012f. "Basis for Interim Operation for the Radioassay and Non-Destructive Testing Facility, Los Alamos National Laboratory," Los Alamos National Laboratory, ABD-WFM-007, Rev. 1.2, March 2012.
- LANL 2013a. "SWEIS Yearbook 2012," Los Alamos National Laboratory, LA-UR-13-29469, December 2013.
- LANL 2013b. "SWEIS Yearbook 2011," Los Alamos National Laboratory, LA-UR-13-20455, January 2013.
- LANL 2013c. "2012 LANL Radionuclide Air Emissions Report," Los Alamos National Laboratory, LA-14469, August 1, 2013.
- LANL 2013d. "Los Alamos National Laboratory 2012 Annual Site Environmental Report," Los Alamos National Laboratory, LA-UR-13-27065, September 13, 2013.
- LANL 2013e. "Fiscal Year 2014 Site Sustainability Plan," Los Alamos National Laboratory, LA-UR-13-29595, December 2013.
- LANL 2014a. "Los Alamos National Laboratory Forest Management Plan," Los Alamos National Laboratory, LA-UR-14-27513, October 2014.
- LANL 2014b. "Threatened and Endangered Species Habitat Management Plan for Los Alamos National Laboratory," Los Alamos National Laboratory, LA-UR-14-21863, March 25, 2011.

- LANL 2014c. "2013 LANL Radionuclide Air Emissions Report," Los Alamos National Laboratory, LA-UR-14-24430, June 17, 2014.
- LANL 2014d. "Nuclear Criticality Safety Program Upgrades Project Management Plan," Los Alamos National Laboratory, NCS-Plan-14-001, June 30, 2014.
- LANL 2014e. "Fiscal Year 2015 Site Sustainability Plan," Los Alamos National Laboratory, LA-UR-15-21896, December 2014.
- LANL 2014f. "Long-Term Strategy for Environmental Stewardship and Sustainability 2014 Almanac," Los Alamos National Laboratory, LA-UR-14-28025, December 2014.
- LANL 2015a. "Progress: Nuclear Materials Safeguards and Security Upgrades Project," Los Alamos National Laboratory, LA-UR-15-27605, September 30, 2015.
- LANL 2015b. "Threatened and Endangered Species Habitat Management Plan for Los Alamos National Laboratory," Los Alamos National Laboratory, LA-UR-15-28610, October 2015.
- LANL 2015c. "SWEIS Yearbook 2013," Los Alamos National Laboratory, LA-UR-15-22755, April 2015.
- LANL 2015d. "Los Alamos National Laboratory 2014 Annual Site Environmental Report," Los Alamos National Laboratory, LA UR-15-27513, September 2015.
- LANL 2015e. "2014 LANL Radionuclide Air Emissions Report," Los Alamos National Laboratory, LA-UR-15-24260, July 21, 2015.
- LANL 2015f. "Sensitive Species Best Management Practices Source Document," Los Alamos National Laboratory, LA-UR-15-20981, May 27, 2015.
- LANL 2015g. "Fiscal Year 2016 Site Sustainability Plan," Los Alamos National Laboratory, LA-UR-15-29667, December 22, 2015.
- LANL 2015h. "Trails Management Plan," Los Alamos National Laboratory, LA-UR-15-20807, November 2015.
- LANL 2016a. "Fire Stations Number 1 and 5 Capability Gaps Los Alamos National Laboratory Mission Need Statement," Los Alamos National Laboratory, REV 0, October 11, 2016.
- LANL 2016b. "LANL Five-Year Wildland Fire Management Plan (2016–2020)," Los Alamos National Laboratory, LA-UR-16-20979, February 18, 2016.



- LANL 2016c. "Pesticide Discharge Management Plan," Los Alamos National Laboratory, LA-UR-16-27150, August 22, 2016.
- LANL 2016d. "SWEIS Yearbook 2014," Los Alamos National Laboratory, LA-UR-16-24711, September 16, 2016.
- LANL 2016e. "2015 LANL Radionuclide Air Emissions Report," Los Alamos National Laboratory, LA-UR-16-23902, June 16, 2016.
- LANL 2016f. "Transmittal of Class 1 Permit Modification Request for the Addition of Treatment in Containers by Stabilization-Los Alamos National Laboratory Hazardous Waste Facility Permit, NM0890010515," Los Alamos National Laboratory, LA-UR-16-23178, July 2016.
- LANL 2016g. "TA-55 Documented Safety Analysis, Los Alamos National Laboratory," Los Alamos National Laboratory, TA-55-DSA-2015-R 1, January 2016.
- LANL 2016h. "Basis for Interim Operation for Technical Area 54, Area G, Los Alamos National Laboratory," Los Alamos National Laboratory, ABD-WFM-001, Rev 3.4, August 2016.
- LANL 2016i. "PISAs Related to TRU Waste Inventory Discrepancies, Rev 1.0., Los Alamos National Laboratory," Los Alamos National Laboratory, AGREAG-ESS-15-002-R1, June 2016.
- LANL 2016j. "Transuranic Waste Facility Documented Safety Analysis, Los Alamos National Laboratory," Los Alamos National Laboratory, DSA-TWF-001, R.S., November 2016.
- LANL 2016k. "Chemical and Metallurgy Research Facility Documented Safety Analysis, Los Alamos National Laboratory," Los Alamos National Laboratory, CMR-DSA-001-R6, July 2016.
- LANL 2017a. "Supplemental Investigation Work Plan for Technical Area 57 Aggregate Area (Fenton Hill)," Los Alamos National Laboratory, LA-UR-17-24144, June 2017.
- LANL 2017b. "Los Alamos Climatology 2016 Update," Los Alamos National Laboratory, LA-UR-17-21060, February 2017.
- LANL 2017c. "Fiscal Year 2017 Site Sustainability Plan " Los Alamos National Laboratory, LA-UR-17-20420 Rev. 1, April 11, 2017.
- LANL 2017d. "Work Plan #4 Discharge Report, Land Application of Treated Groundwater from Technical Areas 9 and 16, DP-1793," Los Alamos National Laboratory, LA-UR-17-20288, February 2017.

- LANL 2017e. "2016 Emissions Inventory Report," Los Alamos National Laboratory LA-UR-17-22005, March 2017.
- LANL 2017f. "LANL Safety Update," Los Alamos National Laboratory. Accessed August 16, 2017, [http://int.lanl.gov/safety/\\_assets/docs/safety-update-letter-size-format.pdf](http://int.lanl.gov/safety/_assets/docs/safety-update-letter-size-format.pdf)
- LANL 2017g. "A Plan for the Management of the Cultural Heritage at Los Alamos National Laboratory, New Mexico," Los Alamos National Laboratory, LA-UR-15-27624, March 2017.
- LANL 2017h. "Facts, Figures for 2016," [Website], Los Alamos National Laboratory. Accessed July 23, 2017, <http://www.lanl.gov/about/facts-figures/index.php>
- LANL 2017i. "Los Alamos National Laboratory Power Master Plan," Los Alamos National Laboratory, UI-PLAN-031-R3, June 30, 2017.
- LANL 2017j. "2017 Update to the Enduring Mission Waste Management Plan at Los Alamos National Laboratory," Los Alamos National Laboratory, LA-CP-17-20037, February 2017.
- LANL 2017k. "Emergency Action Levels," [Website ], Los Alamos National Laboratory. Accessed August 20, 2017, [http://int.lanl.gov/security/safeguards/emergency-planning-analysis/emergency\\_action\\_levels.shtml](http://int.lanl.gov/security/safeguards/emergency-planning-analysis/emergency_action_levels.shtml).
- LANL-LAC 2008. "Renewable Energy Feasibility Study," Los Alamos National Laboratory and Los Alamos County, LA-UR-08-07230, November 2008.
- LANL 2018. "SWEIS Yearbook 2015-2016," Los Alamos National Laboratory, LA-UR-18-20988, February, 2018.
- Liechty, D. 2017. "RE: Footprint Elimination cumulative totals," Email communication from Liechty, D. (LANL) to Musgrave, K. (LANL), Los Alamos, New Mexico, June 29, 2017.
- McDowell, N.G., A.P. Williams, C. Xu, W.T. Pockman, L.T. Dickman, S. Sevanto, R. Pangle, J. Limousin, J. Plaut, D.S. Mackay, J. Ogee, J.C. Domec, C.D. Allen, R.A. Fisher, X. Jiang, J.D. Muss, D.D. Breshears, S.A. Rauscher, and C. Koven. 2016. "Multi-scale predictions of massive conifer mortality due to chronic temperature rise." *Nature Clim. Change* 6 (3):295-300.
- Melillo, J.M., T. Richmond, and T.C. Yohe 2014. "Climate Change Impacts in the United States: The Third National Climate Assessment, U.S. Global Change Research Program," U.S. Global Change Research Program, doi:10.7930/J0Z31WJ2, October 2014.

