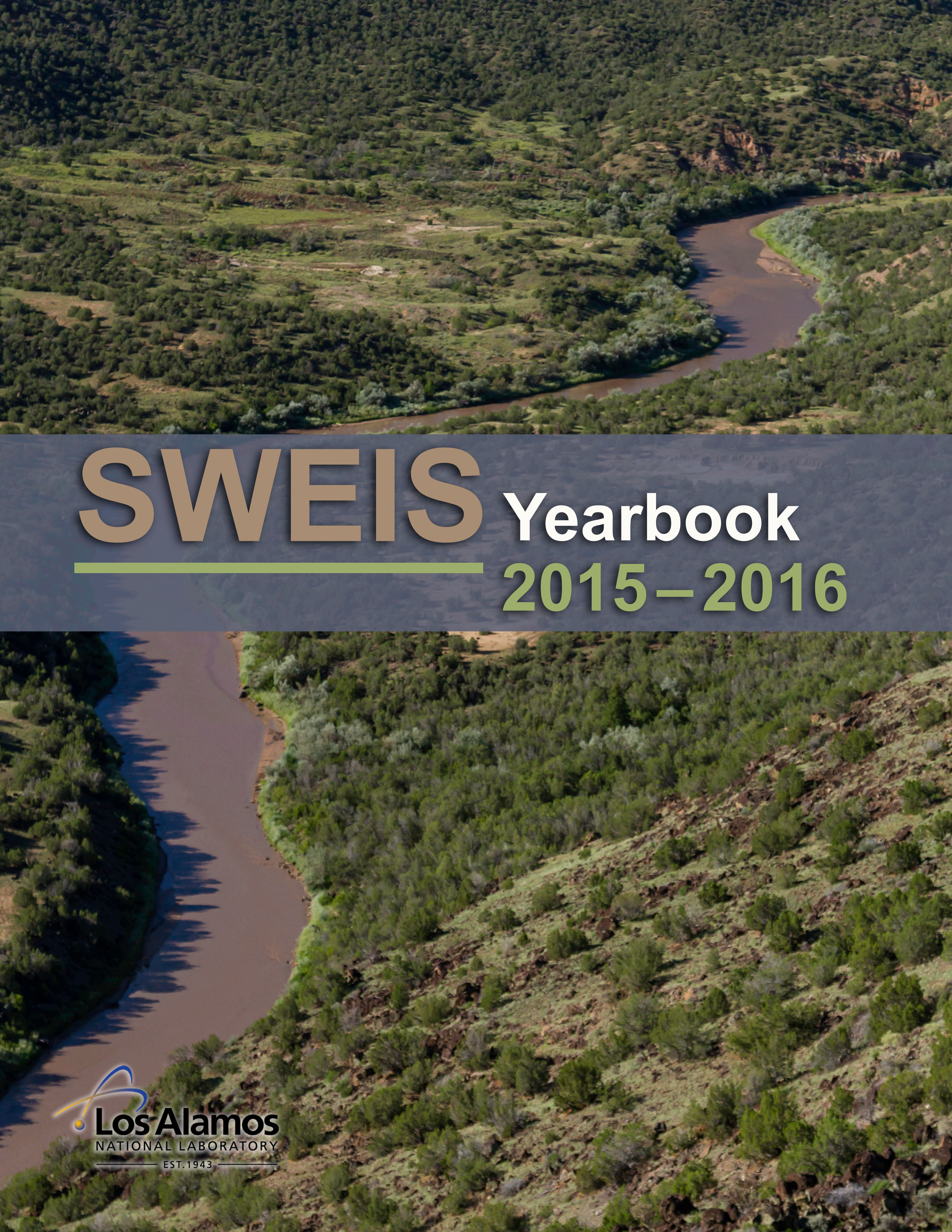
LA-UR-18-20988
Approved for public release; distribution is unlimited.

Title:	SWEIS Yearbook 2015–2016 Comparison of 2015 and 2016 Data with Projections of the 2008 Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory
Author(s):	Wright, Marjorie Alys Musgrave, Karen Suzanne Holtkamp, David Michael Reddick, Randall Franklin
Intended for:	Report Environmental Regulatory Document
Issued:	2018-03-01 (rev.1)

SWEIS Yearbook 2015–2016



Los Alamos
NATIONAL LABORATORY
EST. 1943

LA-UR-18-20988
February 2018

SWEIS Yearbook 2015–2016

Comparison of 2015 and 2016 Data with Projections of the 2008 Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory

Los Alamos
NATIONAL LABORATORY
EST. 1943

Prepared by the Environmental Stewardship Group,
Environmental Protection and Compliance Division

EXECUTIVE SUMMARY

This Site-Wide Environmental Impact Statement (SWEIS) Yearbook compares the 2008 SWEIS projections with actual Los Alamos National Laboratory (LANL or the Laboratory) operations data for calendar years 2015 and 2016. During calendar years 2015 and 2016, LANL operations data mostly fell within the 2008 SWEIS projections. Operation levels for the Radioactive Liquid Waste Treatment Facility exceeded the 2008 SWEIS capability projections. This capability will likely continue to exceed the 2008 SWEIS projections until the new Radioactive Liquid Waste Treatment Facility is operational and the capability is regained. Several facilities exceeded the 2008 SWEIS levels for waste generation quantities; all were infrequent, non-routine events that do not reflect day-to-day LANL operations. Total site-wide waste generation quantities were below SWEIS projections for all waste types with one exception, chemical waste volumes in calendar year 2016 exceeded annual volumes for the Non-Key Facilities. This was the result of the disposition of press filter cakes and reject water from the Sanitary Effluent Reclamation Facility. Gas, electricity, and water consumption remained within the 2008 SWEIS levels projected for utilities in calendar years 2015 and 2016.

Background

In 1999, the U.S. Department of Energy (DOE) published a SWEIS for the continued operation of LANL. DOE issued a Record of Decision (ROD) for this document in September 1999. DOE announced in the ROD that it would operate LANL at an expanded level and that the environmental consequences of that level of operations were acceptable.

In 1999, DOE and LANL implemented the SWEIS Yearbook. The Yearbook provides DOE/National Nuclear Security Administration (NNSA) with a tool to assist decision makers in determining the continued efficacy of the SWEIS in characterizing existing operations. The Yearbook focuses on operations during specific calendar years and specifically addresses

- facility and/or process modifications or additions,
- types and levels of operations,
- environmental effects of operations, and
- site-wide effects of operations.

In August 2005, DOE/NNSA issued a memo requesting that LANL prepare a new SWEIS. The new SWEIS was issued in May 2008. The 2008 SWEIS analyzed the potential environmental impacts of future operations at LANL. In September 2008, DOE/NNSA issued the first ROD for the 2008 SWEIS. DOE/NNSA chose to implement the No Action Alternative with the addition of some elements of the Expanded Operations Alternative in the September ROD. In July 2009, DOE/NNSA issued the second ROD for the 2008 SWEIS; again DOE/NNSA chose to implement the No Action Alternative with some additional elements of the Expanded Operations Alternative.

Current Results

This Yearbook compares LANL operation data collected for calendar years 2015 and 2016 with the 2008 SWEIS projections approved in a ROD.

This Yearbook addresses capabilities and operations using the concept of "Key Facilities" as presented in the 2008 SWEIS. It also discusses the "Non-Key Facilities," which include all buildings and structures not part of a Key Facility.

Operations Levels and Operations Data Levels

The 2008 SWEIS defined capabilities and activity levels for Key and Non-Key Facilities. These operations levels for calendar years 2015 and 2015 were compared with 2008 SWEIS projections.

The 2008 SWEIS No Action Alternative and approved elements of the Expanded Operations Alternative projected 15 facility construction and modification projects within the Key Facilities. During calendar years 2015 and 2016, 15 construction/modification projects were undertaken.

- The repurposing of existing laboratory space began in the Plutonium Facility Building 04.
- Technical Area 55, Building 314 was upgraded to support the Plutonium Facility equipment installation efforts.
- A new 13-plex office trailer at Technical Area 50, Building 9008 was installed.
- A combination facility (Technical Area 55, Building 432) was installed to support the Radiological Laboratory/Utility/Office Building equipment installation project.
- Installation of ventilated enclosures and tunnel access to enable efficient entry into the Radiological Laboratory/Utility/Office Building began.
- The Technical Area 55 Reinvestment Project construction continued.
- The Trinity computer installation at the Nicholas C. Metropolis Center was completed.
- Building modification began at Technical Area 16, Building 307.
- Vertical blast walls were constructed at Technical Area 16, Building 260.
- Technical Area 36, Building 86 was modified to support the installation of a centrifuge.
- A blast tube was installed in the former rocket sled track at Technical Area 36.
- Construction of the new Dynamic Equation of State Facility began at Technical Area 40.
- Building modification and upgrades to Technical Area 40, Building 05 began.
- Construction of the replacement of the Low-level Radioactive Liquid Waste Facility began.
- Construction of the new Transuranic Waste Facility was completed.

During calendar years 2015 and 2016, six construction/modification projects were undertaken in the Non-Key Facilities.

- The Technical Area 49 Training Facility was expanded.
- An Unmanned Aerial Systems User Facility was created at Technical Area 60, Building 17.
- Construction of a new Armory Cleaning Facility Technical Area 72 was completed.
- The Oppenheimer Collaboration Center was renovated.

- Upgrades began at Fire Station One (Technical Area 03, Building 41).
- The Technical Area 03 substation replacement construction began.

During calendar year 2015, 71 capabilities were active and 15 capabilities were inactive at LANL's Key Facilities.

At the Chemistry and Metallurgy Research Building Key Facility, the following capabilities were inactive:

- destructive and nondestructive analysis,
- nonproliferation training,
- actinide research and development, and
- fabrication and processing.

At the Tritium Facilities, the following capabilities were inactive:

- high-pressure gas fills and processing,
- gas boost system testing and development,
- diffusion and membrane purification,
- metallurgical and material research, and
- hydrogen isotopic separation.

At the Los Alamos Neutron Science Center, Materials Test Station equipment was not installed.

At the Solid Radioactive and Chemical Waste Facilities, the following capabilities were inactive:

- waste retrieval,
- waste treatment,
- waste disposal, and
- decontamination operations.

At the Plutonium Facility Complex, no fabrication of ceramic-based reactor fuels took place.

During calendar year 2016, 74 capabilities were active and 12 were inactive at LANL's Key Facilities.

At the Chemistry and Metallurgy Research Building Key Facility, the following capabilities were inactive:

- destructive and nondestructive analysis,
- nonproliferation training,
- actinide research and development, and
- fabrication and processing.

At the Tritium Facilities, the following capabilities were inactive:

- diffusion and membrane purification,

- metallurgical and material research, and
- hydrogen isotopic separation.

At the Los Alamos Neutron Science Center, Materials Test Station equipment was not installed.

At the Solid Radioactive and Chemical Waste Facilities, the following capabilities were inactive:

- waste retrieval,
- waste treatment,
- waste disposal, and
- decontamination operations.

At the Plutonium Facility Complex, no fabrication of ceramic-based reactor fuels took place.

During calendar years 2015 and 2016, operation levels for one LANL facility exceeded the 2008 SWEIS capability projections. The Radioactive Liquid Waste Treatment Facility volumes of radioactive liquid waste bottoms shipped to an offsite commercial facility for treatment and disposal exceeded the 2008 SWEIS projections of 79,252 gallons (300,000 liters) per year. In calendar year 2015, 161,409 gallons (611,000 liters) were shipped offsite and in calendar year 2016, 90,875 gallons (344,000 liters) were shipped offsite. The shutdown of the radioactive liquid waste bottoms evaporator removed the capability to reduce and concentrate the liquid prior to offsite shipment. The new Radioactive Liquid Waste Treatment Facility, when operational, will have the capability for liquid volume reduction.

In calendar years 2015 and 2016, several Key Facilities exceeded 2008 SWEIS waste projections. All exceedances were due to infrequent, non-routine events. The following facilities exceeded 2008 SWEIS projections for waste generation.

Chemical Waste

- Calendar year 2015
  - High Explosives Processing Facilities – due to disposal of rain water and snow melt collected in a sump east of Technical Area 22, Building 91 and due to water and sodium thiosulfate used to flush resistors.
  - High Explosives Testing Facilities – due to disposal of extra low conductivity water from the pulsed power system at the Dual-Axis Radiographic Hydrodynamic Test Facility.
  - Radioactive Liquid Waste Treatment Facility – due to the disposal of MicroBlaze® wastewater used to flush out residual diesel fuel in holding tanks.
  - Solid Radioactive and Chemical Waste Facilities – due to the disposal of Area L sump water collected from rain and snow events and soil stabilizer mixed with water.
  - Plutonium Facility – due to disposal of cooling system descaling solution and disposal of vegetable oil solution from vehicle access gates at Technical Area 55.

- Calendar year 2016
    - High Explosives Processing Facilities – due to disposal of propylene glycol/water mixture used for maintenance operations and due to water containing ferric chloride etchant from the Technical Area 22 etching shop holding tank.
    - Solid Radioactive and Chemical Waste Facilities – due to the disposal of Area L sump water collected from rain and snow events and soil stabilizer mixed with water.

Low-Level Radioactive Waste

- Calendar year 2015
    - Radioactive Liquid Waste Treatment Facility – due to disposal of a wastewater by-product of the treatment process of radioactive liquid waste evaporator bottom at Technical Area 50.
    - Solid Radioactive and Chemical Waste Facilities – due to disposal of general cleanup items at Technical Area 54, Area G.
- Calendar year 2016
    - Radioactive Liquid Waste Treatment Facility – due to disposal of a wastewater by-product of the treatment process of radioactive liquid waste evaporator bottom at Technical Area 50.
    - Solid Radioactive and Chemical Waste Facilities – due to disposal of general cleanup items at Technical Area 54, Area G.

Mixed Low-Level Radioactive Waste

- Calendar year 2015
    - Solid Radioactive and Chemical Waste Facilities – due to the disposal of cleanup of miscellaneous electronics and lighting equipment at Technical Area 54.
- Calendar year 2016
    - Los Alamos Neutron Science Center – due to the disposal of legacy beamline components contaminated with mercury and the disposal of lead blocks used for shielding.

Site-Wide Operations Data and Affected Resources

This Yearbook evaluates the effects of LANL operations during calendar years 2015 and 2016 in three general areas: effluents to the environment, workforce and regional consequences, and changes to environmental areas for which DOE/NNSA has stewardship responsibility as the LANL administrator.

Radioactive airborne emissions from point sources (i.e., stacks) during calendar year 2015 totaled approximately 126 curies, less than 1 percent of the annual projected radiological air emissions of 34,000 curies[1] projected in the 2008 SWEIS. In calendar year 2015, maximum offsite dose to the maximally exposed individual was 0.13 millirem compared with the 8.2 millirem per year projected in the SWEIS.

Radioactive airborne emissions from point sources (i.e., stacks) during calendar year 2016 totaled approximately 254 curies, less than 1 percent of the annual projected radiological air emissions of 34,000 curies projected in the 2008 SWEIS. In calendar year 2016, maximum offsite dose to the maximally exposed individual was 0.12 millirem compared with the 8.2 millirem per year projected in the SWEIS.