- NASA 2017. "What's in a Name? Global Warming vs. Climate Change," [Website]. National Aeronautics Space Agency. Accessed May 16, 2017, [https://www.nasa.gov/topics/earth/features/climate\\_by\\_any\\_other\\_name.html](https://www.nasa.gov/topics/earth/features/climate_by_any_other_name.html).
- NMED 2016a. "Settlement Agreement and Stipulated Final Order," New Mexico Environment Department, January 2016.
- NMED 2016b. "Compliance Order on Consent, U.S. Department of Energy, Los Alamos National Laboratory," New Mexico Environment Department, June 2016.
- NRC. 2008. *Acute Exposure Guideline Levels for Selected Airborne Chemicals: Volume 6*, Washington, DC: The Natural Resource Council, The National Academies Press.
- NREL 2015. "DOE Los Alamos National Laboratory – Photo Voltaic Feasibility Assessment NREL Final Report," National Renewable Energy Laboratory, LA-UR-16-22342, August 12, 2015.
- Reynolds, R.T., A.J. Sánchez Meador, J.A. Youtz, T. Nicolet, M.S. Matonis, P.L. Jackson, D.G. DeLorenzo, and A.D. Graves 2013. "Restoring Composition and Structure in Southwestern Frequent-Fire Forests: A science-based framework for improving ecosystem resiliency," USFS, RMRS-GTR-310, September 2013.
- Rodriguez, S.B. 2017a. "re: Data Help Needed," Email communication from Rodriguez, S.B. (LANL) to Reddick, R. (LANL), Los Alamos, New Mexico, August 14, 2017.
- Rodriguez, S.B. 2017b. "re: Climate Change Vulnerability Assessment and Adaptation Project Meeting," Email communication from Rodriguez, S.B. (LANL) to Reddick, R. (LANL), Los Alamos, NM, July 20, 2017.
- Seager, R., and G.A. Vecchi. 2010. "Greenhouse warming and the 21st century hydroclimate of southwestern North America." *Proceedings of the National Academy of Sciences* 107 (50):21277-21282 doi: 10.1073/pnas.0910856107.
- Tozer, J. 2017. "waste data for the calendar year 2016 SWEIS Yearbook " Email communication from Tozer, J. (LANL) to Wright, M. (LANL), Los Alamos, New Mexico, May 11, 2017.
- UNM 2011. "University of New Mexico Bureau of Business and Economic Research, Impact of Los Alamos National Laboratory on the Economies of Northern New Mexico and the State as a Whole," University of New Mexico, March 2011.

- URS 2007. "Final Report: Update on the Probabilistic Seismic Hazard Analysis and Development of Seismic Design Ground Motions at the Los Alamos National Laboratory," URS Corporation, LA-UR-07-3965, May 25, 2012.
- USDA 2010. "Santa Fe National Forest Plan," U.S. Department of Agriculture Forest Service Southwestern Region, Amended June, 2010.
- Vierra, B., and K.M. Schmidt 2008. "The Land Conveyance and Transfer Data Recovery Project: 7000 Years of Land Use on the Pajarito Plateau," Los Alamos National Laboratory, LA-UR-07-6205, June 2008.
- White, Cambridge, United Kingdom and New York, New York, USA: Intergovernmental Panel on Climate Change, ISBN 9781107683860.

This page intentionally left blank.

## APPENDIX A. CATEGORICAL EXCLUSION CROSSWALK

2008 SWEIS Appendix L Heading	Applicable 10 CFR 1021, Appendix B to Subpart D, DOE Categorical Exclusion Section Title	Applicable 10 CFR 1021, Appendix B to Subpart D, DOE Categorical Exclusions	LANL Umbrella Categorical Exclusion <sup>a</sup>
Routine Maintenance Activities	<ul style="list-style-type: none"> <li>• B1 Facility Operations</li> </ul>	<ul style="list-style-type: none"> <li>• B1.3 Routine Maintenance</li> <li>• B1.4 Air Conditioning Systems for Existing Equipment</li> <li>• B1.7 Electronic Equipment</li> <li>• B1.33 Stormwater Runoff Control</li> </ul>	Routine Maintenance at LANL (Accession #6066 <sup>b</sup> , LAN-96-010 <sup>c</sup> )
Safety, Environmental, and Equipment Improvements	<ul style="list-style-type: none"> <li>• B1 Facility Operations</li> <li>• B2 Safety and Health</li> </ul>	<ul style="list-style-type: none"> <li>• B1.35 Drop-off, Collection, and Transfer Facilities for Recyclable Materials</li> <li>• B2.1 Workplace Enhancements</li> <li>• B2.5 Facility Safety and Environmental Improvements</li> <li>• B2.3 Personnel Safety and Health Equipment</li> <li>• B2.2 Building and Equipment Instrumentation</li> </ul>	Safety and Environmental Improvements at LANL (Accession #6067, LAN-96-012) and Building and Equipment Instrumentation at Los Alamos National Laboratory (Accession #6068, LAN-96-014)
Support Structure Activities	<ul style="list-style-type: none"> <li>• B1 Facility Operations</li> <li>• B2 Safety and Health</li> </ul>	<ul style="list-style-type: none"> <li>• B1.13 Pathways, short access roads, and rail lines</li> <li>• B1.15 Support buildings</li> <li>• B1.22 Relocation of buildings</li> <li>• B1.23 Demolition and disposal of buildings</li> <li>• B1.27 Disconnection of utilities</li> <li>• B1.28 Placing a facility in an environmentally safe condition</li> <li>• B2.2 Building and equipment instrumentation</li> </ul>	Support Structures at LANL (Accession #6069, LAN-96-022), Relocation of Structures and Operations at LANL (Accession #6070, LAN-96-011), Workplace Habitability Improvements at LANL (Accession #6065, LAN-96-015), Building and Equipment Instrumentation at LANL (Accession #6068, LAN-96-014), and Decontamination and Decommissioning of Vacant Structures (Accession #6137, LAN-98-052)
General Shop Operations	<ul style="list-style-type: none"> <li>• B1 Facility Operations</li> </ul>	<ul style="list-style-type: none"> <li>• B1.15 Support Buildings</li> </ul>	Support Structures at LANL (Accession #6069, LAN-96-022)

2008 SWEIS Appendix L Heading	Applicable 10 CFR 1021, Appendix B to Subpart D, DOE Categorical Exclusion Section Title	Applicable 10 CFR 1021, Appendix B to Subpart D, DOE Categorical Exclusions	LANL Umbrella Categorical Exclusion <sup>a</sup>
Security and Protection Operations	<ul style="list-style-type: none"> <li>B1 Facility Operations</li> </ul>	<ul style="list-style-type: none"> <li>B1.2 Training Exercises and Simulations</li> <li>B1.15 Support Buildings</li> </ul>	TA-72 Shooting House/Concrete Pad (Accession #6795, LAN-97-112)
Radiation Detection and Monitoring Training	<ul style="list-style-type: none"> <li>B1 Facility Operations</li> </ul>	<ul style="list-style-type: none"> <li>B1.2 Training Exercises and Simulations</li> </ul>	Hazmat Response Team Facility (Accession #4108, LAN-93-008)
Wildfire Response	<ul style="list-style-type: none"> <li>B1 Facility Operations and Other NEPA Document</li> </ul>	<ul style="list-style-type: none"> <li>B1.2 Training Exercises and Other NEPA - 2000 Wildfire Reduction and Forest Health Improvement Program Environmental Assessment</li> </ul>	TA-49 Bandelier Wildfire Building (Accession #6852, LAN-98-021), and Interagency Helibase Operation (Accession #8830, LAN-02-031)
Environmental Characterization and Limited Removals	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> <li>B6 Environmental Restoration and Waste Management Activities</li> </ul>	<ul style="list-style-type: none"> <li>B3.1 Site Characterization and Environmental Monitoring</li> <li>B6.1 Cleanup Actions</li> <li>B6.2 Waste Collection, Treatment, Stabilization, and Containment Facilities</li> </ul>	Site Characterization of Operable Units 1085, 1100, 1136, and 1154 (Accession #5363, LAN-94-053), Site Characterization of Canyon Systems (Accession #6288, LAN-96-108), and PCB Removals at LANL (Accession #5325, LAN-94-059)
Hydrology, Geology, and Geochemistry Research	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	Geology and Geochemistry Research (Accession #6264, LAN-96-101)
Atmospheric, Climate and Environmental Dynamics	<ul style="list-style-type: none"> <li>General Agency Actions (Appendix A) and B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>A9 Information Gathering, Analysis, and Dissemination</li> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> <li>B3.8 Outdoor Terrestrial Ecological and Environmental Research</li> </ul>	Outdoor Atmospheric & Ionospheric Field Experiments (Accession #6629, LAN-97-119)
Geotechnical Engineering and Research	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.1 Site Characterization and Environmental Monitoring</li> </ul>	Trace Elemental Analysis by Inductively Coupled Plasma Mass Spectrometer (Accession #3354, DEC-92-0119 <sup>d</sup> ), and Geology and Geochemistry Research (Accession #6264, LAN-96-101)

2008 SWEIS Appendix L Heading	Applicable 10 CFR 1021, Appendix B to Subpart D, DOE Categorical Exclusion Section Title	Applicable 10 CFR 1021, Appendix B to Subpart D, DOE Categorical Exclusions	LANL Umbrella Categorical Exclusion <sup>a</sup>
Environmental Geology and Spatial Analysis	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> <li>B6 Environmental Restoration and Waste Management Activities</li> </ul>	<ul style="list-style-type: none"> <li>B3.1 Site Characterization and Environmental Monitoring</li> <li>B6.1 Cleanup Actions</li> </ul>	Geology and Geochemistry Research (Accession #6264A, LAN-96-101)
Geophysics	<ul style="list-style-type: none"> <li>General Agency Actions (Appendix A)</li> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>A9 - Information Gathering, Analysis, and Dissemination</li> <li>B3.1 Site Characterization and Environmental Monitoring</li> </ul>	Acoustical Studies (Accession #6607, LAN-97-079)
Planetary Physics	<ul style="list-style-type: none"> <li>General Agency Actions (Appendix A)</li> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>A9 Information Gathering, Analysis, and Dissemination</li> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	Satellite Instrumentation (Accession #5021, LAN-94-002)
Archeological Site Evaluation	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.1 Site Characterization and Environmental Monitoring</li> <li>B3.3 Research Related to Conservation of Fish, Wildlife, and Cultural Resources</li> </ul>	The Los Alamos Test Site for Archaeo-Geophysics (Accession #8829, LAN-02-028)
Biological Field Studies	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.1 Site Characterization and Environmental Monitoring</li> <li>B3.3 Research Related to Conservation of Fish, Wildlife, and Cultural Resources</li> </ul>	Biological Resources Evaluation/Raptor Study (Accession #2533, DEC-91-0054)
Water and Soil Monitoring	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.1 Site Characterization and Environmental Monitoring</li> </ul>	Site Characterization of Canyon Systems (Accession #6288, LAN-96-108)
Automation and Robotics Research and Fabrication	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	Automation and Robotics Research and Fabrication (Accession #9816, LAN-03-022)



2008 SWEIS Appendix L Heading	Applicable 10 CFR 1021, Appendix B to Subpart D, DOE Categorical Exclusion Section Title	Applicable 10 CFR 1021, Appendix B to Subpart D, DOE Categorical Exclusions	LANL Umbrella Categorical Exclusion <sup>a</sup>
Electronic Control Systems Fabrication	<ul style="list-style-type: none"> <li>• B1 Facility Operations</li> <li>• B3 Site Characterization, Monitoring and General Research</li> </ul>	<ul style="list-style-type: none"> <li>• B1.15 Support Buildings</li> <li>• B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	Fabricate Electronic Control Systems (Accession #5905, LAN-95-024A)
Antenna and Pulse Power Outdoor Test Range	<ul style="list-style-type: none"> <li>• B1 Facility Operations</li> <li>• B3 Site Characterization, Monitoring and General Research</li> </ul>	<ul style="list-style-type: none"> <li>• B1.19 Microwave, Meteorological, and Radio Towers</li> <li>• B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> <li>• B3.11 Outdoor tests and experiments on materials and equipment components</li> </ul>	Pulse Power Experiment (Accession #6306, LAN-96-143)
Small-Scale Basic Laser Science Research and Development	<ul style="list-style-type: none"> <li>• B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>• B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	Small-Scale Basic Laser Science Applications (Accession #6433, LAN-97-066A)
Industrial Hygiene Research and Development	<ul style="list-style-type: none"> <li>• B2 Safety and Health</li> <li>• B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>• B2.3 Personnel Safety and Health Equipment</li> <li>• B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	Industrial Hygiene Research and Development (Accession #6515, LAN-97-043)
Radiation Monitoring Techniques	<ul style="list-style-type: none"> <li>• B1 Facility Operations</li> <li>• B2 Safety and Health</li> <li>• B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>• B1.15 Support Buildings</li> <li>• B2.2 Building and Equipment Instrumentation</li> <li>• B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> <li>• B3.10 Particle Accelerators</li> </ul>	Safeguards Science and Technology (Accession #7324, LAN-99-010) and Building and Equipment Instrumentation at LANL (Accession #6068, LAN-96-014)
Physical Detector Research and Development	<ul style="list-style-type: none"> <li>• B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>• B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	Physical Detector Research and Development (Accession #10074, LAN-03-028)
Advanced Image Sensor Research and Development	<ul style="list-style-type: none"> <li>• B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>• B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	Advanced Image Sensor Technology (Accession #6303, LAN-96-125)