Emissions of criteria pollutants were well below 2008 SWEIS projections and below the New Mexico Administrative Code, Title 20, Chapter 2, Part 73 limits.

In response to DOE Executive Order 13514, Los Alamos National Security, LLC reported its greenhouse gas emissions from stationary combustion sources to the Environmental Protection Agency for calendar years 2015 and 2016. These stationary combustion sources emitted approximately 46,312 metric tons of carbon dioxide equivalents in calendar year 2015 and 43,837 metric tons of carbon dioxide in calendar year 2016.

Since 1999, the total number of permitted outfalls was reduced from 55 to 11 and regulated under the National Pollutant Discharge Elimination System permit number NM0028355. In calendar year 2015, eight outfalls flowed totaling an estimated 110 million gallons. In calendar year 2016, eight outfalls flowed totaling an estimated 108 million gallons. These totals are well under the 2008 SWEIS projected volume of 279.5 million gallons per year.

LANL personnel performed significant groundwater compliance work in calendar years 2015 and 2016 pursuant to the New Mexico Environment Department Compliance Order on Consent. These activities included groundwater monitoring, groundwater investigations, and installation of monitoring wells in support of various groundwater investigations and corrective measures evaluations. In calendar year 2015, DOE completed installation of three new regional aquifer wells (R58, R67, and San Ildefonso Monitoring Regional SIMR-2) and four regional aquifer piezometers, (CrPZ-2 S1, CrPZ-2 S2, CrPZ-4, and CrPZ-5). In calendar year 2016, DOE completed installation of one new regional aquifer well (R68), one chromium extraction well, (CrEX-3), five chromium injection wells (CrIN-1, CrIN-2, CrIN-3, CrIN-4, CrIN-5), and eight Sandia Wetland Alluvial wells (SWA-1-1, SWA-1-3, SWA-2-4, SWA-2-5, SWA-3-7, SWA-3-9, SWA-4-10, and SWA-4-11).

In 2015, DOE prepared an environmental assessment to analyze the environmental impacts associated with implementing the chromium plume control interim measure. Groundwater extraction would occur in Mortandad Canyon. In calendar 2016, the chromium plume control interim measures were implemented.

Groundwater characterization and monitoring beneath Cañon de Valle in Technical Area 16 for RDX (1,3,5-trinitro-1,3,5-triazacyclohexane or royal demolition explosive) continued in calendar years 2015 and 2016. In calendar years 2015 and 2016, a multi-well tracer injection test was initiated in three wells in Technical Areas 09 and 16. Data collected to date indicate that

1 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. Annual radiological air emissions from 1999–2005 were used to project air emissions in the 2008 SWEIS. Emissions of activation products from the Los Alamos Neutron Science Center were much higher in those years because of a failure in one component of the emissions control system. The repair of the system in calendar year 2006 has resulted in significantly decreased emissions.

characterization of nature and extent of RDX in the perched-intermediate and regional groundwater is incomplete.

Total waste quantities from LANL operations during calendar years 2015 and 2016 were below 2008 SWEIS projections for all waste types with one exception. In calendar year 2016, site-wide chemical waste generation exceeded annual volumes for the Non-Key Facilities. This was the result of the disposition of press filter cakes and reject water from the Sanitary Effluent Reclamation Facility. Waste quantities at specific Key Facilities that exceeded the 2008 SWEIS levels were infrequent, non-routine events. The 2008 SWEIS combined transuranic and mixed transuranic waste into one waste category since they are both managed for disposal at the Waste Isolation Pilot Plant. In calendar year 2014, transuranic and mixed transuranic shipments to the Waste Isolation Pilot Plant were suspended. No waste was shipped to the Waste Isolation Pilot Plant in calendar years 2015 and 2016.

In calendar years 2015 and 2016, DOE/NNSA removed approximately 35 structures at LANL eliminating 56,370 square feet of the Laboratory's footprint.

In the 2008 SWEIS No Action Alternative, the total utility consumption projections were reduced from 1999 SWEIS projections to a number closer to the average utility consumption for the six previous years. Water consumption for calendar year 2015 was 265 million gallons and 285 million gallons for calendar year 2016. The 2008 SWEIS projection for water consumption was 459.8 million gallons. Improvements to Sanitary Effluent Reclamation Facility operations have led to increased use of recycled effluent in cooling towers in calendar years 2015 and 2016. In calendar year 2015, electricity consumption was 426,781 megawatt-hours and 462,925 megawatt-hours in calendar year 2016. The 2008 SWEIS projection for electricity consumption was 651 gigawatt-hours. Gas consumption for calendar year 2015 was 917 thousand decatherms and 899 thousand decatherms in calendar year 2016. The 2008 SWEIS projection for gas consumption was 1.20 million decatherms.

Radiological exposures to LANL workers were well within the levels projected in the 2008 SWEIS. The total effective dose equivalent for the LANL workforce in calendar year 2015 was 97.9 person-rem and 95.6 person-rem in calendar year 2016, much lower than the 280 person-rem workforce dose projected in the 2008 SWEIS. There were 114 recordable cases of occupation injury and illness in calendar year 2015 and 123 recordable cases of occupation injury and illness in 2016, which represents a 6.5 percent increase. In addition, approximately 34 cases resulted in days away, restricted, or transferred duties in calendar year 2015 and 26 cases resulted in days away, restricted, or transferred duties in calendar year 2016, representing a 33 percent decrease. Both of these rates were well below 2008 SWEIS projections.

In the 2008 SWEIS No Action Alternative, the 2005 levels of employment were projected to remain steady at 13,504. In calendar year 2015, there were 10,446 employees. At the end of calendar year 2016, there were 10,730 employees, a 3 percent increase. The total number of employees in calendar year 2016 is 21 percent below 2008 SWEIS projections.

Measured parameters for cultural resources and land resources were below 2008 SWEIS projections. Ecological resources include biological resources such as protected sensitive species, ecological processes, and biodiversity. During calendar years 2015 and 2016, LANL continued annual surveys under the Threatened and Endangered Species Habitat Management Plan. No archaeological excavations occurred on LANL property. The 1999 SWEIS projected that 15 prehistoric sites would be affected by the expansion of Area G into Zones 4 and 6 at

Technical Area 54. The 2008 SWEIS projected the disturbance of 41 acres of new land at Technical Area 54 because of the need for additional disposal cells for low-level radioactive waste. As of calendar year 2016, this expansion had not become necessary. Fourteen historic buildings were demolished in fiscal years 2015 and 2016. The 2014 National Defense Authorization Act was signed by President Obama providing legislation for the creation of the Manhattan Project National Historical Park. Los Alamos was selected as one of three locations to represent the Park, which will be jointly managed by the National Park Service and DOE under a Memorandum of Agreement between the Department of Interior and DOE that was signed on November 10, 2015.

From calendar year 2001 to 2016, approximately 3,000 acres of land were transferred to the Bureau of Indian Affairs to be held in trust for the Pueblo de San Ildefonso or conveyed to Los Alamos County. In calendar years 2015 and 2016, DOE/NNSA conveyed most of Tract A-18-A (Lower Pueblo Canyon) and all of Tract C-3 (Front Hill Road) to Los Alamos County.

CONTENTS

Figures

Tables

This page intentionally left blank.

ACKNOWLEDGMENTS

Marjorie Wright, Environmental Stewardship Group, served as the document manager for the 2015–2016 SWEIS Yearbook. Karen Musgrave, Randy Reddick, and David Holtkamp, Environmental Stewardship Group, served as chief contributors. Teresa Hiteman, Environmental Stewardship Group, provided formatting and editorial support.

Many individuals assisted in the collection of information and review of drafts. Data and information came from LANL personnel, including facility and operations personnel and those who monitor and track environmental parameters. This Yearbook could not have been completed and verified without their help. Although all individuals cannot be mentioned here, the major contributors from each of the Key Facilities and other operations are listed below.

Area of Contribution	Contributor
Air Emissions	David Fuehne
Air Emissions	Rebecca Lattin
Air Emissions	Sonja Salzman
Air Emissions	Walt Whetham
Appendix B	Walt Whetham
Bioscience	Joe Fawcett
Chemistry and Metallurgy Research Building	Steve Cossey
Cultural Resources	Kari Garcia
Decontamination, Decommissioning, and Demolition	LeRoy Hasenack
Decontamination, Decommissioning, and Demolition	Denise Liechty
Decontamination, Decommissioning, and Demolition	Denise Olivas
Decontamination, Decommissioning, and Demolition	Marc Gallegos
Ecological Resources	Charles Hathcock
Ecological Resources	Brent Thompson
Ecological Resources	Leslie Hansen
Environmental Cleanup	Joe English
Fire Station One Upgrade at Technical Area 3, Building 41	Matthew Brazil
Footprint Reduction	Denise Liechty
Geographic Information System Cartography	Ben Sutter
Groundwater	Mark Everett
High Explosives Processing Facilities	Kelkenny Bileen
High Explosives Processing Facilities	Brian Watkins
High Explosives Testing Facilities	Kelkenny Bileen
High Explosives Testing Facilities	Brian Watkins
Land Resources	Dan Pava
Liquid Effluents	Marc Bailey

Area of Contribution	Contributor
Liquid Effluents	Terrill Lemke
Liquid Effluents	Thaddeus Kostrubala
Liquid Effluents	Holly Wheeler
Liquid Effluents	Jeff Walterscheid
Los Alamos Neutron Science Center	Pattie Baucom
Machine Shops	Marc Gallegos
Materials Science Laboratory	Diane Wilburn
Nicholas C. Metropolis Center	Jason Hick
National Pollutant Discharge Elimination System Data	Marc Bailey
Offsite Source Recovery Program	Justin Griffin
Oppenheimer Collaboration Center Renovation	David Carr
Plutonium Facility Complex	Stephen Cossey
Radioactive Liquid Waste Treatment Facility	Chris Del Signore
Radiochemistry Facility	Courtney Perkins
Sanitary Waste/Recycling	Terry Foecke
Sigma Complex	Paul Dunn
Socioeconomics	Paula Padilla
Solid Radioactive and Chemical Waste Facilities	Victoria Baca
Target Fabrication Facility	Diane Wilburn
Technical Area 3 Substation Replacement Project	Craig Keller
Technical Area 49 Training Facility Expansion	Christian Rittner
Technical Area 72 Armory Cleaning Facility	Karen Rose
Tritium Facilities	Kelkenny Bileen
Tritium Facilities	Bob Lechel
Unmanned Aerial Systems User Facility	Rollin Lakis
Utilities	Maura Miller
Utilities	Andrew Erickson
Waste Data	Justin Tozer
Worker Safety/Doses	Paul Hoover
Worker Safety/Doses	Vanessa De La Cruz

ACRONYMS AND ABBREVIATIONS

ALARA	as low as reasonably achievable
AOC	area of concern
CMR	Chemical and Metallurgy Research (Building)
CMRR	CMR Replacement
Consent Order	NMED Compliance Order on Consent
DARHT	Dual-Axis Radiographic Hydrodynamic Test (Facility)
DD&D	decontamination, decommissioning, and demolition
DNA	deoxyribonucleic acid
DOE	US Department of Energy
EIS	Environmental Impact Statement
HEPA	high-efficiency particulate air (filter)
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
LANSCE	Los Alamos Neutron Science Center
linac	linear accelerator
LLW	low-level radioactive waste
Metropolis Center	Nicholas C. Metropolis Center
MeV	million electron volts
MLLW	mixed low-level radioactive waste
NEPA	National Environmental Policy Act
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyl
RDX	1,3,5-trinitro-1,3,5-triazacyclohexane or royal demolition explosive
RLUOB	Radiological Laboratory/Utility/Office Building
RLWTF	Radioactive Liquid Waste Treatment Facility

RNA	ribonucleic acid
ROD	Record of Decision
SWEIS	Site-Wide Environmental Impact Statement
SWMU	solid waste management unit
TCE	trichloroethylene
TRP	Technical Area 55 Reinvestment Project
TRU	transuranic
WETF	Weapons Engineering Tritium Facility

1.0 INTRODUCTION

1.1 Site-Wide Environmental Impact Statement

In 1999, the U.S. Department of Energy (DOE) published a Site-Wide Environmental Impact Statement (SWEIS) for Continued Operation of the Los Alamos National Laboratory (LANL or the Laboratory) (DOE 1999a). DOE issued its Record of Decision (ROD) for this SWEIS in September 1999 (DOE 1999b). The ROD identified the decisions DOE made on future levels of operation at LANL.

As per DOE regulations, in 2004 DOE/National Nuclear Security Administration (NNSA)[2] initiated preparation of a supplement analysis of the 1999 SWEIS (NNSA 2004). The purpose of the supplement analysis was to determine if the existing SWEIS remained effective. In August 2005, DOE/NNSA issued a memo requesting the preparation of a new LANL SWEIS (NNSA 2005). A new SWEIS was determined to be the appropriate level of analysis for compliance with the National Environmental Policy Act (NEPA) as a result of the required five-year adequacy review. Environmental impacts were analyzed for facility replacements and refurbishments, and projects involving operational changes at LANL.

The new SWEIS was issued in May 2008 (DOE 2008a). In September 2008, DOE/NNSA issued the first ROD for the 2008 SWEIS (DOE 2008b). Concurrently, DOE/NNSA was analyzing actions described in the "Complex Transformation Supplemental Programmatic Environmental Impact Statement Summary" (DOE 2008c). DOE/NNSA decided not to make any decisions regarding nuclear weapons production prior to the completion of the Complex Transformation Supplemental Programmatic EIS. As a result, DOE/NNSA chose the No Action Alternative for the 2008 SWEIS with the addition of some elements of the Expanded Operations Alternative in this initial ROD.

The second ROD for the 2008 SWEIS was issued in June 2009 (DOE 2009a). The ROD was based on the information and analyses contained in the 2008 SWEIS and other factors, including comments received on the SWEIS, costs, technical and security considerations, and the NNSA missions. Again, DOE/NNSA chose the No Action Alternative for the 2008 SWEIS with the addition of some elements of the Expanded Operations Alternative in this ROD.

The first supplement analysis to the 2008 SWEIS was issued in October 2009 (DOE 2009b). This analysis was prepared to determine if the 2008 SWEIS adequately bounded offsite transportation of low-specific-activity, low-level radioactive waste (LLW) by a combination of truck and rail to *EnergySolutions* in Clive, Utah. DOE/NNSA concluded that the proposed shipment of waste to *EnergySolutions* by truck and rail is bounded by the 2008 SWEIS transportation analysis.

DOE/NNSA issued a second supplement analysis to the 2008 SWEIS in April 2011 (DOE 2011a). It was prepared to assess DOE/NNSA activities of the Offsite Source Recovery Project to recover and manage high-activity beta/gamma sealed sources from Uruguay and other

2 Congress established the NNSA within the DOE to manage the nuclear weapons program for the United States. LANL is one of the facilities now managed by the NNSA. The NNSA officially began operations on March 1, 2000. Its mission is to carry out the national security responsibilities of the DOE, including maintenance of a safe, secure, and reliable stockpile of nuclear weapons and associated materials capabilities and technologies; promotion of international nuclear safety and nonproliferation; and administration and management of the naval nuclear propulsion program.

locations. DOE/NNSA published an amended SWEIS ROD in the Federal Register on July 20, 2011 (DOE 2011b), in response to the supplement analysis on the Offsite Source Recovery Project.

1.2 2008 SWEIS Yearbook

To enhance the usefulness of the 2008 SWEIS, DOE/NNSA and Los Alamos National Security, LLC (LANS) implemented a program where annual comparisons would be made between SWEIS projections and actual operations via an annual Yearbook. The Yearbook's purpose is not to present environmental impacts or environmental consequences but to provide data that could be used to develop an impact analysis.

The Yearbook addresses capabilities and operations using the concept of "Key Facilities" as presented in the SWEIS. The definition of each Key Facility hinges upon operations (research, production, services, and environmental impacts) and capabilities and is not necessarily confined to a single structure, building, or technical area. The Yearbook also discusses the "Non-Key Facilities," which include all buildings and structures not part of a Key Facility.

This Yearbook encompasses data from calendar years 2015 and 2016 and focuses on the following information.

- *Facility and process modifications or additions.* These include projected activities for which NEPA coverage was provided by the SWEIS and some post-SWEIS activities for which NEPA coverage was not provided. In the latter case, the Yearbook identifies the additional NEPA analyses (i.e., categorical exclusions, environmental assessments, or environmental impact statements [EISs]) that were prepared.

- *The types and levels of operations occurring during the calendar years (Appendix A).* Types of operations are described using capabilities defined in the 2008 SWEIS. Levels of operations are expressed in units of production, numbers of researchers, numbers of experiments, hours of operation, and other descriptive units.

- *Operations data for the Key and Non-Key Facilities, comparable to data projected in the SWEIS.* Data for each facility include waste generated, air emissions, and National Pollutant Discharge Elimination System (NPDES) outfall discharge data (Appendix A).

- *Site-wide effects of operations for the calendar year.* These include measurements of site-wide effects such as number of workers, radiation doses, workplace incidents, utility requirements, air emissions, liquid effluents, and solid wastes. These effects also include changes in ecological resources, and other resources for which DOE/NNSA has long-term stewardship responsibilities as an administrator of federal lands.

- *Conclusion.* Chapter 4 summarizes data to form the basis of the conclusion for whether or not LANL is operating within the envelope of the 2008 SWEIS.

- *Chemical usage and emissions data (Appendix B)*. These data summarize the chemical usage and air emissions by Key Facility.

- *Nuclear facilities list (Appendix C).* This appendix provides a summary of the facilities identified as having a nuclear hazard category[3] and all facility changes in hazard category through calendar year 2016.

Data for comparison come from a variety of sources, including facility records, operations reports, facility personnel, and the Annual Site Environmental Report.[4] The focus on operations, rather than on programs, missions, or funding sources, is consistent with the approach of the SWEIS.

The Yearbook provides DOE/NNSA with information needed to evaluate the adequacy of the 2008 SWEIS and enable decision making on when and if a new SWEIS is needed. The Yearbook also provides LANS managers with a guide to determine whether activities are within the SWEIS operating envelope. The Yearbook serves as a summary of environmental information collected and reported by the various groups at LANL.

1.3 Calendar Years 2015 and 2016 SWEIS Yearbook

This Yearbook represents data collected for calendar years 2015 and 2016. It compares calendar year data with 2008 SWEIS projections. The collection of data on facility operations is a unique effort. The type of information developed for the 2008 SWEIS is not routinely compiled at LANL. Nevertheless, this information is the heart of the 2008 SWEIS and the Yearbook, and the description of current operations and indications of future changes in operations are believed to be sufficiently important to warrant this effort.

In calendar year 2015, an environmental assessment was prepared to evaluate an interim measure to control chromium plume migration and maintain the 50 parts-per-billion and greater chromium contamination level within the LANL boundary while long-term corrective action remedies are evaluated and implemented. DOE determined the proposed interim measure to control the migration of a plume of chromium would not result in any significant adverse effect (DOE 2015a).

A supplement analysis to the EIS for the Chemistry and Metallurgy Research (CMR) Building Replacement Project was issued in January 2015 (DOE 2015b). The analysis was performed to determine if the EIS adequately bounds the proposed relocation of analytical chemistry and materials characterization capabilities at the Laboratory from the CMR Building to other existing LANL facilities. DOE/NNSA concluded in the supplement analysis that the EIS analysis bounds the proposed relocation of analytical chemistry and materials characterization capabilities to existing facilities.

In calendar year 2016, two supplement analyses were prepared for the 2008 SWEIS. DOE prepared the first supplement analysis to the 2008 SWEIS for the proposal to implement facility

3 DOE DOE-STD-1027-92 (DOE 1997) categorizes nuclear hazards as Category 1, Category 2, or Category 3. Because LANL has no Category 1 nuclear facilities (usually applied to nuclear reactors), definitions are presented for only Categories 2 and 3: Category 2 Nuclear Hazard – has the potential for significant onsite consequences. DOE-STD-1027-92 (DOE 1997) provides the resulting threshold quantities for radioactive materials that define Category 2 facilities. Category 3 Nuclear Hazard – has the potential for only significant localized consequences. Category 3 is designed to capture those facilities such as laboratory operations, LLW handling operations, and research operations that possess less than Category 2 quantities of material. DOE-STD-1027-92 (DOE 1997) provides the Category 3 thresholds for radionuclides.

4 The Annual Site Environmental Report was previously titled “Environment Surveillance at Los Alamos.” In 2010 the title was changed to “Los Alamos National Laboratory Environment Report.” In 2013 the title was changed to “Los Alamos National Laboratory Annual Site Environmental Report.”

modifications in order to maintain safe handling and storage, and to conduct processing studies of 60 transuranic (TRU) remediated nitrate salt waste drums at LANL. The proposal included implementing minor building modifications, installing a pressure release device with supplemental filtration, and conducting tests to determine appropriate treatment methodologies. DOE/NNSA determined the environmental impacts of the proposed actions were bounded by analyses presented in the 2008 SWEIS (DOE 2016a).

DOE prepared a second supplement analysis to the 2008 SWEIS for the proposal to treat, repackage, transport onsite and store 89 TRU waste drums for disposition at the Waste Isolation Pilot Plant. DOE determined there would be no substantial changes and the proposed actions were bounded by the analyses presented in the 2008 SWEIS (DOE 2016b).

In addition to the environmental assessment and supplement analyses written for the 2008 SWEIS, separate NEPA documents were completed in calendar years 2015 and 2016.

Seven projects were approved to proceed under existing DOE categorical exclusions.

- Pueblo Canyon Grade Control Structure Revitalization and Wetlands Stabilization at Technical Area 74 (DOE 2015c)
- Lease Extension for the Operation of a Telecommunications Tower at Los Alamos (DOE 2015d)
- Domestic Source Recovery Fiscal Year 2016 (DOE 2015e)
- Foreign Location Source Recovery Fiscal Year 2016 (DOE 2015f)
- Technical Area 3 Substation Replacement (DOE 2016c)
- Unmanned Aerial System User Facility (DOE 2016d)
- Detection and Analysis of Chemicals (DOE 2016e)

The DOE/NNSA NEPA Compliance Officer issued formal determinations on six projects that were covered under existing NEPA documents.

- Formulation and Thermal Behavior Investigations of Surrogate Waste – DOE/NNSA determined that the proposed experiments using surrogate waste designed to recreate the circumstances associated with the 55-gallon drum that breached and resulted in an airborne radiation leak at the Waste Isolation Pilot Plant were bounded within the 2008 SWEIS, High Explosives Processing Key Facility capabilities (DOE 2015g).
- Radioactive Liquid Waste Treatment Facility (RLWTF) – DOE/NNSA determined the impacts associated with the proposal to construct two radioactive liquid waste treatment facilities at Technical Area 50 to replace the existing RLWTF would be similar or less than the impacts presented in the 2008 SWEIS, Appendix G Option 2 (DOE 2015h).
- Exascale Class Computer – DOE/NNSA determined that proposed modifications to the Nicholas C. Metropolis Center (Metropolis Center) in support of the next generation of super computers (Crossroads and Commodity Technology System 2) were within the utility limits of the 2008 SWEIS. Modifications include the installation of heat exchangers, cooling towers, chilled water piping, and other related mechanical equipment based on the technological requirements. Electrical requirements would consist of the addition of power panels necessary to support the mechanical systems. Laydown areas to support

the construction efforts would be established using existing parking areas near the Metropolis Center (DOE 2016f).

- Technical Area 59 Filtration Project – DOE/NNSA determined that the proposal to modify Technical Area 59, Building 1 in support of activities for uranium, plutonium and other radionuclide processing was within the boundaries of activities previously analyzed in the "CMR Building Replacement Project Environmental Impact Statement" (DOE 2003) and ROD (DOE 2004a), the 2008 SWEIS (DOE 2008a), the 2008 and 2009 RODs (DOE 2008b, 2009a); the "Environmental Impact Statement for the Proposed Relocation of Technical Area 18 Capabilities and Material" (DOE 2002a) ROD (DOE 2002b); and DOE categorical exclusion B2.5 Facility Safety and Environmental Improvements (DOE 2016g).
- Increased number of safety and mechanical tests – DOE/NNSA determined there were no environmental impacts associated with an increased number of safety and mechanical tests done in the High Explosives Processing Key Facility (DOE 2016h).
- Increase Production of Medical and Industrial Radioisotopes – DOE/NNSA determined the proposal to expand production of medical and industrial radioisotopes to meet increasing market demand was within the boundaries of activities previously analyzed in the 2008 SWEIS (DOE 2016i).

2.0 FACILITIES AND OPERATIONS

LANS manages 976 buildings, trailers, and transportable buildings containing 8.2 million square feet under roof, spread over an area of approximately 40 square miles of land owned by the United States government and administered by DOE/NNSA and the DOE Office of Science. Much of the undeveloped area at LANL provides a buffer for security, safety, and possible future expansion. Approximately 41 percent of the square footage at the site is considered laboratory or production space; the remaining square footage is considered administrative, storage, service, and other space. While the number of structures changes with time (there is frequent addition or removal of temporary structures and miscellaneous buildings), the current breakdown is approximately 803 permanent buildings and 173 temporary structures (trailers and transportable buildings). In calendar years 2015 and 2016, LANS leased approximately 39 additional buildings and DOE leased one building within the Los Alamos town site and Carlsbad, New Mexico.

To present a logical, comprehensive evaluation of the potential environmental impacts at LANL, the 1999 SWEIS (DOE 1999a) developed the Key Facility concept, a framework for analyzing the types and levels of activities performed across the entire site. This framework assisted in analyzing the impacts of activities in specific locations (technical areas) and the impacts related to specific programmatic operations (Key Facilities and capabilities). Taken together, the 15 Key Facilities represent the majority of environmental risks associated with LANL operations. The 15 Key Facilities identified are critical to meeting mission assignments and

- house operations that have the potential to cause significant environmental impacts,
- are of most interest or concern to the public (based on comments in the 1999 and 2008 SWEIS public hearings), or
- might be subject to change because of DOE/NNSA programmatic decisions.

In 2008, Pajarito Site (Technical Area 18) was placed into surveillance and maintenance mode. All operations ceased and the facility was downgraded to a Less-than-Hazard Category 3 Nuclear Facility (radiological facility) (LANL 2017a). For the purpose of the 2008–2016 SWEIS Yearbooks, Pajarito Site has been removed as a Key Facility. In addition, the 2008 SWEIS recognized the Metropolis Center, also known as the Strategic Computing Complex, as a new Key Facility because of the amounts of electricity and water it uses.

Since the issuance of the 2008 SWEIS, DOE/NNSA and LANS have published three lists identifying nuclear facilities at LANL (LANL 2017a). Appendix C provides a summary of the current nuclear facilities, and a table has been added to each section of Chapter 2 to identify the nuclear facilities currently listed by DOE/NNSA within a Key Facility. In December 2016, the TRU Waste Facility at Technical Area 63 was added as a Hazard Category 2 facility (LANL 2017a).

The definition of each Key Facility hinges upon operations[5], capabilities, and location, but is not necessarily confined to a single structure, building, or technical area. The number of structures composing a Key Facility ranges from one (e.g., the Target Fabrication Facility) to more than 400 structures comprising the Los Alamos Neutron Science Center (LANSCE) Key Facility. Key Facilities can also exist in more than a single technical area, as is the case with the High Explosives Testing and High Explosives Processing Key Facilities, which exist in all or part of five and six technical areas, respectively.

This chapter discusses each of the 15 Key Facilities from three aspects: significant facility construction and modifications, types and levels of operations, and environmental effects of operations that have occurred during calendar years 2015 and 2016. Each of these three aspects is given perspective by comparing them with projections made in the 2008 SWEIS. This comparison provides an evaluation of whether or not data resulting from LANL operations continue to fall within the environmental envelope established in the 2008 SWEIS. Modifications and construction activities that were completed prior to calendar years 2015 and 2016 are summarized in previous Yearbooks.

This chapter also discusses Non-Key Facilities, which include buildings and structures not part of a Key Facility and make up the majority of LANL facilities. The Non-Key Facilities represent a significant fraction of LANL and comprise all, or the majority of, 30 of the 49 technical areas, including Technical Area 00, which consists of leased space within the Los Alamos town site, White Rock, and Technical Area 57 at Fenton Hill. Non-Key Facilities comprise approximately half of LANL land. The Non-Key Facilities include important buildings and operations such as the Nonproliferation and International Security Center; the National Security Sciences Building, the main administration building; and the Technical Area 46 Sanitary Wastewater System. Routine maintenance, support activities, safety and environmental improvements, and footprint reduction are on-going at LANL. These activities are described in Appendix L of the 2008 SWEIS (DOE 2008a).

Table 2-1 identifies and compares the acreage of the 15 Key Facilities and the Non-Key Facilities. Figure 2-1 shows the location of LANL within northern New Mexico, Figure 2-2 illustrates the locations of the technical areas and the Key Facilities.

---

5 As used in the 1999 and 2008 SWEISs and this Yearbook, facility operations include three categories of activities: research, production, and services to other LANL organizations. Research is both theoretical and applied. Examples include modeling (e.g., atmospheric weather patterns) to subatomic investigations (e.g., using the Los Alamos Neutron Science Center linear accelerator) to collaborative efforts with industry (e.g., fuel cells for automobiles). Production involves delivery of a product, such as plutonium pits or medical radioisotopes. Examples of services provided to other LANL facilities include utilities and infrastructure support, analysis of samples, environmental surveys, and waste management.

Table 2-1. Key and Non-Key Facilities

Key Facility	Technical Areas	Size (acres)
Chemistry and Metallurgy Research (CMR) Building	03	14
Sigma Complex	03	10
Machine Shops	03	7
Materials Science Laboratory	03	2
Nicholas C. Metropolis Center (Metropolis Center)	03	5
High Explosives Processing Facilities	08, 09, 11, 16, 22, and 37	1,115
High Explosives Testing Facilities	15, 36, 39, and 40	8,691
Tritium Facility	16	18
Target Fabrication Facility	35	3
Bioscience Facilities	43, 03, 16, 35, and 46	4
Radiochemistry Facility	48	116
Radioactive Liquid Waste Treatment Facility (RLWTF)	50	62
Los Alamos Neutron Science Center (LANSCE)	53	751
Solid Radioactive and Chemical Waste Facilities	50 and 54	943
Plutonium Facility Complex	55	93
Subtotal, Key Facilities	19 of 49 technical areas	11,834
All Non-Key Facilities	30 of 49 technical areas	13,920
Total: LANL		**25,754***

* Updated DOE-owned land boundaries in 2017.