2008 SWEIS Appendix L Heading	Applicable 10 CFR 1021, Appendix B to Subpart D, DOE Categorical Exclusion Section Title	Applicable 10 CFR 1021, Appendix B to Subpart D, DOE Categorical Exclusions	LANL Umbrella Categorical Exclusion <sup>a</sup>
Space and Atmospheric Instrumentation	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	Satellite Instrumentation (Accession #5021, LAN-94-0028)
Materials Characterization Research and Development	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	Nonconventional Processing of Materials (Accession #6294, LAN-96-116) and Dynamic Properties of Materials (Accession # 6295, LAN-96-117)
General Optical Characterization and Calibration	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	General Optical Characterization and Calibration (Accession #7182, LAN-98-098)
Ion Beam Materials Science Laboratory Research	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> <li>B3.10 Particle Accelerators</li> </ul>	Ion Beam Materials Science Laboratory (Accession # 7235, LAN-99-004) and Plasma Source Ion Implantation (Accession #5927, LAN-95-081)
High Magnetic Field Research	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	Electrons in High Magnetic Fields (Accession #6567, LAN-97-067), Alternating Electric Current Loss Measurements on High Temperature Superconductor Cable (Accession #6002, DEC-95-0105)
Ultra-High Strength and High Energy Density Materials Research and Development	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	High Energy Density Experiments Laboratory (Accession # 6122, LAN-96-031)
X-Ray Tomography and Ultrasound Testing	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	X-Ray Tomography and Ultrasound Testing at TA-8 (Accession #6521, LAN-97-052)
Materials Science Research and Development at the Los Alamos Neutron Science Center	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.10 Particle accelerators, B3.6 Small-scale research and development, laboratory operations, and pilot projects</li> </ul>	Materials Science Research and Development at LANSCE (Accession #7641, LAN-99-074)

2008 SWEIS Appendix L Heading	Applicable 10 CFR 1021, Appendix B to Subpart D, DOE Categorical Exclusion Section Title	Applicable 10 CFR 1021, Appendix B to Subpart D, DOE Categorical Exclusions	LANL Umbrella Categorical Exclusion <sup>a</sup>
Energetic Neutral Beam Facility Research and Development	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> <li>B3.10 Particle Accelerators</li> </ul>	Electronic and Electrochemical Materials and Devices Research and Development (Accession #5686, LAN-96-99)
Basic and Applied Chemistry Research and Development	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> <li>B3.10 Particle Accelerator</li> <li>B3.15 Small-scale Indoor Research and Development Projects using Nanoscale Materials</li> </ul>	Chemistry Division Research and Development at LANL (Accession #11090, LAN-05-004)
Electronic and Electrochemical Materials and Devices Research and Development	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring and General Research</li> <li>B6 Environmental Restoration and Waste Management</li> </ul>	<ul style="list-style-type: none"> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	Electronic and Electrochemical Materials and Devices Research and Development (Accession #5686, LAN-96-127)
Advanced Oxidation Technology Research and Development	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	Advanced Oxidation Technology Research (Accession #6808, LAN-98-041)
High-Temperature/High-Pressure Fluids Research and Development	<ul style="list-style-type: none"> <li>B3 Site Characterization, Monitoring, and General Research</li> </ul>	<ul style="list-style-type: none"> <li>B3.6 Small-scale Research and Development, Laboratory Operations, and Pilot Projects</li> </ul>	High-Temperature/High-Pressure Fluids Technologies (Accession #6627, LAN-98-009)

<sup>a</sup> Umbrella Categorical Exclusion list may not be comprehensive for all activities listed Appendix L.

<sup>b</sup> Accession numbers are used in the internal LANL NEPA database to catalogue all projects reviewed for NEPA compliance.

<sup>c</sup> LAN numbers are an internal document number for the LANL NEPA program. The first two numbers refer to the fiscal year the project was first reviewed, the second three numbers refer to the review number for that year.

<sup>d</sup> DEC refers to the Department of Energy Environmental Checklist. This numbering system pre-dates the LAN numbering system.

## **APPENDIX B. LOS ALAMOS PLUTONIUM HISTORY**

The Los Alamos plutonium mission dates back to the summer of 1943, when the Manhattan Project's spontaneous fission research was relocated from Berkeley to Los Alamos (Hoddeson et al. 2004). A team led by Emilio Segrè immediately began measurements on minute quantities of cyclotron-produced plutonium-239. This research effort expanded early the next year when additional plutonium-239 from the X-10 reactor in Oak Ridge became available to Los Alamos scientists. With the increase in the amount of material available, the development of plutonium purification techniques began, along with studies in plutonium metallurgy. In early 1945, after Los Alamos received the first shipment of plutonium in solution from the Hanford B Reactor, metal production and the fabrication of plutonium components for the Trinity device were able to proceed in earnest. This plutonium research and development and production work was performed in D Building in TA-1, which was completed in December 1943 (CDC 2010). By the time D Building was decommissioned in September 1945, approximately 27 kilograms of plutonium metal had been produced (CDC 2010) and three plutonium cores had been fabricated, one for the Trinity test device and two for atomic bombs.

### **Plutonium Mission and Capabilities**

Although the laboratory at Los Alamos was created for a single purpose, to design and build the atomic bomb, a broad range of plutonium research and development was required to support this effort. Wartime plutonium research and development was carried out at several laboratories across the country, including parallel efforts to confirm the suitability of plutonium-239 for use in an atomic weapon and to develop related chemical processes. The principle efforts at Los Alamos were focused on understanding the basic chemical and physical properties of plutonium, determining its critical mass, and developing processes and techniques needed to purify plutonium, convert it into a metal form, and to form it into parts suitable for use in the atomic bomb. At the conclusion of World War II, the Los Alamos Laboratory was the only facility in the United States capable of performing all of these tasks.

Plutonium research and development continued to be a top national priority after the end of the war. The laboratory was made a permanent institution, and was placed under the control of the newly created Atomic Energy Commission, effective at the beginning of 1947. Under the Atomic Energy Commission, the plutonium mission at Los Alamos expanded rapidly, not only in support of the nuclear weapons program but also for basic research and development applicable to other defense-related and civilian programs. Over the years Los Alamos has made significant contributions to the understanding of plutonium's properties and its potential applications. In addition to nuclear weapons applications, Los Alamos has developed plutonium reactor fuels, plutonium heat sources for space missions and for medical devices such as pacemakers and artificial hearts, and plutonium processes for use at other laboratories and production facilities. A unique set of facilities was, and will always be, required to house the plutonium operations necessary to perform these missions.

### **Plutonium Facilities**

Early in the Manhattan Project, given the rapid increase in the amount of plutonium being handled at Los Alamos, the decision was made to construct safer and more modern plutonium facilities at DP Site on the eastern side of the Los Alamos townsite (CDC 2010). The majority of plutonium operations were transferred from D Building to the new DP-West plutonium facilities

in late 1945. Over the years the DP-West facilities were incrementally improved and upgraded to meet more stringent health and safety requirements. In addition, new buildings such as the CMR Building in Technical Area 3 (TA-3) and Building 150, a plutonium fuels development facility at DP-West, were constructed to accommodate increasing workloads and to house new programs. As is the case today, the CMR Building and Building 150 were built to conform to the latest building codes and state-of-the art construction standards. However, continued upgrades to the DP-West facilities to meet new Atomic Energy Commission requirements for plutonium facilities were no longer feasible (AEC 1972). As a result, the decision was made in the early 1970s to construct a new plutonium facility at TA-55. Operations at the TA-55 Plutonium Facility began in 1978. Similar to the situation with the predecessor DP-West facility, the TA-55 Plutonium Facility has seen numerous facility modifications and upgrades and over the years, including extensive seismic upgrades in recent years.