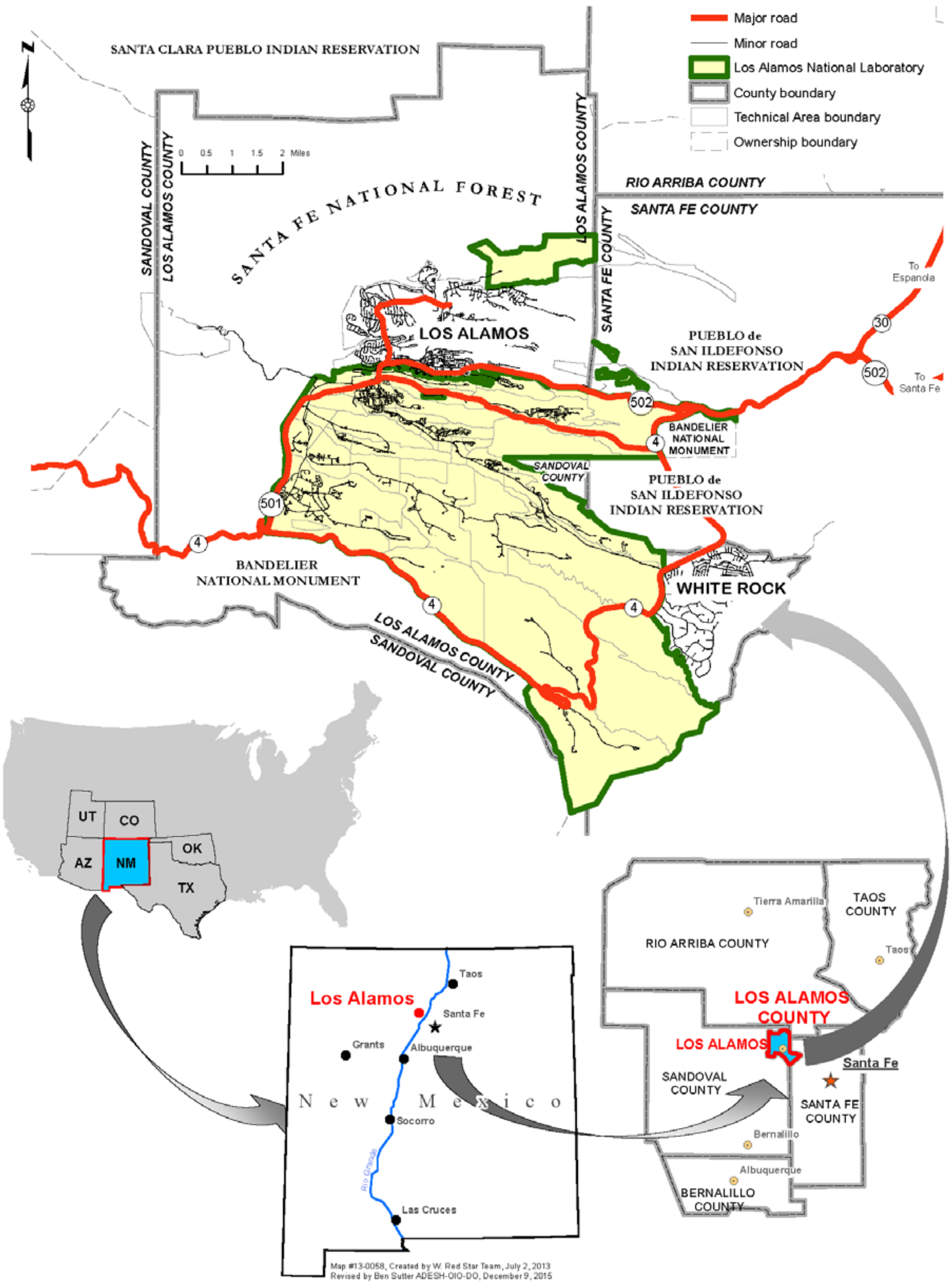


Figure 2-1. Location of LANL

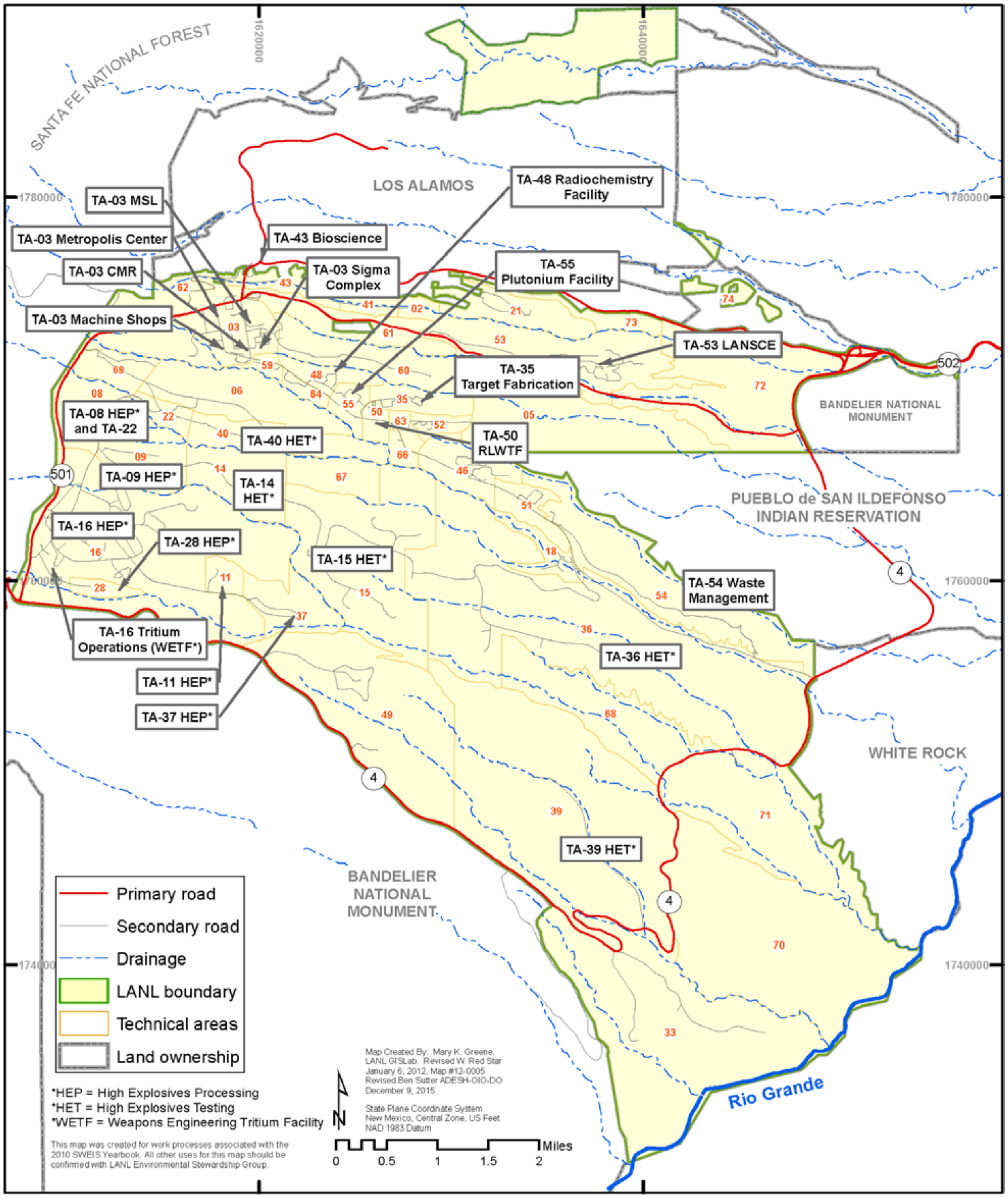


Figure 2-2. Location of technical areas and Key Facilities

2.1 Chemical and Metallurgy Research Building (Technical Area 03)

The CMR Building was designed and constructed to the 1949 Uniform Building Code and occupied in 1952 to house analytical chemistry, plutonium metallurgy, uranium chemistry, and engineering design and drafting activity. At the time the 1999 SWEIS was issued, the CMR Building was described as a “production, research, and support center for actinide chemistry and metallurgy research and analysis, uranium processing, and fabrication of weapon components” (DOE 1999a).

The CMR Building consists of three floors: basement, first floor, and attic. It has seven independent wings connected by a common corridor.

As shown in Table 2-2, the CMR Building was designated a Hazard Category 2 Nuclear Facility in the 2008 SWEIS (DOE 2008a).

Table 2-2 and the Nuclear Hazard Classification tables in the other sections of this Yearbook reflect the data in the published lists of LANL Nuclear Facilities. The most recent list of LANL nuclear facilities was published in calendar year 2017.

Table 2-2. CMR Buildings with Nuclear Hazard Classification

Building	Description	2008 SWEIS	LANL 2015*	LANL 2016*
Technical Area 03, Building 29	CMR	2	2	2

* List of LANL nuclear facilities (LANL 2017a).

2.1.1 Construction and Modifications at the CMR Building

The 2008 SWEIS projected two changes to this Key Facility.

- Replace the CMR Building: Construct and operate a CMR Replacement (CMRR) Nuclear Facility at Technical Area 55.
- Conduct decontamination, decommissioning, and demolition (DD&D) of the CMR Building.

In November 2003, DOE/NNSA issued an EIS for the CMRR Project (DOE 2003) that evaluated the potential environmental impacts resulting from activities associated with consolidating and relocating the mission-critical CMR Building capabilities at LANL and replacement of the CMR Building. In its ROD issued in February 2004, DOE/NNSA decided to replace the CMR Building with a new CMRR Nuclear Facility at Technical Area 55 and to completely vacate and demolish the CMR Building (DOE 2004a). The ROD stated that the new facility would be established as a Hazard Category 2 Nuclear Facility. In January 2005, a supplement analysis (DOE 2005) to the CMRR EIS was written to determine if the environmental impacts of proposed changes to the location of the CMRR Nuclear Facility components were adequately addressed in the CMRR EIS. DOE/NNSA determined that the proposed actions were adequately bounded by the analyses of impacts projected by the 2003 CMRR EIS, and at the time no supplemental CMRR EIS was required. The CMRR Nuclear Facility would replace the CMR Building as the Key Facility.

On September 28, 2010, DOE/NNSA published a notice of intent to prepare a Supplemental EIS for the CMRR Nuclear Facility. Since the issuance of the CMRR EIS ROD in 2004, new geologic information regarding seismic conditions caused DOE/NNSA to change some design aspects of the CMRR Nuclear Facility. The Supplemental EIS assessed potential environmental impacts of these proposed changes and of the construction and operation of the nuclear facility portion of the CMRR (DOE 2011c). The notice of intent was followed by a 30-day scoping/public comment period.

An amended ROD was issued on October 12, 2011 (DOE 2011d). DOE/NNSA selected the Modified CMRR Nuclear Facility Alternative described in the Supplemental EIS to proceed with the design and construction of the nuclear facility at LANL. On February 13, 2012, DOE/NNSA deferred the CMRR Nuclear Facility, and on August 21, 2014, Deputy Secretary of Energy Daniel Poneman approved the cancellation of the CMRR Nuclear Facility.

Construction of the Radiological Laboratory/Utility/Office Building (RLUOB) was completed in calendar year 2012. In August 2014, radiological operations began.

In 2014, DOE/NNSA prepared a supplement analysis to the CMRR EIS (DOE 2015b) to analyze the proposal to relocate analytical chemistry and materials characterization capabilities from the CMR Building to other LANL facilities. In January 2015, DOE/NNSA determined that modifications to Technical Area 55, Building 4 and RLUOB that would provide the full suite of analytical chemistry and materials characterization capabilities did not represent a substantial change in environmental impacts as described in the CMRR EIS.

In calendar years 2015 and 2016, construction activities began for relocating analytical chemistry and materials characterization capabilities out of the CMR Building. The repurposing of existing laboratory space began in the Plutonium Facility Building 04. Work included the DD&D of gloveboxes, modification of existing ventilated enclosures, and procurement and installation of new ventilated enclosures in several laboratory spaces. In RLUOB, work included the procurement of new ventilated enclosures, beginning installation of the enclosures, and tunnel access to enable efficient entry and egress for crews. The Technical Area 55, Building 314 warehouse was upgraded to support the Plutonium Facility equipment installation efforts. A new 13-plex office trailer at Technical Area 50, Building 9008 was installed to support additional project staff. A combination facility (Technical Area 55, Building 432) for supporting the RLUOB equipment installation construction work and materials staging was constructed adjacent to the RLUOB facility.

During calendar year 2003, modifications to Wing 9 in the CMR Building were started in support of the Confinement Vessel Disposition Project that would provide for the disposition of large vessels previously used to contain experimental explosive shots involving various actinides. NEPA coverage for this project was provided by a supplement analysis to the “1999 Site-Wide Environmental Impact Statement for Continued Operation of LANL for the Proposed Disposition of Certain Large Containment Vessels” (DOE 2004b). The project was placed on hold in 2004 because DOE/NNSA determined that the project was a major modification. This decision was later rescinded and the project moved forward in 2009. In calendar year 2010, installation of the confinement vessel disposition enclosure and glovebox began. In 2011, the work to complete the confinement vessel disposition enclosure continued. Startup activities began in calendar year 2012. Vessel processing began in calendar year 2014. One vessel was processed in 2015 and two vessels were processed in 2016.

2.1.2 Operations at the CMR Building

The 2008 SWEIS identified seven capabilities for this Key Facility. Three of the seven capabilities were active in calendar years 2015 and 2016, and all three were below operational levels projected in the 2008 SWEIS (Table A-1).

2.1.3 Operations Data at the CMR Building

Operations data levels at the CMR Building remained below levels projected in the 2008 SWEIS. Table A-2 provides operations data details.

2.2 Sigma Complex (Technical Area 03)

The Sigma Complex Key Facility consists of four principal buildings: the Sigma Building (03-66), the Beryllium Technology Facility (03-141), the Press Building (03-35), and the Forming Building (03-159; previously referred to as the Thorium Storage Building), as well as several support and storage facilities. The Press Building ceased operations in 1987. In calendar year 2015, utilities were disconnected. In calendar year 2016, demolition of the building began. Demolition was completed in calendar year 2017. The primary activities at the Sigma Complex are the fabrication of metallic and ceramic items, characterization of materials, and process research and development.

2.2.1 Construction and Modifications at the Sigma Complex

The 2008 SWEIS projected no new construction or major modifications to this Key Facility. However, in calendar year 2016, a 3,000-square-foot addition was proposed to be added on the northeast corner of the main Sigma building. Construction of the addition is anticipated to begin in calendar year 2018. This additional space will allow the consolidation of uranium machining from the Machine Shops Key Facility in Technical Area 03, Building 102.