In the early 1990s Los Alamos initiated a project to upgrade the aging CMR Building structure and its ventilation and fire protection systems, with the intent to extend the building's life by 20 to 30 years (DOE 1997c). After the 1998 discovery of two parallel faults underlying several wings of the building, a decision was made to cancel the upgrade and begin planning for a replacement facility, including some infrastructure upgrades to the CMR Building to allow it to safely operate until the operations therein could be relocated. In the interim, many of the CMR Building nuclear material operations were relocated to the TA-55 Plutonium Facility, an effort that continues today. Following an extensive review of alternatives, the NNSA decided in 2004 to consolidate the Los Alamos plutonium activities at TA-55 and to construct two new buildings to house analytical chemistry and materials characterization operations (DOE 2004). The first building, the RLUOB, was completed in 2010, and radiological operations began in August 2014 (DOE 2015c). The second building, the CMRR-NF, was not constructed and has been cancelled.

### **Plutonium Pit-Related Programs**

Following the end of World War II, Los Alamos continued to fabricate the plutonium components for both stockpile weapons and nuclear test devices. Although Hanford's Plutonium Finishing Plant began producing plutonium weapons components in 1949 (DOE 1997d), the Los Alamos responsibility for fabrication of stockpile weapons was not terminated until 1953 (AEC 1972), at the time the Rocky Flats Plant started producing plutonium pits for the stockpile. Rocky Flats also performed process development to improve the efficiency of production and development of new production techniques, and supported the stockpile certification by performing destructive examination of stockpile-return pits. During this time, Los Alamos continued to produce pits for nuclear test devices through the cessation of nuclear testing in September 1992, and continued to perform R&D related to weapons component fabrication and characteristics.

After the cessation of production at the Rocky Flats Plant in 1989, the United States was left without a designated stockpile pit production facility. When it was determined that Rocky Flats operations would be permanently discontinued, the pit surveillance activities were transferred to Los Alamos. Following a detailed review of alternatives, DOE announced in December 1996 its decision to re-establish a limited pit production capability at LANL (DOE 1996a). Largely because the capability to support the level of production anticipated at the time was already in place at TA-55, and because long-term pit production was envisioned to be supported by a new facility (the Modern Pit Facility) it was determined that the most environmentally preferable

alternative that could be accomplished at the least cost with the least technical risk. In the late 1990s, DOE tasked LANL with providing a number of certified war reserve pits for the W88 submarine-launched ballistic missile warhead. The first certified pit was accepted for insertion into the stockpile in June 2007 (LANL 2007b). The twenty-ninth, and final, pit was delivered to NNSA on August 17, 2011 (LANL 2011f).

Since the fabrication of the plutonium core for the Trinity device 72 years ago, Los Alamos has fabricated hundreds of plutonium pits for the stockpile and for nuclear test devices, not including the even greater number of pits fabricated during process development and for training purposes. Although a greater number of pits can be produced annually using existing facilities and equipment, LANL is currently authorized to produce only 20 pits per year (DOE 1999a). Since 1945, Los Alamos has also performed basic plutonium R&D in support of the development, maintenance, and certification of the stockpile.

### **Other Plutonium Program Areas**

Part of the weapons program activities since 1945 is the continual growth in understanding of plutonium in static and dynamic environments. Los Alamos, both internally and through its collaboration with other laboratories and universities, has nurtured the development of scientific and engineering expertise and characterization and analysis techniques to study and understand the behavior of plutonium. The CMR Building and the TA-55 Plutonium Facility were central facilities in which such techniques were and continue to be developed. As Los Alamos plans to cease operations in the CMR Building, these techniques are being moved to existing facilities at TA-55, namely the Plutonium Facility and the RLUOB.

The RLUOB, which is adjacent to the Plutonium Facility, is the nation's newest plutonium analytical facility. Although RLUOB is currently authorized to operate with a radiological material limit of 38.6 grams of Pu-239 equivalent, it was designed to be very robust in preparation for construction of the nuclear facility. The RLUOB physical structure is robust enough such that it can potentially accommodate a greater quantity of nuclear material without requiring any changes to the building structure or systems.

Since the late 1990s, Los Alamos was designated as the process development site for pit disassembly and conversion in support of surplus plutonium disposition programs. The processes for disassembling the various pit types in the legacy stockpile, converting the plutonium to oxide, converting uranium to oxide, and packaging these materials were developed for eventual deployment into a new facility. When the new facility (the Pit Disassembly and Conversion Facility) was cancelled, it was determined that a cost-effective option would be to expand Los Alamos capacity to perform the disassembly and plutonium oxide conversion mission.

Since the 1950s, Los Alamos was also involved in the development of technologies for the recovery, purification, and fabrication of Pu-238 components for both defense and non-defense applications. The most celebrated application of Pu-238 components is as a power supply for National Aeronautics and Space Administration space missions. Originally, the Mound Plant in Ohio produced these electric generators, but the mission was transferred to Los Alamos when the Mound Plant ceased operations. Most recently, the spacecraft and its Los-Alamos-fabricated heat sources aboard the Cassini mission reentered the Saturn atmosphere as the mission ended after

providing the world with extensive scientific information and discoveries about the planet and its satellites.

As part of the rapid development of civilian nuclear energy applications in the 1960s and 1970s, Los Alamos was instrumental in developing the technology to fabricate plutonium oxide, nitride, and carbide fuels. Such reactors were envisioned for use in commercial power production, space applications, and other esoteric applications. Fuels work continued through the early 2000s, but faded as the United States reduced support for development of new reactor technologies.

## APPENDIX C. LIST OF NEPA REVIEWS CONDUCTED SINCE THE 2008 SWEIS

Title	Description	NEPA Compliance Officer Determination Date
TA-33 Storm Water Control Measure (Accession number 18915)	Install permanent engineered storm water control measures at TA-33 to meet the requirements of National Pollutant Discharge Elimination System Permit No. NM0030759, commonly referred to as the LANL Individual Storm Water Permit.	12/16/2013
Mitigations for the proposed New Mexico State Road 4 Project (Accession number 18797)	Creation of a wildfire defensible space corridor along State Route 4.	1/22/2014
Conveyance of Land Conveyance and Transfer Tract A-18-A (Lower Pueblo Canyon) (Accession number 19478)	A review of environmental changes that have occurred within Tract A-18-A since the issuance of the 1999 "Environmental Impact Statement for the Conveyance and Transfer of Certain Land Tracts Administered by the Department of Energy and Located at Los Alamos and Santa Fe Counties, New Mexico," DOE/EIS-0293.	7/23/2014
TA-39 Storm Water Control Measures (Accession number 19728 and 19852)	Install a permanent engineered storm water control measure (retention wall) at TA-39 to meet the requirements of National Pollutant Discharge Elimination System Permit No. NM0030759, commonly referred to as the LANL Individual Storm Water Permit.	12/16/2014
Increase Production of Medical Radioisotopes at the Radiochemistry Facility (Accession number 19526)	Increase production of commercially unavailable or under-produced isotopes used in nuclear medicine (e.g., cancer treatment and diagnostics), research, and by industrial isotope user communities. This increase would increase annual off-site shipments.	2/23/2016
Formulation and Thermal Behavior Investigations of Surrogate Waste (Accession number 20358)	Perform experiments designed to recreate the circumstances associated with the 55-gallon (7.35-cubic feet) drums that breached and resulted in an airborne radiation leak at the Waste Isolation Pilot Plant on February 14, 2014.	7/08/2015
Radioactive Liquid Waste Treatment Facility Upgrade Project (Accession numbers 18236 and 19630)	Construct two liquid waste treatment facilities at TA-50 to replace the existing Radioactive Liquid Waste Treatment Facility.	9/29/2015
Detection and Analysis of Chemicals	Deposit chemical mixtures onto substrates for detection.	7/28/2016
Increased Number of Safety and Mechanical Tests at the High Explosives Processing Facilities (Accession number 19538)	Remove numeric limitations on the number of safety and mechanical tests conducted annually on high explosives and weapon systems components at LANL.	9/14/2016



Title	Description	NEPA Compliance Officer Determination Date
Unmanned Aerial System User Facility and Unmanned Aircraft Flights inside LANL Restricted Airspace (Accession number 20887)	Use Unmanned Aerial Systems (including unmanned, remote-controlled airplanes, balloons, and helicopters) for sensor testing, training, security, surveillance, detection, and emergency management within LANL restricted airspace.	6/22/2016
Metropolis Center Computer Cooling and Power (Accession number 21072)	Expand the computing capabilities of the Metropolis Center. Building modifications for Exascale computing include the installation of heat exchangers, cooling towers, chilled water piping, and other related mechanical equipment.	10/12/2016
Relocation of Radionuclide Processing Activities from the CMR Building to TA-59-0001 (Accession numbers 20821 and 21066)	Relocate uranium materials from the CMR Building to TA-59-0001, and recover uranium from a solution to a stable oxide powder, and extract plutonium from graphite and/or salt targets.	10/13/2016
Mortandad Wetland Enhancement and the DP Dissipater Supplemental Environmental Projects (Accession numbers 22127 and 22128)	This project was funded through the Supplemental Environmental Projects to improve the watersheds surrounding LANL. The DP dissipater portion of this project was cancelled.	5/11/2017
Upper Cañon de Valle Watershed Enhancement Project (Accession number 22183)	Implementation of Supplemental Environmental Project at upper Cañon de Valle watershed is designed to reduce soil erosion, slow stormwater flow, and improve water quality.	9/20/2017
Proposal to Conduct Mobile-Loading Operations of Transuranic and Mixed-Transuranic Waste at Technical Area 55 (Accession number 23279)	Use a Resource Conservation and Recovery Act-permitted outdoor storage pad and the High-efficiency Neutron Counter pad as staging areas for the loading of transuranic and mixed-transuranic waste for shipment to the Waste Isolation Pilot Plant.	10/26/2017
Uranium Machining Consolidation at Technical Area 3 from Building 102 into Building 66 (Accession number 22061)	Relocate uranium machining operations to Building 66 to improve efficiency of the machining operations that support hydrodynamic tests.	12/11/2017
Stabilization and Characterization of Americium 241 Residues from Thermo Fisher Scientific (Accession number 23373)	Stabilize, characterize, and repackage a drum containing americium-241 residues previously owned by Thermo Fisher Scientific.	1/3/2018
TA-3 Modular Laboratory Building (Accession number 20919)	Install a preconstructed modular biosafety level 2 facility to support bioscience work at LANL.	1/4/2018

Title	Description	NEPA Compliance Officer Determination Date
Supplemental Environmental Projects Sandia and Ancho Canyons Watershed Enhancement (Accession numbers 22124 and 22181)	Implementation of Supplemental Environmental Project at North Ancho and lower Sandia watersheds is designed to reduce soil erosion, slow stormwater flow, and improve water quality.	1/4/2018
Area 1 Waterline (Accession number 22339)	Install a 10-inch fire waterline and a potable 2-inch waterline from Technical Area 15 to Area 1 of Technical Area 36.	1/4/2018
TA-49 Training Operations in Support of Fire Departments (Accession number 23374)	Conduct open burn training operations to train fire departments in arson investigation at the Technical Area 49 training facility.	1/10/2018

## APPENDIX D. PRESCRIPTIONS FOR DESIRED FINAL CONDITIONS BY FOREST COVER TYPE

	Piñon-Juniper	Ponderosa Pine and Dry Mixed Conifer	
		Drier Sites (mesa tops and south-facing slopes)	Wetter Sites (north-facing canyon slopes and riparian areas)
Forest cover type definition/description	Dominated by piñon and/or juniper with less than 10 percent cover of taller tree species	Mesa tops and south-facing slopes—thin, rocky soils, lower tree density, and fewer species.	North-facing canyon slopes—deeper soils, higher tree density, and greater species diversity.  Riparian areas—at least 100 feet (30.5 meters) from edge of drainage channel.
Desired final community	Heterogeneous wooded grassland	Heterogeneous forest	Not applicable
Desired final tree density	Individual or groups of trees separated by open areas up to 3 acres (1.2 hectares)	10 to 125 trees per acre (4 to 31 trees per hectare) (approximately 66 to 19 feet [20 to 5.8 meters] tree spacing)  Leave individual trees or groups of trees and up to 3-acre (1.2-hectare) open areas	10 to 125 trees per acre (4 to 31 trees per hectare) (approximately 66 to 19 feet [20 to 5.8 meters] tree spacing)
Desired final tree crown separation	At least 10 feet (3 meters) between individual trees, clusters of trees separated by >40 feet (>12.2 meters)	Not applicable	Not applicable
Desired final canopy cover	10 percent or less	10 to 50 percent	10 to 50 percent
Desired final understory	Perennial grasses, forbs, and shrubs	Retain representation of piñons and junipers in understory where present	Not applicable
Plant/tree species preference	Selectively remove junipers, retain mature piñons	Retain xeric-adapted (dry climate) species (ponderosa pine, Douglas fir, limber pine, Southwestern white pine)	Retain cottonwoods and remove invasive species like Russian olives and elms
Largest tree diameter (at breast height) removed	Retain mature piñons, no other size limits	16 inches (41 centimeters)	16 inches (41 centimeters)
Non-natives	Remove whenever possible (any size)	Remove whenever possible (any size)	Remove whenever possible (any size) Russian Olives and Salt Cedar

Adapted from (LANL 2016b, 2014b).

This page intentionally left blank.