2.2.2 Operations at the Sigma Complex

The 2008 SWEIS identified three capabilities for the Sigma Complex. All three of the capabilities were active in calendar years 2015 and 2016 and all were below operational levels projected in the 2008 SWEIS (Table A-3).

2.2.3 Operations Data for the Sigma Complex

Operations data levels at the Sigma Complex remained below levels projected in the 2008 SWEIS.

2.3 Machine Shops (Technical Area 03)

The Machine Shops Key Facility consists of two buildings, the Nonhazardous and Hazardous Materials Machine Shop (03-39) and the Radiological Hazardous Materials Machine Shop (03-102). Both buildings are located within the same fenced area. Activities consist primarily of machining, welding, fabrication, inspection, and assembly of various materials in support of many LANL programs and projects.

2.3.1 Construction and Modifications at the Machine Shops

The 2008 SWEIS projected no new construction or major modifications to the Machine Shops. However, a radiological area or a beryllium area is proposed to be installed in Building 39 for the inspection of machined depleted uranium or beryllium parts.

2.3.2 Operations at the Machine Shops

The 2008 SWEIS identified three capabilities at the Machine Shops. All three of the capabilities were active in calendar years 2015 and 2016 and all were below operational levels projected in the 2008 SWEIS (Table A-5). The workload at the Machine Shops is directly linked to research and development and production requirements.

2.3.3 Operations Data for the Machine Shops

Operations data levels at the Machine Shops remained below levels projected in the 2008 SWEIS. Table A-6 provides operations data details.

2.4 Materials Science Laboratory (Technical Area 03)

The Materials Science Laboratory Complex comprises several buildings in Technical Area 03 (32, 34, 1415, 1420, 1698, 1819, and 2002). Building 1698 is the main laboratory in the complex and is a two-story, approximately 55,000-square-foot building that contains 27 laboratories, 60 offices, and 21 materials research and support areas.

This Key Facility supports four major types of experimentation: materials processing, mechanical behavior in extreme environments, advanced materials development, and materials characterization.

2.4.1 Construction and Modifications at the Materials Science Laboratory Complex

The 2008 SWEIS projected no new construction or major modifications to this Key Facility.

2.4.2 Operations at the Materials Science Laboratory Complex

The 2008 SWEIS identified five capabilities at the Materials Science Laboratory Complex.[6] In calendar years 2015 and 2016, all five of the capabilities were active and all were below operational levels projected in the 2008 SWEIS (Table A-7).

2.4.3 Operations Data for the Materials Science Laboratory

Operations data levels at the Materials Science Laboratory remained below levels projected in the 2008 SWEIS. Table A-8 provides operations data details.

2.5 Nicholas C. Metropolis Center for Modeling and Simulation (Technical Area 03)

The Metropolis Center was listed as a Key Facility in the 2008 SWEIS. The Metropolis Center began operating in 2002 and is housed in a three-story, 303,000-square-foot structure in Technical Area 03, Building 2327. It is the home of the Trinity Supercomputer (one of the

6 As stated in the 2014 SWEIS Yearbook, a new capability was added to the Materials Science Laboratory Complex Key Facility for applied energy research (LANL 2016a).

world's fastest and most advanced computers), which is an integral part of the tri-laboratory (LANL, Lawrence Livermore National Laboratory, and Sandia National Laboratories) mission to maintain, monitor, and ensure the Nation's nuclear weapons performance through the Advanced Simulation and Computing Program. The Metropolis Center, together with the Laboratory Data Communication Center, the Central Computing Facility, and the Advanced Computing Laboratory, forms the center for high-performance computing at LANL.

The impacts associated with operating the Metropolis Center at an initial capacity of a 50-teraflop[7] platform were analyzed in the "Environmental Assessment for the Proposed Strategic Computing Complex, Los Alamos National Laboratory, Los Alamos, New Mexico" (DOE 1998) and the associated Finding of No Significant Impact. The 2008 SWEIS analyzed the proposed increase in the operating platform beyond 50 teraflops to support approximately 1,000 teraflops (1 petaflop).

The exact level of operations supported at the Metropolis Center cannot be directly correlated to a set amount of water or electrical power consumption. Each new generation of computing capability machinery continues to be designed with enhanced efficiency in terms of both electricity consumption and cooling requirements. The 2008 SWEIS analyzed 15 megawatts of electrical usage and 51 million gallons per year (193 million liters) of potable water to be used at the Metropolis Center.

2.5.1 Construction and Modifications at the Metropolis Center

The 2008 SWEIS projected one facility modification at this Key Facility.

- Installation of additional processors to increase functional capability. This expansion would involve the addition of mechanical and electrical equipment, including chillers, cooling towers, and air conditioning units.

The Metropolis Center was initially constructed to have adequate power and cooling for the first computer, and space was allocated for future expansion of the electrical and mechanical systems as new and more powerful computers arrived.

There have been several supercomputers housed in the Metropolis Center, including Lightning, Bolt, Redtail, Hurricane, Roadrunner, Cielo, and now Trinity. In preparation for these machines, the electrical and mechanical systems in the Key Facility were expanded to meet the new computers' requirements.

To prepare the Metropolis Center for the arrival of the next computer, Trinity, in 2015, an upgrade to the power and cooling systems at the site was required. Five 1,200-ton open cell cooling towers, four large heat exchangers, primary and secondary process pumps, and a large amount of carbon steel piping material was installed in 2014. In addition, two 3,000-amp electrical substations were installed, and power distribution was reconfigured to maximize power efficiency. This reconfiguration maintains power redundancy and reliability to vital components of computing systems on the computer floor. Construction began in October 2013 and was substantially completed by the end of calendar year 2014. Although Trinity may exceed water and electrical use limits analyzed in the 2008 SWEIS for the Metropolis Center, DOE/NNSA determined that increases requiring more than 15 megawatts of electricity or 51 million gallons

7 A teraflop is a measure of a computer's speed and can be expressed as: a trillion floating point operations per second, 10 to the 12th power floating-point operations per second, 2 to the 40th power flops.

(193 million liters) of water per year would be covered by 2008 SWEIS site-wide utility limits, not specific facility limits.

In 2015, preparation and planning for the Exascale Class Computer Cooling Equipment Project commenced. The project prosed to expand the cooling capability of the Metropolis Center by 4,800 tons. The project will add approximately five 1,200-ton open cell cooling towers, heat exchangers, process pumps, and carbon steel piping to expand the current cooling system. The Crossroads and second generation of Commodity Technology Systems is expected to be operational by 2020 and will require additional cooling and power for up to 500 petaflops of computing. Work also commenced on modifying the power distribution within the Metropolis Center to maximize power to the computer floor.

In 2016, the DOE/NNSA NEPA Compliance Officer approved the NEPA determination for this project (DOE 2016f). It was determined that the Metropolis Center could support up to 500 petaflops with an anticipated electrical power load of 21 megawatts requiring approximately 20 million gallons (75.7 million liters) per year of potable water and 73 million gallons (276 million liters) per year of reclaimed water from the Sanitary Effluent Reclamation Facility. Although these water and electrical requirements exceed the consumption limits projected in the 2008 SWEIS for the Metropolis Center Key Facility, they remain within utility limits for all operations and activities at LANL in the 2008 SWEIS.

2.5.2 Operations at the Metropolis Center

The 2008 SWEIS identified one capability at the Metropolis Center. This capability was active in calendar years 2015 and 2016 and was performed at operational levels projected in the 2008 SWEIS (Table A-9).

As described in the 2008 SWEIS, the Metropolis Center computing platform would expand the capabilities and operations levels to increase functional capability. Computer operations are performed 24 hours a day, with personnel occupying the control room around the clock to support computer operation activities. Operations consist of office-type activities, light laboratory work such as computer and support equipment assembly and disassembly, and computer operations and maintenance. The Metropolis Center has capabilities to enable remote-site user access to the computing platform, and its co-laboratories and visualization theatres are equipped for distance operations to allow collaboration between weapons designers and engineers across the DOE weapons complex.

Computer simulations have become the only means of integrating the complex processes that occur in the nuclear weapon lifespan. Large-scale calculations are now the primary tools for estimating nuclear yield and evaluating the safety of aging weapons in the nuclear stockpile. Continued certification of aging stockpile safety and reliability depends upon the ability to perform highly complex, three-dimensional computer simulations.

2.5.3 Operations Data for the Metropolis Center

The environmental measure of activities at the Metropolis Center is the amount of electricity and water it uses. The 2008 SWEIS analyzed the operating levels to be supported by approximately 15 megawatts of electrical power and 51 million gallons (193 million liters) per year of groundwater.[8] The Metropolis Center water consumption is currently metered. Water usage is monitored daily and reported monthly. In calendar year 2015, the Metropolis Center used approximately 8.8 megawatts of electricity, 5.2 million gallons (19.6 million liters) of groundwater, and 26.9 million gallons (112 million liters) of reclaimed water from the Sanitary Effluent Reclamation Facility. In calendar year 2016, the Metropolis Center consumed approximately 11.2 megawatts of electricity, 5.4 million gallons (20.4 million liters) of groundwater, and 24.8 million gallons (93.8 million liters) of reclaimed water from the Sanitary Effluent Reclamation Facility. Operations data levels at the Metropolis Center remained below levels projected in the 2008 SWEIS. Table A-10 provides operations data details.

2.6 High Explosives Processing Facilites (Technical Areas 08, 09, 11, 16, 22, and 37)

High Explosives Processing Facilities are located in all or parts of six LANL technical areas. Building types include production and assembly facilities, analytical and synthesis laboratories, test facilities, explosives storage magazines, units for treating hazardous explosive waste by open burning, and a facility for treatment of explosive-contaminated wastewaters. Activities consist primarily of manufacture and assembly of detonators for nuclear weapons, and high explosives components for Science-Based Stockpile Stewardship Program tests and experiments, and work conducted under the global security/threat reduction missions. Environmental, performance, and safety tests are performed at Technical Areas 11 and 09. Technical Area 08 houses nondestructive testing including radiography and ultrasonic activities.

Operations are performed by personnel in multiple directorates, divisions, and groups. These operations include high explosives manufacturing and assembly work, chemical synthesis of new explosives, explosives analytical and testing services, research and development of new initiation systems, production of stockpile detonators and initiation devices, and nondestructive testing and evaluation. All explosives at LANL are managed through this Key Facility where explosives are stored as raw materials, pressed into solid shapes, and machined to customers' specifications (this occurs at Technical Area 16, Building 260). The completed shapes are shipped to customers both onsite and offsite for use in experiments and open detonations. Personnel at Technical Area 09 produce a small quantity of high explosives from basic chemistry and laboratory-scale synthesis operations. Other groups use small quantities of explosives for manufacturing and testing of detonators and initiating devices. Detonable explosives waste from pressing and machining operations and excess explosives are treated by open burning or open detonation.

Information from multiple divisions is combined to capture operational parameters for manufacturing, production, and processing high explosives.

8 The 2008 SWEIS analyzed 15 megawatts of electrical power and 51 million gallons (193 million liters) of groundwater. However, future editions of the SWEIS Yearbooks will compare Metropolis Center building performance compared with LANL site-wide consumption values rather than just to the Metropolis Center. DOE determined that greater consumption of energy and water at the Metropolis Center, that is less than the 2008 SWEIS bounding site-wide analysis, would have a "negligible effect" on the environment (DOE 2016f).

2.6.1 Construction and Modifications at the High Explosives Processing Facilities

The 2008 SWEIS projected the following modifications to this Key Facility.

- Complete construction of the Technical Area 16 Engineering Complex. The construction of this complex was never initiated and the project was cancelled.
- Removal or demolition of vacated structures that are no longer needed.

In calendar year 2015, Technical Area 16, Buildings 542 and 201 were demolished or removed (see section 3.11 for more details). No structures were demolished or removed during calendar year 2016. Upgrades, such as the installation of a heating, ventilation, and air conditioning system; the installation of fire alarm connections; and electrical upgrades at Technical Area 16, Building 301 were initiated in calendar year 2015 and completed in calendar year 2016. Modifications to Technical Area 16, Building 307 were initiated in calendar year 2016. Work consisted of levelling the floor in Building 307, the installation of a concrete pad, and the installation of a thermal chamber and heat exchanger in support of safety and environmental testing for stockpile assurance. In calendar year 2016, several vertical blast walls used to divert blast waves away from adjacent work bays in the event of an accident were constructed at Technical Area 16, Building 260. The blast walls are stand-alone structures that can be easily removed from the historic building.

2.6.2 Operations at the High Explosives Processing Facilities

The 2008 SWEIS identified six capabilities at this Key Facility. All six capabilities were active in calendar years 2015 and 2016 and all were below operational levels projected in the 2008 SWEIS (Table A-11). The 2008 SWEIS projected that personnel at the Technical Area 11 High Explosives Processing Key Facility would conduct up to 15 safety and mechanical tests per year. In calendar 2016, DOE/NNSA determined that the number of safety and mechanical tests performed annually was not a good parameter to use as a measurement of environmental effects and removed the numerical limitation (DOE 2016h). The plastics research and development capability is currently being performed in other facilities.

The total amount of explosives and mock explosives used across all activities is an indicator of overall activity levels for this Key Facility. Amounts projected in the 2008 SWEIS were 82,700 pounds of explosives and 2,910 pounds of mock explosives. In calendar year 2015, less than 7,500 pounds of high explosives and less than 600 pounds of mock explosives material were used in the fabrication of test components for internal and external customers. In calendar year 2016, less than 10,000 pounds of high explosives and less than 800 pounds of mock explosives materials were used in the fabrication of test components. In calendar year 2015, materials tested at Technical Area 09 resulted in shots expended within the High Explosives Testing Key Facility and 1,190 grams of explosives. In calendar year 2016, materials tested at Technical Area 09 resulted in 608 shots expended within the High Explosives Testing Key Facility and 1,216 grams of explosives. Materials testing at Technical Area 22 expended less than 4 pounds of pentaerythritol tetranitrate-based detonators.

In calendar years 2015 and 2016, high explosives processing and high explosives laboratory operations generated approximately 60,363 gallons (228,498 liters) of explosive-contaminated water annually, which was treated at the High Explosives Wastewater Treatment Facility using an evaporator system resulting in zero liquid discharge. All high explosives burning operations are conducted at Technical Area 16, Building 388. There were approximately 2,400 pounds of water-saturated high explosives and 1,000 pounds of high explosives-contaminated scrap metal treated annually. No explosives-contaminated solvents were treated. Approximately 2,000 gallons (7,570 liters) of propane were expended annually to treat these materials. Non-detonable, explosive-contaminated equipment was steam cleaned in Technical Area 16, Building 260 and salvaged or sent for recycling.

In calendar years 2015 and 2016, efforts continued to develop protocols for obtaining stockpile-returned materials, develop new test methods, and procure new equipment to support requirements for science-based studies on stockpile and energetic materials.

2.6.3 Operations Data for the High Explosives Processing Facilities

Operations data levels at the High Explosives Processing Facilities were below levels projected in the 2008 SWEIS with two exceptions.