## APPENDIX E. LANL FLOODPLAIN AND WETLAND ASSESSMENTS SINCE THE 2008 SWEIS

Name	Year	Description	Project Status
Burning Ground Spring Wetland, TA-16, Los Alamos National Laboratory (LA-UR-09-05485)	2009	Implement carbon filters, remediate Research Department Explosive; hexahydro-1,3,5-trinitro-1,3,5 triazine (RDX) present in spring waters at Burning Ground Spring in Cañon de Valle at TA-16.	Completed
Proposed Cleanup of Potentially Contaminated Soil in Los Alamos Canyon, TA-43, Los Alamos National Laboratory (LA-UR-09-06183)	2009	Corrective action cleanup at the drainage below the town site from a septic tank and associated outfall that served as a uranium machine shop. Approximately 500 cubic yards (382 cubic meters) of sediment are estimated to be excavated.	Completed
Proposed Grade Control Structure in Pueblo Canyon, TA-74, Los Alamos National Laboratory (LA-UR-09-05780)	2009	Repair the degraded channel in Pueblo Canyon at TA-74 to limit the loss of sediment and dissipate floodwater leaving LANL property. The sediment retained by the grade-control structure will fill the channel, re-establish and extend the wetland in Pueblo Canyon, and establish a new grade that provides stability to the channel.	Completed
Proposed Remediation and Effluent Discharge Actions in Sandia Canyon, Los Alamos National Laboratory (LA-UR-10-037S4)	2010	LANL is preparing to conduct remediation actions in Sandia Canyon as directed by the New Mexico Environmental Department under the 2005 Consent Order. In addition, LANL is preparing to meet new and more stringent water quality requirements for wastewater discharges and to reduce the amount of potable water it uses by reducing the amount of effluent discharged into Sandia Canyon.	Grade-control structure installed
Continued response to the Las Conchas fire, Los Alamos National Laboratory (LA-UR-11-03907)	2011	As part of the emergency response to the Las Conchas fire in June of 2011, LANL installed several fire breaks and suppressed fire in Los Alamos, Pajarito, and Upper Ancho canyons. The installation of the fire breaks was quickly reviewed to avoid areas of concern (cultural and biological resources). Fires will be fought as they occur and any suppression in sensitive habitat will have storm water protection and restored as soon as emergency conditions allow.	Completed
Proposed Engineered Erosion Controls at TA-72 in Lower Sandia Canyon, Los Alamos National Laboratory (LA-UR-12-24060)	2012	LANL is preparing to implement engineering controls in Sandia Canyon at TA-72 to install storm water controls. The project consists of (A) enhancing water recharge upstream of the site via the installation of (1) two check dams within the secondary channel, which connects to the Sandia Canyon main channel and (2) site grading outside of but adjacent to the south and east portion of the main Sandia Canyon channel and (B) installing a reinforced (i.e., soil-cement or similar material) channel to replace the existing channel to route water through the site.	Completed

Name	Year	Description	Project Status
Proposed Outdoor Fire Range Upgrades at TA-72 in Lower Sandia Canyon, Los Alamos National Laboratory (LA-UR-12-23681)	2012	In order to remain current on training requirements, the firing ranges at TA-72 will be upgraded, which will result in increased safety and efficiencies in the training for Protective Force personnel	Completed
Construction of a Parking Lot in Los Alamos Canyon (LA-UR-14-29451)	2014	Seventeen parking spaces will be constructed on the south side of Omega Road, and a lighted walking path will be constructed to the ice rink. Some trees will be removed during this action. A guardrail of approximately 400 feet (122 meters) will be constructed along the north side of West Road to prevent unsafe parking in that area.	Completed
Construction and Restoration Activities in Lower Pueblo Canyon (LA-UR-14-27630)	2014	Stabilize the Pueblo Canyon wetland and support floodplain development.	Completed
Chromium Plume Control Interim Measure and Plume-Center Characterization in Mortandad Canyon, Los Alamos National Laboratory (LA-UR-15-28814)	2015	DOE proposes to install two to six angled or vertical injection wells and up to three extraction wells that range in depth between 1,000 and 1,300 feet (305 to 396 meters) below ground surface screened within the regional aquifer capable of pumping up to 150 gallons (568 liters) per minute each. In addition, the project would design and install a piping network capable of delivering 100 to 450 gallons (379 to 1,703 liters) per minute of chromium-contaminated water from the extraction wells to the ion exchange treatment units and then from treatment to the injection wells for injection into the regional aquifer.	Partially completed
Enhanced Storm Water Controls in Three-mile Canyon at Technical Area 18 at Los Alamos National Laboratory (LA-UR-15-23666)	2015	The objective of the proposed action is to stabilize the channel in this area and support floodplain development. This project will install enhanced storm water control measures at solid waste management units 18-002(b), 18-003(c), and 18-010(f) in support of the Individual Permit Storm Water Program's goals to meet requirements of the National Pollutant Discharge Elimination System Individual Permit.	Completed
Floodplain Assessment for Corrective Actions in Ancho Canyon, Technical Area 39, Los Alamos National Laboratory, Los Alamos, New Mexico (LA-UR-16-26253)	2016	DOE proposes to redirect channel flows away from solid waste management unit 39-010 to protect it from erosion. This would entail the construction of a diversion berm made from soil surfaced with rock riprap or redi-rock blocks in North Ancho Canyon to divert channel flows away from the soil dump. The earthen berm would be covered in turf reinforcement mats, a stabilized material used to limit erosion and encourage vegetation regrowth.	Completed

Name	Year	Description	Project Status
Floodplain Assessment for Corrective Actions in Potrillo Canyon, Technical Area 36, Los Alamos National Laboratory, Los Alamos, New Mexico (LA-UR-16-20393)	2016	DOE proposes construction of the erosion protection measures to minimize sediment migration from further up the canyon. As part of the action, the road will be improved through blading and the addition of gravel and will be rerouted around areas of erosion protection measures and archaeological sites.	Completed
North Ancho Canyon Aggregate Area Cleanup in Technical Area 39 at Los Alamos National Laboratory (LA-UR-17-22996)	2017	Remove contaminated soil until native soil is reached where concentrations are below the residential soil screening levels and soil action levels. The goal of this proposed action is to appropriately characterize and remediate these sites to ensure there is no unacceptable human health or ecological risk associated with chemicals previously released during legacy operations.	Partially completed
Floodplain Assessment for the Middle Los Alamos Canyon Aggregate Area Investigations in Technical Area 02 at Los Alamos National Laboratory (LA-UR-17-21756)	2017	The DOE proposes to conduct soil sampling and excavate as part of a corrective actions effort. Additional shallow surface soil samples (soil grab samples) will be collected throughout the TA-2 area, including within the floodplain, to perform ecotoxicology studies.	Partially completed
Mortandad Wetland Enhancement and the DP Dissipater Projects at Los Alamos National Laboratory (LA-UR-17-22373)	2017	Correct the existing storm water controls that are beginning to fail and that are causing head-cutting in the wetland and slow water flow and control sediment in a reach of DP Canyon. The phases may include extraction of existing sediment, soil, piping and gabion, utilizing spoils on-site along with rock from existing gabion.	Mortandad Wetland Enhancement Project completed. DP Dissipater Project cancelled

This page intentionally left blank.



## APPENDIX F. LANL BIOLOGICAL ASSESSMENTS SINCE THE 2008 SWEIS

Name	Fiscal Year	Description	U.S. Fish and Wildlife Service Determination	Project Status
Potential Effects of Effluent Reduction Ponds on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory: Reconsultation for 22420-2006-1-0091 (LA-CP-06-0863)	2006	Change the location and size of the Radioactive Liquid Waste Treatment Facility evaporation tanks to be used in the outfall reduction project from consultation 22420-2006-1-0091.	May affect, not likely to adversely affect or no effect (depending on species)	Completed
Potential Change in Project Effects of the Chemistry and Metallurgy Research Facility Replacement Project on Federally Listed Threatened and Endangered Species, Los Alamos National Laboratory, Los Alamos, New Mexico (LA-CP-11-00306)	2007	Expand the Chemistry and Metallurgy Research Facility Replacement Project footprint to the east to allow additional lay down areas and construct and operate a cement plant to provide concrete for the construction work.	May affect, not likely to adversely affect or no effect (depending on species)	Deferred
Potential Effects of Monitoring and Maintenance of Monitoring Stations and Wells on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory (LA-CP-08-0137)	2008	Install four new wells, collect water samples from those wells, and conduct maintenance and repairs when necessary on those wells.	May affect, not likely to adversely affect or no effect (depending on species)	Completed
Potential Change in Project Effects of the Chemistry and Metallurgy Research Facility Replacement Project on Federally Listed Threatened and Endangered Species, Los Alamos National Laboratory, Los Alamos, New Mexico (LA-CP-09-00626)	2009	Move the underground utilities from the north side of the existing footprint of Pajarito Road followed by moving Pajarito Road to the south by one road width to the edge of Two-mile Canyon for approximately 3,000 feet (1,000 meters). The proposed electrical substation would also be moved as far south as possible while remaining on the mesa.	May affect, not likely to adversely affect or no effect (depending on species)	Deferred
Potential Effects of Monitoring and Maintenance of Monitoring Stations and Wells on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory (LA-CP-09-00071)	2009	Install 40 new wells; collect water samples from those wells and other locations, including 559 locations for surface, storm water, and spring sampling locations; and conduct maintenance and repairs when necessary at these locations.	May affect, not likely to adversely affect or no effect (depending on species)	Completed