In calendar year 2015, chemical waste generation at the High Explosives Processing Facilities exceeded 2008 SWEIS projections because of rain water and snow melt that collected in the old truck sump east of Technical Area 22, Building 91, which accounted for approximately 34 percent (13,607.8 kilograms) of chemical waste generated. Water and sodium thiosulfate used to flush liquid resistors to control any biological growth accounted for approximately 34 percent (13,606.9 kilograms) of chemical waste generated at the High Explosives Processing Facilities.

In calendar year 2016, chemical waste generation at the High Explosives Processing Facilities exceeded 2008 SWEIS projections because of the propylene glycol/ water mixture used for Weapons Facility maintenance operations, which accounted for approximately 43 percent (13,607.77 kilograms) of chemical waste generated. An additional 16 percent (4,981 kilograms) of chemical waste was generated from recirculating water containing ferric chloride etchant (2,504 kilograms) or sodium hydroxide and water (2,477 kilograms) from the Technical Area 22 etching shop holding tank.

All of the exceedances in calendar years 2015 and 2016 were one-time, non-routine events that do not reflect day-to-day LANL operations. The 2008 SWEIS Table A-12 provides operations data details.

2.7 High Explosives Testing Facilities (Technical Areas 14, 15, 36, 39, and 40)

High Explosives Testing Facilities, located in all or parts of five technical areas, comprise more than half (22 square miles) of the land area occupied by LANL and have 16 associated firing sites. All firing sites (sites specifically designed to conduct experiments with explosives) are situated in remote locations within canyons. Major buildings are located at Technical Area 15 and include the Dual-Axis Radiographic Hydrodynamic Test (DARHT) Facility (Building 312) and the Vessel Preparation Building (Building 534). Building types consist of preparation and assembly facilities, bunkers, analytical laboratories, high explosives storage magazines, and offices. Activities consist primarily of testing munitions and high explosives components for nuclear weapons and for Science-Based Stockpile Stewardship Program tests and experiments for threat reduction and other national security programs.

2.7.1 Construction and Modifications at the High Explosives Testing Facilities

The 2008 SWEIS projected the following modifications to this Key Facility.

- Complete construction of 15 to 25 new structures within the Two-Mile Mesa Complex (Technical Area 22) to replace 59 structures currently used for dynamic experimentation.
- Remove or demolish vacated structures that are no longer needed.

The construction of new facilities within the Two-Mile Mesa Complex was not pursued in calendar years 2015 and 2016; however, modifications and upgrades to existing facilities were initiated in calendar years 2015 and 2016.

In 2011, phase one of an upgrade to the aboveground mineral oil storage tanks at Technical Area 15, Building 313, the Radiographic Support Laboratory, was initiated with the decommissioning of one existing tank, structure 15-436. In calendar year 2013, the second tank, structure 15-435, was decommissioned in preparation for phase two installation of a double-walled replacement tank. The installation was completed in 2017 but is still pending approval from the New Mexico Environment Department (NMED).

In calendar year 2016, the operations and equipment of two firing sites within Technical Area 36 (Lower Slobbovia firing site [36-12] and Eenie firing site [36-03]) were swapped in order to reduce fire risk. Explosive shots previously conducted at Eenie firing site posed a greater fire risk because of the amounts of pyrophoric materials used compared with those typically fired at Lower Slobbovia. Eenie firing site is located near the edge of Potrillo Canyon and adequate tree thinning was not feasible because of the proximity to the canyon. Lower Slobbovia's site characteristics and topography are better suited for larger pyrophoric shots; therefore, the equipment and operations from Eenie firing site were moved to the Lower Slobbovia firing site.

A new control room facility was proposed in calendar year 2015 at Technical Area 11 (K-Site) to monitor safety and mechanical testing operations in Building 30. Construction began in calendar year 2017.

In calendar year 2015, Technical Area 36, Building 86, the former pulsed intense (flash) x-ray machine building, was modified to support the installation of a centrifuge. The centrifuge facilitates high G (high levels of acceleration) testing and experimentation on a variety of materials and live high explosives assemblies. In addition, a blast tube was installed in the former rocket sled track location within Lower Slobbovia to allow precision shock wave studies to be conducted. The centrifuge and blast tube were installed during calendar years 2015 and 2016 and completed in 2017.

A new steel building at Technical Area 40, Building 15 will be constructed to enclose the existing firing point. The purpose of the upgrade is to create a new indoor firing facility that will allow for year-round mission capability. The project began in calendar year 2016 and is expected to be completed in calendar year 2018.

In calendar year 2015, DOE/NNSA proposed the construction of the new Dynamic Equation of State Facility. The facility is a 15,000-square-foot facility at Technical Area 40 that will consolidate Technical Area 39 powder and gas gun activities. This facility will relocate three gas gun facilities from Technical Area 39 (Ancho Canyon) to Technical Area 40 while closing the gas gun facilities and their supporting structures in Technical Area 39. This new facility will replace six facilities and reduce the Laboratory footprint by approximately 5,000 square feet.

Construction of this facility began in calendar year 2017 is anticipated to be completed in 2018. When operational, this facility will enhance operational efficiencies and reduce operational costs.

Building modifications and upgrades to Technical Area 40, Building 05 began in calendar year 2016 and were completed in calendar year 2017. Upgrades and modifications include installing new Armag®[9] units, a new exhaust fan, new electrical outlets to power the Armag® units, a new inlet for storm drainage, and the removal of the existing exterior steel blast shields.

Cleanup efforts at the Pulsed High-Energy Radiographic Machine Emitting X-Rays Facility were initiated in calendar year 2010. The cleanup effort was completed in calendar year 2015. Three shipments of surface contaminated objects (e.g., concrete blocks, vehicles, and equipment) were shipped to the Nevada National Security Site for disposal. Extensive cleanup work is still needed.

2.7.2 Operations at the High Explosives Testing Facilities

The 2008 SWEIS identified seven capabilities at this Key Facility. All seven of the capabilities were active in calendar years 2015 and 2016 and all were below operational levels projected in the 2008 SWEIS (Table A-13).

The total amount of depleted uranium expended during testing (all capabilities) is an indicator of overall activity levels at these High Explosives Testing Facilities. In calendar year 2015, 210 kilograms of depleted uranium was expended, compared with approximately 3,900 kilograms projected in the 2008 SWEIS. In calendar year 2016, 140 kilograms of depleted uranium was expended. The quantity of expended depleted uranium includes the quantity of depleted uranium expended during material sanitization.

Four hydrotests were performed at the DARHT Facility in calendar year 2015, and six were performed in calendar year 2016. Intermediate-scale dynamic experiments containing beryllium using single-walled steel containment vessels continued at the Eenie firing site (36-03), along with other programmatic experiments. A steel vessel is used to mitigate essentially all of the fragments and particulate emissions associated with an experiment.

2.7.3 Operations Data for the High Explosives Testing Facilities

Operations data levels at High Explosives Testing Facilities remained below levels projected in the 2008 SWEIS with one exception. Chemical waste generation exceeded 2008 SWEIS projections in calendar year 2015 because of extra low conductivity water from the pulsed power system at DARHT. This accounted for approximately 35 percent (13,480.8 kilograms) of chemical waste generated at the High Explosives Testing Facilities. The exceedance in calendar year 2015 was a one-time, non-routine event. Table A-14 provides operations data details.

2.8 Tritium Facilities (Technical Area 16)

The Weapons Engineering Tritium Facility (WETF) in Technical Area 16 is the principal building in this Key Facility. In 2008, tritium operations at Technical Area 21, the Tritium Science and Fabrication Facility (21-209) and the Tritium Systems Test Assembly (21-155), were put in surveillance and maintenance mode. In 2009, tritium operations were consolidated in WETF.

9 Armag® Corporation manufactures secure, modular storage vaults used for high explosives storage.

DD&D of these facilities and remediation of the Technical Area 21 site began in calendar year 2009, with demolition of both the Tritium Systems Test Assembly and the Tritium Science and Fabrication Facility completed in 2010. Operations at WETF consist of research, development, and processing tritium to meet requirements of the present and future Stockpile Stewardship Program.

WETF structures include Technical Area 16, Buildings 205, 329, 450, and 824. The majority of tritium operations are conducted in Building 205. Building 450 is physically connected to Building 205 but radiologically separated and is not currently operational with tritium. Buildings 329 and 824 are office buildings. Limited operations involving the removal of tritium from actinide materials are conducted at LANL's Plutonium Facility Complex; however, these operations are small in scale and were not included as part of Tritium Facilities in the 2008 SWEIS. The tritium emissions from Technical Area 55, however, are included as part of the Plutonium Complex Facility.

WETF is listed as a Hazard Category 2 Nuclear Facility (Table 2-3). In calendar years 2015 and 2016, the tritium inventory at WETF was greater than 30 grams.

Table 2-3. WETF Buildings with Nuclear Hazard Classification

Building	Description	2008 SWEIS	LANL 2015*	LANL 2016*
Technical Area 16, Building 205	WETF	2	2	2
Technical Area 16, Building 450	WETF	2	2	2

* List of LANL nuclear facilities (LANL 2017a).

2.8.1 Construction and Modifications at the Tritium Facilities

The 2008 SWEIS projected one major facility modification to this Key Facility.

- DD&D of Technical Area 21 tritium facilities. This was completed in calendar year 2010.

2.8.2 Operations at the Tritium Facilities

The 2008 SWEIS identified eight capabilities for this Key Facility.[10] Three of the eight capabilities were active in calendar year 2015 and five of the eight capabilities were active in calendar year 2016. All capabilities were below operational levels projected in the 2008 SWEIS (Table A-15), with WETF performing fewer than the projected 65 gas processing operations.

Five flanged tritium waste containers (LLW) have classified tritium waste and are stored at WETF. These containers have some internal pressure from radiolytic decomposition of tritium gas. Because these containers have classified components, they will require special preparation or controls to meet requirements for disposal. Repackaging will also be required to meet offsite disposal requirements. DOE/NNSA is considering offsite disposal at the National Nuclear Security Site and/or at a commercial facility. It is anticipated that actions to prepare for offsite disposal will begin in calendar year 2018.

10 The 2008 SWEIS identified nine capabilities for this Key Facility. In calendar year 2010, the radioactive liquid waste treatment capability ended with the demolition of Technical Area 21 tritium buildings.

2.8.3 Operations Data for the Tritium Facilities

Operations data levels at WETF remained below levels projected in the 2008 SWEIS. Table A-16 provides operations data details.

2.9 Target Fabrication Facility (Technical Area 35)

The Target Fabrication Facility (35-213) is a two-story building housing activities related to weapons production and laser fusion research. This Key Facility is categorized as a low-hazard, non-nuclear facility. The Target Fabrication Facility laboratories and shops are specialized to provide precision machining, polymer science, physical and chemical vapor deposition, and target assembly.

2.9.1 Construction and Modifications at the Target Fabrication Facility

The 2008 SWEIS projected no major facility modifications to this Key Facility.

2.9.2 Operations at the Target Fabrication Facility

The 2008 SWEIS identified three capabilities at the Target Fabrication Facility. All three of the capabilities were active in calendar years 2015 and 2016 and all were below operational levels projected in the 2008 SWEIS (Table A-17). The primary measurement of activity for this facility is production of targets for research and testing (laser and physics testing). The number of targets and specialized components fabricated for testing purposed in calendar years 2015 and 2016 was less than the 12,400 targets per year projected in the 2008 SWEIS.

2.9.3 Operations Data for the Target Fabrication Facility

Operations data levels at the Target Fabrication Facility remained below levels projected in the 2008 SWEIS. Table A-18 provides operations data details.

2.10 Bioscience Facilities (Technical Areas 43, 03, 35, and 16)

Bioscience facilities include the main Health Research Laboratory Facility (Technical Area 43, Building 01) plus additional offices and laboratories located at Technical Area 35, Buildings 85 and 254 and Technical Area 03, Buildings 562, 1076, and 4200. Operations at Technical Area 43 and Technical Area 35, Building 85 include chemical and biological activities that maintain hazardous materials inventories and generate hazardous chemical wastes. Bioscience research capabilities focus on the study of intact cells (conducted at biosafety levels 1 and 2, cellular components (e.g., RNA, DNA, and proteins), instrument analysis (e.g., DNA sequencing, flow cytometry, nuclear magnetic resonance spectroscopy, and mass spectroscopy), and cellular systems (e.g., repair, growth, and response to stressors). All Key Facility activities at bioscience facilities are categorized as low hazard non-nuclear.

2.10.1 Construction and Modifications at the Bioscience Facilities

The 2008 SWEIS projected one construction or major modification to this Key Facility.

- Construct and operate Los Alamos Science Complex in Technical Area 62.

The Los Alamos Science Complex was proposed to be constructed at Technical Area 62 on approximately 15 acres; however, DOE/NNSA cancelled the project in calendar year 2010.

Currently, a replacement facility for Technical Area 43, Building 01 is being evaluated at the location of the Press Building (Technical Area 03, Building 35).

During calendar year 2004, construction was finalized on the biosafety level 3 facility. The biosafety level 3 facility is a windowless, single-story 3,202-square-foot stand-alone biocontainment facility located in Technical Area 03, Building 1076. The building includes two biosafety level 3 laboratories and one biosafety level 2 laboratory, plus associated administrative space designed to safely handle and store biohazardous materials. Because of the biosafety level 3 facility's small size and the small quantities of samples studied, there is no expected increase in quantities of sewage, solid wastes, chemical wastes, or increased demand for utilities. NEPA coverage for this project was initially provided in 2002 by the "Environmental Assessment for the Proposed Construction and Operation of a Biosafety Level 3 Facility at Los Alamos National Laboratory" and a Finding of No Significant Impact (DOE 2002). However, on January 22, 2004, DOE/NNSA withdrew the Finding of No Significant Impact to re-evaluate the environmental consequences of operating the facility based on its location on fill material and related seismic concerns. On November 29, 2005, DOE/NNSA issued a notice of intent to prepare an EIS for the proposed operation of the biosafety level 3 facility. A draft EIS is currently in final review prior to release for public comment. The facility remains unused at this time.

2.10.2 Operations at the Bioscience Facilities

The 2008 SWEIS identified 12 capabilities for this Key Facility. All of the 12 capabilities were active in calendar years 2015 and 2016 and all were at or below levels projected in the 2008 SWEIS (Table A-19).

Work with radioactive materials at this Key Facility is limited. This is attributed to technological advances and new methods of research, such as the use of laser-based instrumentation and chemo-luminescence, which do not require the use of radioactive materials. For example, instead of radioactive techniques, DNA sequencing predominantly uses laser analysis of fluorescent dyes adhering to DNA bases.

The single cesium one cobalt radiological source that had been located at Technical Area 43, Building 01 was moved to Technical Area 54 prior to removal by the manufacturer. The dual cesium source (known as the Mark 1) was relocated to Technical Area 36 for use there.

In calendar year 2015, small samples of encapsulated plutonium were analyzed using nuclear magnetic resonance spectroscopy. This type of spectroscopy determines the physical and chemical properties of atoms or the molecules in which they are contained.

This Key Facility has biosafety level-1 and -2 laboratories that include limited work with potentially infectious microbes. All activities involving infectious microorganisms are regulated by the Centers for Disease Control and Prevention, National Institutes of Health, LANL's Institutional Biosafety Committee, and the Institutional Biosafety Officer. Biosafety level 2 work is expanding as part of LANL's growing Chemical and Biological Nonproliferation Program.

The In Vivo Measurements Laboratory is located in Technical Area 43, Building 01 and is a capability within this Key Facility. This capability is operated by the Radiation Protection Services Division. The In Vivo Measurements Laboratory is used for direct monitoring of personnel for intakes of radioactive materials as part of the overall Radiation Protection and Internal Dosimetry Programs at LANL. Measurements are performed in two 20-centimeter-thick pre-World War II steel counting chambers (SB-14 and SB-16) located in the subbasement of

Building 01. In calendar year 2015, the In Vivo Measurements Laboratory was re-accredited by the DOE Accreditation Program for Radiobioassay for the measurement of TRU radionuclides, uranium, and thorium in the chest; fission and activation products in the chest and whole body; and radioiodine in the thyroid. In Vivo Measurements Laboratory also maintains capabilities for measurement of radionuclides in other organs. The monitoring an individual receives is determined by the work they perform (routine monitoring) and if there has been any involvement in radiological incidents (special bioassay). During calendar year 2016, the SB-14 and SB-16 counting systems were operational and used for client counts. As a result of the Laboratory's goal to close Building 01, the LANL Strategic Improvements Office and the Radiation Protection Services Division started discussions to relocate the In Vivo Measurements Laboratory. Current plans are for relocation and closure of the facility in calendar year 2018. An evaluation of In Vivo Measurements Laboratory services was performed in preparation for closure of the facility and it was determined that it was best to focus operations on whole-body counting for fission and activation products. Therefore, routine lung counts for uranium and americium were discontinued in April 2015.

2.10.3 Operations Data for the Bioscience Facilities

In calendar years 2015 and 2016, operations data levels at Bioscience Facilities remained below levels projected in the 2008 SWEIS. Table A-20 provides operations data details.

2.11 Radiochemistry Facility (Technical Area 48)

The Radiochemistry Facility includes all of Technical Area 48 (116 acres). It is a research facility that fills three roles: research; production of medical, industrial, and research radioisotopes; and support services to other LANL organizations, primarily through radiological and chemical analyses of samples. Technical Area 48 contains six major research buildings: 01, 17, 28, 45, 107, and 08.

2.11.1 Construction and Modifications at the Radiochemistry Facility

The 2008 SWEIS projected no major facility modifications to the Radiochemistry Facility.

The following construction and modification projects were initiated and/or completed in calendar years 2015 and 2016.

- Completed the DD&D of Technical Area 48, Buildings 02, 129, and 143 under the Footprint Reduction Program (see section 3.11 for details)
- Ongoing DD&D of Technical Area 48, Buildings 29 and 34 under the Footprint Reduction Program
- Completed housekeeping activities in Technical Area 48, Building 01
- Ongoing replacement of breaker panels in Technical Area 48, Building 01
- Ongoing installation and upgrades for exhaust fans and stacks for perchloric hoods in Technical Area 48, Building 45
- Ongoing upgrades for security systems in Technical Area 48, Building 01

2.11.2 Operations at the Radiochemistry Facility

The 2008 SWEIS identified 10 capabilities at the Radiochemistry Facility.[11] All 10 capabilities were active in calendar years 2015 and 2016 (Table A-21). The 2008 SWEIS projected approximately 150 offsite shipments of medical and industrial isotopes. In calendar year 2016, DOE/NNSA determined the increase of shipments from approximately 150 up to 500 was bounded under the 2008 SWEIS analysis (DOE 2016i).

2.11.3 Operations Data for the Radiochemistry Facility

Operations data levels at the Radiochemistry Facility remained below levels projected in the 2008 SWEIS. Table A-22 provides operations data details.

2.12 Radioactive Liquid Waste Treatment Facility (Technical Area 50)

The RLWTF is located in Technical Area 50 and consists of six primary structures: the RLWTF Building (50-01), the influent storage building for low-level radioactive liquid wastes (50-02), the influent storage building for TRU radioactive liquid waste (50-66), a 100,000-gallon (380,000-liter) influent tank for LLW (50-90), a facility for the storage of secondary liquid wastes (50-0248), and the Waste Mitigation and Risk Management Facility (50-250), which has the capacity to store 300,000 gallons of low-level influent in an emergency such as a wildfire. Five of the six structures are listed as Hazard Category 3 Nuclear Facilities (Table 2-4). The sixth structure, Technical Area 50, Building 250, does not have a nuclear facility classification. The RLWTF treats radioactive liquid waste generated by other LANL facilities and houses analytical laboratories to support waste treatment operations. The RLWTF Building is the largest structure in Technical Area 50 with 40,000 square feet under roof.

Table 2-4. RLWTF Buildings with Nuclear Hazard Classification

Technical Area 50 Building	Description	2008 SWEIS	LANL 2015*	LANL 2016*
01	RLWTF Building	3	3	3
02	Influent Storage Building for LLW	3	3	3
66	Influent Storage Building for TRU	3	3	3
90	Holding Tank for LLW	3	3	3
248	Evaporator Storage Tanks	3	3	3

* List of LANL nuclear facilities (LANL 2017a).

2.12.1 Construction and Modifications at the RLWTF

The 2008 SWEIS projected two modifications to this Key Facility.

- Construct and operate a replacement for the existing RLWTF at Technical Area 50.
- Construct and operate evaporation tanks in Technical Area 52.

11 The 2008 SWEIS identified 11 capabilities at the Radiochemistry Facility. In calendar year 2012, the hydro test sample capability moved from Technical Area 48 to Technical Area 15.

The following action took place during calendar years 2015 and 2016.

- Construction of a replacement Low-Level Radioactive Liquid Waste Facility began in calendar year 2015 and continued during calendar year 2016. The design of the replacement TRU Liquid Waste Facility began in calendar year 2014 and continued during calendar years 2015 and 2016.

2.12.2 Operations at the RLWTF

The 2008 SWEIS identified two capabilities at this Key Facility. Both capabilities were active in calendar years 2015 and 2016 and were below levels projected in the 2008 SWEIS with one exception, volumes of radioactive liquid waste bottoms shipped to an offsite commercial facility for treatment and disposal exceeded the 2008 SWEIS projection of 79,252 gallons (300,000 liters) per year. In calendar year 2015, 161,409 gallons (611,000 liters) were shipped offsite and in calendar year 2016, 90,875 gallons (344,000 liters) were shipped offsite. The shutdown of the radioactive liquid waste bottoms evaporator in December 2011 removed the capability to concentrate the evaporator bottoms and reduce the volume of liquid prior to shipment. This capability will most likely continue to exceed the 2008 SWEIS projections until the new RLWTF is operational, anticipated to be completed by calendar year 2019 (DOE 2017a).

2.12.3 Operations Data for the RLWTF

Operations data levels at the RLWTF remained below levels projected in the 2008 SWEIS with two exceptions. Chemical waste generation in calendar year 2015 exceed SWEIS projections because of the disposal of MicroBlaze® wastewater used to flush out residual diesel fuel in holding tanks, which accounted for approximately 91 percent (1,605 kilograms) of chemical waste generated at the RLWTF. LLW generation in calendar years 2015 and 2016 exceeded 2008 SWEIS projections because of disposal of a wastewater by-product resulting from the treatment process of radioactive liquid waste evaporator bottoms at Technical Area 50. In calendar year 2015, this accounted for approximately 90 percent (837 cubic meters) of the LLW generated at the RLWTF. In calendar 2016, this accounted for approximately 91 percent (925 cubic meters) of the LLW generated at the RLWTF. The 2008 SWEIS Table A-24 provides operations data details.

2.13 Los Alamos Neutron Science Center (Technical Area 53)

LANSCE lies entirely within Technical Area 53. The Key Facility has more than 400 structures, including one of the largest buildings at LANL. Building 03, which houses the linear accelerator (linac), is 315,000 square feet. Activities consist of neutron science and nuclear physics research, proton radiography, the development of accelerators and diagnostic instruments, and production of medical radioisotopes. The majority of LANSCE (the User Facility) is composed of the 800-million-electron-volt (MeV) linac, a Proton Storage Ring, and five major experimental areas: the Manuel Lujan Neutron Scattering Center, the Weapons Neutron Research Facility, the Isotope Production Facility, Experimental Area B (known as the Ultracold Neutron Facility), and Experimental Area C (the Proton Radiography Facility).

Experimental Area A, formerly used for nuclear physics experiments using pi mesons[12] including cancer therapy research and isotope production, is currently inactive and was emptied of most beam and experimental equipment in calendar year 2009. Technical Area 53, Building

12 Pi meson is any of three subatomic particles: π0, π+, and π−.

365 is currently being used for modern LANSCE linac injector and radio frequency system development. Building 365 was used for the Free Electron Laser prototype and future plans may include an Electron Beam Test Facility.

LANSCE is classified as an accelerator facility regulated under DOE Order 420.2C and currently operates under two main safety basis documents: the LANSCE Safety Assessment Document (LANL 2015a) and the LANSCE Accelerator Safety Envelope (LANL 2015b).

2.13.1 Construction and Modifications at LANSCE

The 2008 SWEIS projected two modifications to LANSCE.

- Installation of Materials Test Station equipment in Experimental Area A.
- Construction of the Neutron Spectroscopy Facility within existing buildings (under high-powered microwaves and advanced accelerators capability).

The following construction and modification projects were initiated and/or completed in calendar years 2015 and 2016.

The planning, design, and procurement of long-lead-time components for the multiyear LANSCE Risk Mitigation Project was approved in 2010. The scope of this project encompasses the restoration of the LANSCE 800-MeV linac to historic performance levels (DOE 2010). The LANSCE Risk Mitigation Project made significant progress towards extending the lifetime and operations of the LANSCE accelerator complex. The LANSCE Risk Mitigation Project was completed in calendar year 2015.

In calendar year 2015, high-power amplifier components for drift-tube linac module 3 were procured, a new computer-controlled water cooling system for drift-tube linac module 2 was installed, new cRio industrial controls in Technical Area 53, Building 03, Sector A were installed as part of the 805-megahertz linac, and facility improvements were made to support new digital low-level radio frequency controls for the 201-megahertz drift-tube linac in Sector A.

In calendar year 2016, numerous controls and timing upgrades were completed. The upgrade of module 3 in Technical Area 53, Building 03, Sector A was completed, digital low-level radio frequency controls were implemented on modules 2–4, and numerous magnet power supplies along the accelerator and beam lines were upgraded.

2.13.2 Operations at LANSCE

The 2008 SWEIS identified eight capabilities at this Key Facility. Seven of the eight capabilities were active in calendar years 2015 and 2016 and all seven fell below operational levels projected in the 2008 SWEIS (Table A-25).

During calendar years 2015 and 2016, LANSCE operated the linear accelerator and the five experimental areas identified in section 2.13. The primary indicator of activity for LANSCE is production of the 800-MeV LANSCE proton beam as shown in Table A-25. These production figures were less than the 6,400 hours at 1,250 microamps projected in the 2008 SWEIS. In calendar years 2015 and 2016, a significant accomplishment at LANSCE included the installation of a modified beam current limiter in Line X that allows a nearly factor of two increase in average beam current to the ultra-cold neutron experimental area.

There were no experiments conducted for transmutation of wastes. In calendar years 2015 and 2016, the Office of Naval Research cancelled funding for the Free Electron Laser system in Technical Area 53, Building 365.

2.13.3 Operations Data for LANSCE

Operations data levels at LANSCE remained below levels projected in the 2008 SWEIS. Table A-27 provides operations data details.

In calendar year 2016, mixed low-level waste (MLLW) generation at LANSCE exceeded 2008 SWEIS projections because of the disposal of legacy beamline components contaminated with mercury, which accounted for approximately 74 percent (21.4 cubic meters) of the total MLLW generated at LANSCE. The disposal of lead blocks used for shielding accounted for approximately 26 percent (7.6 cubic meters) of the total MLLW generated at LANSCE.

2.14 Solid Radioactive and Chemical Waste Facilities (Technical Areas 50 and 54)

Solid Radioactive and Chemical Waste Facilities are located at Technical Areas 50 and 54. Activities at this Key Facility are related to the management (packaging, characterization, receipt, transport, storage, and disposal) of radioactive and chemical wastes generated at LANL.

It is important to note that LANL's waste management operation captures and tracks data for waste streams (whether or not they go through the Solid Radioactive and Chemical Waste Facilities) regardless of their points of generation or disposal. The Waste Compliance and Tracking System was specifically designed to manage LANL's waste from generation to disposition. This includes information on the waste generating process, quantity, chemical and physical characteristics of the waste, regulatory status of the waste, applicable treatment and disposal standards, and the final disposition of the waste. The data are ultimately used to assess operational efficiency, help ensure environmental protection, and demonstrate regulatory compliance.

The 2008 SWEIS recognized structures at the Solid Radioactive and Chemical Waste Facility as having Hazard Category 2 Nuclear Classification (Table 2-5). (Area G was recognized as a whole, and then individual buildings and structures were also recognized.)

Table 2-5. Solid Waste Buildings with Nuclear Hazard Classification

Building	Description	2008 SWEIS	LANL 2015 and 2016[a]
50-69	Waste Characterization, Reduction, and Repackaging Facility	2	2
50-69 Outside	Nondestructive Analysis Mobile Activities	N/A[b]	2
50-69 Outside[c]	Drum Storage	2	2
54-Area G[d]	LLW Storage/Disposal	2	2
54-02	TRU Storage Building	N/A	2
54-08	MLLW/LLW Storage Building	2	2
54-33	TRU Drum Preparation	2	2
54-38	Radioassay and Nondestructive Testing Facility	2	2

Building	Description	2008 SWEIS	LANL 2015 and 2016[a]
54-48	TRU Waste Management Dome	2	2
54-49	TRU Waste Management Dome	2	2
54-153	TRU Waste Management Dome	2	2
54-224	Mixed Waste Storage Dome	N/A	2
54-229	TRU Waste Management Dome	2	2
54-230	TRU Waste Management Dome	2	2
54-231	TRU Waste Management Dome	2	2
54-232	TRU Waste Management Dome	2	2
54-283	TRU Waste Management Dome	2	2
54-375	TRU Waste Management Dome	2	2
54-412	TRU Waste Management Building	N/A	2
54-1027	Hazardous, Chemical, Mixed, and Tritiated Waste Storage Shed	N/A	2
54-1028	Hazardous, Chemical, Mixed, and Tritiated Waste Storage Shed	N/A	2
54-1030	Hazardous, Chemical, Mixed, and Tritiated Waste Storage Shed	N/A	2
54-1041	Hazardous, Chemical, Mixed, and Tritiated Waste Storage Shed	N/A	2
54-Pad1[e]	Storage Pad	2	2
54-Pad10[f]	Storage Pad	2	2
54-Pad281	LLW Storage	N/A	2
63-144	TRU Waste Facility	N/A	2

a. List of LANL nuclear facilities (LANL 2017a).

b. N/A = not available.

c. Drum Storage includes drum staging/storage pad and waste container temperature equilibration activities outside Technical Area 50, Building 69.

d. This includes LLW (including mixed waste) storage and disposal in domes, pits, shafts, and trenches; TRU waste storage in domes and shafts (does not include TRU Waste Inspection and Storage Program); TRU legacy waste in pits and shafts; and low-level disposal of asbestos in pits and shafts. Operations building: TRU waste storage.

e. Pad 1 was formerly the Technical Area 54, Building 226 TRU Waste Storage Dome.

f. Pad 10 was originally designated as Pads 2 and 4 in the 2008 SWEIS.