Name	Fiscal Year	Description	U.S. Fish and Wildlife Service Determination	Project Status
Potential Effects of Sample Collection in Three-mile Canyon on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory (LA-CP-09-01685)	2010	Collect soil and groundwater samples from Three-mile Canyon and surrounding areas at LANL to measure chemical and radionuclide levels, including sample collections by means of hand and auger sampling from ground surface to a depth of 500 feet (150 meters), sampling from groundwater wells, and construction of a new groundwater well.	May affect, not likely to adversely affect or no effect (depending on species)	Completed
Effects of Elimination of Effluent Outfalls and Cleanup of Wetland Soil Contamination in Sandia Canyon at Los Alamos National Laboratory, Los Alamos (LA-CP-10-00833)	2010	Expand the Sanitary Effluent Reclamation Facility, including construction of two additional evaporation ponds on Sigma Mesa (TA-60), a storage lagoon in TA-46, and a reduction or elimination of the 3 acres (1.2 hectares) of Sandia Canyon wetland and the perennial stream reach.	May affect, not likely to adversely affect or no effect (depending on species)	Completed
Effects of the Construction of Five Protective Force Training Facilities at Los Alamos National Laboratory (LA-CP-10-01807)	2010	Account for individual and cumulative impacts of five new proposed or constructed protective force training facilities at LANL, including an outdoor running track, a tactical training facility, an indoor live fire range, an outdoor live fire range, and an office building.	May affect, not likely to adversely affect or no effect (depending on species)	Three of the five were completed (except for outdoor live fire range and office building)
Effects of Las Conchas Wildfire Mitigations Including Mexican Spotted Owl Habitat Redelineation in Los Alamos Canyon on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory (LA-CP-11-01147)	2011	Account for direct, indirect, and cumulative effects of the Las Conchas fire mitigations, including a proposed redelineation of the Los Alamos Canyon Mexican spotted owl area of environmental interest at LANL.	May affect, not likely to adversely affect or no effect (depending on species)	Completed
Effects of Proposed Temporary Spoils Storage, Staging, New Parking, and Vehicle Turnaround on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory (LA-CP-11-00306)	2011	Construct laydown areas for storage of Chemistry and Metallurgy Research Facility Replacement Project and other spoils materials and a new parking lot and vehicle turnaround at LANL	May affect, not likely to adversely affect or no effect (depending on species)	Deferred

Name	Fiscal Year	Description	U.S. Fish and Wildlife Service Determination	Project Status
Potential Effects of Monitoring and Maintenance of Monitoring Stations and Wells on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory (LA-CP-11-00013)	2011	Install or re-drill 18 wells, sample, and conduct maintenance and repair on these wells and their sampling instrumentation when necessary.	May affect, not likely to adversely affect or no effect (depending on species)	Completed
Effects of the Construction and Use of the Upper Sandia Canyon Access Road on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory (LA-CP-11-01686)	2011	Construct and use a new access road into upper Sandia Canyon at LANL.	May affect, not likely to adversely affect or no effect (depending on species)	Completed
Effects of Construction and Operation of a Transuranic Waste Facility at Los Alamos National Laboratory (LA-CP-11-00165)	2011	Build and operate a Transuranic Waste Facility, with the capacity to store a minimum of 825 55-gallon drums (172 cubic meters) with contingency storage of up to 1,240 drums.	May affect, not likely to adversely affect or no effect (depending on species)	Completed
Effects of the Sigma Mesa Clean Fill Yard on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory (LA-CP-12-00038)	2012	Create a 5-acre (2-hectare) central secured clean fill yard on Sigma Mesa (TA-60) to stage and store clean fill from construction and demolition projects.	May affect, not likely to adversely affect or no effect (depending on species)	Completed
Effects of Implementing the Jemez Mountains Salamander Site Plan on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory (LA-UR-13-25060)	2013	Implement a site plan for the Jemez Mountains salamander and include the site plan into the Threatened and Endangered Species Habitat Management Plan at LANL.	May affect, not likely to adversely affect or no effect	Completed
Effects of the Recreational Use of Los Alamos Canyon on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory (LA-UR-14-29595)	2013	Construct and operate a biking and walking path the length of Los Alamos Canyon and provide an easement of DOE land to Los Alamos County for the enlargement of parking facilities at the County ice rink in Los Alamos Canyon.	None	Project moved location; U.S. Fish and Wildlife Service concurrence did not happen.

Name	Fiscal Year	Description	U.S. Fish and Wildlife Service Determination	Project Status
Effects of the Decommissioning and Removal of Infrastructure at the Technical Area 57 Fenton Hill Site at Los Alamos National Laboratory (LA-CP-15-20378)	2015	Decommission and demolish all LANL facilities at the TA 57 Fenton Hill site and restore the site back to a natural state. DOE leased this land from the Santa Fe National Forest Service and will return the property back to the Santa Fe National Forest Service.	May affect, not likely to adversely affect or no effect (depending on species)	Partially Complete
Addition of the Western Distinct Population Segment of the Yellow-billed Cuckoo and the New Mexico Meadow Jumping Mouse to the Los Alamos National Laboratory Habitat Management Plan (LA-UR-15-23445)	2015	Implement site plans for the yellow-billed cuckoo and the New Mexico meadow jumping mouse and include the site plans into LANL's Threatened and Endangered Species Habitat Management Plan.	May affect, not likely to adversely affect or no effect (depending on species)	Completed
Effects of the Paleoseismic Trenching Project to Conduct a Probabilistic Seismic Hazard Analysis of the Pajarito Fault System around Los Alamos National Laboratory (LA-CP-16-20525)	2016	Excavate trenches across specific segments of the Pajarito fault system to determine the timing and magnitude of earthquakes in the Holocene epoch (11,000 years ago to the present). This new data will provide the foundation for design basis of critical facilities at LANL.	May affect, not likely to adversely affect or no effect (Mexican spotted owl) May adversely affect (Jemez Mountains salamander)	Not started
Operation and Expansion of water monitoring programs at Los Alamos National Laboratory (LA-UR-17-20753)	2017	Install no more than 10 regional groundwater monitoring wells, sample the wells, and conduct maintenance and repairs on these wells when necessary.	May affect, not likely to adversely affect or no effect (depending on species)	Partially complete
Changing Habitat Boundaries in Lower Water Canyon and the Construction of a New Building at Los Alamos National Laboratory (LA-UR-17-20797)	2017	Removal of the lower portion of the area of environmental interest core habitat in Water Canyon for the federally-listed Mexican spotted owl and construction of a new building in TA-40. The habitat boundary was in an active firing site.	May affect, not likely to adversely affect or no effect (depending on species)	Partially complete