2.14.1 Construction and Modifications at the Solid Radioactive and Chemical Waste Facilities

The 2008 SWEIS projected one major modification to this Key Facility.

- Plan, design, construct, and operate waste management facilities transition projects to facilitate actions required by the NMED Compliance Order on Consent (Consent Order).

These projects were scheduled to replace LANL's existing facilities for solid waste management. In calendar year 2014, construction began at Technical Area 63, Building 144 on the new TRU Waste Facility. Construction was completed in calendar year 2017 and operations are scheduled to begin in calendar year 2018. The TRU Waste Facility will enhance LANL's capability to manage newly generated TRU wastes at the complex. The existing facilities at Technical Area 54 for TRU waste, LLW, MLLW and hazardous/chemical waste were analyzed in the 2008 SWEIS for closure and remediation under the Consent Order (DOE 2008a).

On February 14, 2014, an airborne radiological release occurred underground at the Waste Isolation Pilot Plant involving improperly treated TRU wastes generated by LANL. Because of this event, wastes destined for transportation to the Waste Isolation Pilot Plant have been stored onsite. In addition to the suspension of waste shipments to the Waste Isolation Pilot Plant, two LANL facilities (the Waste Compaction Reduction and Repackaging Facility and the Radioassay and Nondestructive Testing Facility) involved in the processing and packaging of waste suspended operations.

In calendar year 2016, DOE/NNSA prepared a supplement analysis to the 2008 SWEIS to determine if an additional NEPA analysis was required to conduct processing studies of remediated TRU waste drums containing remediated nitrate salts. This also included some facility modifications to maintain safe handling and storage. DOE determined the environmental impacts of the proposed actions are bounded by analyses presented in the 2008 SWEIS and no further NEPA documentation is required (DOE 2016a). The supplement analysis was signed on May 11, 2016, and minor facility modifications were implemented at the Waste Compaction Reduction and Repackaging Facility (Technical Area 50, Building 69) to maintain safe handling and storage of the TRU waste drums containing remediated nitrate salts.

In calendar year 2016, DOE/NNSA prepared a second supplement analysis to the 2008 SWEIS. DOE/NNSA proposed to treat, repackage, transport onsite, and store 89 TRU waste drums in preparation for transport and ultimate disposition at the Waste Isolation Pilot Plant. There were 60 waste drums containing remediated nitrate salts and 29 drums containing un-remediated nitrate salts. DOE determined the environmental impacts of the proposed actions are bounded by analyses presented in the 2008 SWEIS and no further NEPA documentation is required (DOE 2016b). Treatment on the 60 TRU waste drums containing remediated nitrate salts was completed in calendar year 2017.

2.14.2 Operations at the Solid Radioactive and Chemical Waste Facilities

The 2008 SWEIS identified seven capabilities at this Key Facility. Four of the seven capabilities were active in calendar years 2015 and 2016 and all four fell below operational levels projected in the 2008 SWEIS (Table A-27). The primary measurements of activity for this facility are volumes of newly-generated chemical/hazardous, LLW, and TRU wastes to be managed, and volumes of legacy TRU waste and MLLW in storage.

2.14.3 Operations Data for the Solid Radioactive and Chemical Waste Facilities

The 2008 SWEIS waste projections were exceeded for chemical waste, LLW, and MLLW at the Solid Radioactive and Chemical Waste Facilities in calendar year 2015. Chemical waste generation exceeded 2008 SWEIS projections because of the disposal of Area L sump water collected from rain and snow events, which contributed to 63 percent (9,767 kilograms) of chemical waste; the removal of empty drums from Technical Area 54 contributed to an additional 13 percent (2,050 kilograms) of chemical waste; and the disposal of unused or unspent products contributed to an additional 13 percent (2,021 kilograms) of the total chemical waste at the Solid Radioactive and Chemical Waste Facilities. LLW generation exceeded 2008 SWEIS projections in calendar year 2015 because of the general clean up from Area G at Technical Area 54, which included the disposal of non-compactable LLW from throughout

Technical Area 54 Area G (wood, plastic, cardboard, cloth, etc.). This contributed to 79 percent (372 cubic meters) of the LLW waste generated at Solid Radioactive and Chemical Waste Facilities. MLLW generation exceeded 2008 SWEIS projections in calendar year 2015 because of the cleanup of miscellaneous electronics and lighting equipment that contributed 43 percent (4 cubic meters) of the MLLW waste generated at Solid Radioactive and Chemical Waste Facilities.

The 2008 SWEIS waste projections were exceeded for chemical waste and LLW in calendar year 2016 at the Solid Radioactive and Chemical Waste Facilities. Chemical waste generation exceeded 2008 SWEIS projections because of the disposal of Area L sump water collected from rain and snow events, which contributed to 60 percent (6,029 kilograms) of the chemical waste generated; and the disposal of soil stabilizer mixed with water (used as dust suppression at Technical Area 54) contributed to an additional 17 percent (1,781 kilograms) of the total chemical waste at the Solid Radioactive and Chemical Waste Facilities. LLW generation at the Solid Radioactive and Chemical Waste Facilities also exceeded the 2008 SWEIS projections because of the general clean up from Area G at Technical Area 54, which contributed to 20 percent (69 cubic meters) of the total LLW generation; and the removal of empty drums from Technical Area 54 Area G, which contributed to an additional 45 percent (145 cubic meters) of the total LLW generated at the Solid Radioactive and Chemical Waste Facilities. All of the exceedances in calendar years 2015 and 2016 were one-time, non-routine events that do not reflect day-to-day LANL operations. Table A-28 provides operations data details.

2.15 Plutonium Facility Complex (Technical Area 55)

The Plutonium Facility Complex consists of six primary buildings and a number of support, storage, security, and training structures located throughout Technical Area 55. The Plutonium Facility, 55-04, is categorized as a Hazard Category 2 Nuclear Facility but was built to comply with the seismic standards for a Hazard Category 1 Nuclear Facility at the time of construction. In addition, Technical Area 55 includes two low-hazard chemical facilities (55-03 and 55-05) and one low-hazard energy source facility (55-07). The DOE/NNSA listing of LANL nuclear facilities for 2017 (LANL 2017a) retained Building 04 as a Hazard Category 2 Nuclear Facility (Table 2-6).

Table 2-6. Plutonium Facility Complex Buildings with Nuclear Hazard Classification

Building	Description	2008 SWEIS	LANL 2015*	LANL 2016*
Plutonium Facility (55-04)	Plutonium Processing	2	2	2

* List of LANL nuclear facilities (LANL 2017a).

2.15.1 Construction and Modifications at the Plutonium Facility Complex

The 2008 SWEIS projected two facility modifications.

- Technical Area 55 Reinvestment Project (TRP) (identified as the Plutonium Facility Complex Refurbishment Project in the 2008 SWEIS).
- Technical Area 55 Radiography Facility Project.

The TRP consists of three line items (TRP I, TRP II, and TRP III). Each line item was split into subprojects. TRP I included the repair and replacement of mission-critical cooling system components for buildings in Technical Area 55 that allow these facilities to continue to operate and also for the installation of a new cooling system that meets current phase-out standards for Class 1 ozone-depleting substances. TRP I construction activities were completed in calendar year 2010. During calendar year 2014, TRP II activities were conducted and included confinement door replacement and structural glovebox upgrades. TRP III was in the planning stage and will include ventilation system replacement in Building 41. In calendar years 2015 and 2016, planning and construction work on the TRP projects continued.

The Technical Area 55 Radiography Facility Project was cancelled. In 2006, DOE established an interim radiography capability in an existing area at the Plutonium Facility Complex until a stand-alone facility could be built. Interim work continued in calendar years 2015 and 2016.

The following construction/modification projects continued in calendar years 2015 and 2016.

- DD&D and upgrades of equipment were initiated in order to upgrade small sample fabrication with a new machining line for plutonium samples.
- The Seismic Analysis of Facilities and Evaluation of Risk Project at Technical Area 55, Building 04 addresses deficiencies identified through structural analysis conducted to evaluate the ability of the Technical Area 55 Plutonium Facility safety structures, systems, and components to meet their credited safety functions as defended in the Documented Safety Analysis (LANL 2016b). Project planning and construction activities continued through calendar years 2015 and 2016.
- As discussed in section 2.1.1, construction activities began in Technical Area 55, Building 04 as described in the supplement analysis for relocating analytical chemistry and materials characterization capabilities out of the CMR Building (DOE 2015b).
- Various programs performed DD&D, design, procurement, and installation of equipment in their respective areas of the Plutonium Facility.

2.15.2 Operations at the Plutonium Facility Complex

The 2008 SWEIS identified seven capabilities at this Key Facility. Six of the seven capabilities listed in Table A-29 were active in calendar years 2015 and 2016. For all six active capabilities, activity levels were below those projected by the 2008 SWEIS. Operations at Technical Area 55 to manufacture plutonium parts were temporarily halted in 2013 to address DOE/NNSA’s safety concerns. Capabilities restarted soon after the work pause.

The CMRR Nuclear Facility project was cancelled in 2014. DOE/NNSA has since developed a plutonium infrastructure strategy that maintains continuity in analytical chemistry and materials characterization capabilities using existing facilities within LANL at Technical Area 55. DOE/NNSA now intends to relocate some CMR capabilities to RLUOB and Plutonium Facility Building 04 at Technical Area 55.

During 2016, LANL was directed to prepare a lifecycle cost estimate for the dilute and dispose alternative in the “2015 Surplus Plutonium Disposition Supplemental Environmental Impact Statement” (DOE 2015i). DOE anticipated issuing a ROD in 2020 for the selection of the site that will conduct this work. Under this alternative, Pantex would ship plutonium pits to LANL for disassembly and oxidation using the Advanced Recovery and Integrated Extraction System at Technical Area 55. These materials would then be shipped to the Savannah River Site to be diluted and then shipped to the Waste Isolation Pilot Plant for disposal. Pit disassembly processing can be accomplished with existing equipment through 2025. New equipment and one additional room will be required for increased processing by 2031.

The Plutonium Sustainment Program at LANL continues to prepare to meet the requirement of re-establishing War Reserve pit production by the beginning of fiscal year 2024, and establishing a production capacity of 30 pits per year in fiscal year 2026.

2.15.3 Operations Data for the Plutonium Facility Complex

Operations data levels at the Plutonium Facility Complex remained below levels projected in the 2008 SWEIS with one exception. In calendar year 2016, chemical waste generation at the Plutonium Facility Complex exceeded 2008 SWEIS projections. Disposal of a water and vegetable oil solution from the maintenance of an access control system gate at Technical Area 55 contributed to 50 percent (5,512 kilograms) of the chemical waste generated at the Plutonium Facility. Table A-29 provides operations data details.

2.15.4 Offsite Source Recovery Project

The Offsite Source Recovery Project recovers and manages unwanted radioactive sealed sources and other radioactive material that

- present a risk to national security, public health, and safety;
- present a potential loss of control by a U.S. Nuclear Regulatory Commission or agreement state licensee;
- are excess and unwanted and are a DOE responsibility under Public Law 99-240[13] (42 USC); or
- are DOE-owned.

The Offsite Source Recovery Project, International Threat Reduction Group, and the Nuclear Engineering and Nonproliferation Division at LANL are tasked by NNSA's Office of Global Material Security to recover and manage sealed radioactive sources from domestic and international locations. The sealed radioactive sources are delivered to the Technical Area 3, Building 30 warehouse and transported by truck to Technical Areas 54, 55, or other approved LANL facilities for storage.

NEPA coverage for the Offsite Source Recovery Project has been analyzed and approved in various NEPA documents, including the 2008 SWEIS. In April 2011, the "Supplement Analysis for the Transport and Storage of High-Activity Sealed Sources from Uruguay and Other Locations" (DOE 2011a) was prepared for the project. This document analyzed transportation of sealed sources recovered from foreign countries to the United States through the global commons by commercial cargo aircraft and also examined the role of a commercial facility in managing these sealed sources (an aspect of the Offsite Source Recovery Project that was not addressed in the 2008 SWEIS). DOE/NNSA issued an amended ROD in the Federal Register on July 8, 2011 (DOE 2011b), that stated NNSA will continue implementing the Offsite Source Recovery Project source recovery program, including the recovery, storage, and disposition of high-activity beta/gamma sealed sources. This program includes the recovery of sealed sources

13 Public Law 99-240 is an act to amend the Low-Level Radioactive Waste Policy Amendments Act of 1985. The act was introduced in the Senate and House of Representatives of the United States of America in Congress assembled, Ninety-Ninth Congress, January 15, 1986. The Policy Act was designed to stimulate development of new facilities by encouraging states to form interstate compacts for disposal on a regional basis.

from foreign countries, and NNSA has decided that transport of high-activity and other sealed sources through the global commons by commercial cargo aircraft, highway, and/or vessel may be utilized as part of this ongoing program.

On September 28, 2011, DOE submitted NEPA regulation revisions to the Federal Register. The final regulations became effective October 13, 2011. In the revised rule, DOE established 20 new categorical exclusions, including recovery of radioactive sealed sources and sealed source-containing devices from domestic or foreign locations provided that 1) the recovered items are transported and stored in compliant containers and 2) the receiving site has sufficient existing storage capacity and all required licenses, permits, and approvals.

Of the planned countries slated for source repatriation in calendar years 2012–2016, the Offsite Source Recovery Project recovered sources from Australia, Austria, Bolivia, Brazil, Canada, Germany, India, Jamaica, Japan, Mexico, Nicaragua, Philippines, and Sri Lanka.

In calendar year 2015, the Offsite Source Recovery Project recovered 18 radiological sources from Mexico, 20 from Australia, and 2,236 from United States-domestic locations. In calendar year 2016, the project recovered six sources from Australia, one from Jamaica, five from Japan, 46 from Sri Lanka, and 2,692 sources from United States-domestic locations.

2.16 Non-Key Facilities

The balance, and majority, of LANL buildings are referred to in the 2008 SWEIS as Non-Key Facilities. Non-Key Facilities house operations that do not have the potential to cause significant environmental impacts. These buildings and structures are located in 30 of LANL's 49 technical areas and comprise approximately 13,920 of LANL's 25,754 acres.

2.16.1 Construction and Modifications at the Non-Key Facilities

The 2008 SWEIS projected no major modifications to the Non-Key Facilities under the No Action Alternative. Major projects that have been completed since 2008 are listed in Table 2-7. A complete description of these projects can be found in previous Yearbooks.

Table 2-7. Non-Key Facilities Completed Construction Projects

Description	Year Completed
Los Alamos Site Office Building	2008
Protective Force Running Track	2010
Expansion of the Sanitary Effluent Reclamation Facility	2012
Photovoltaic Array Reuse of Los Alamos County Landfill Location	2012
The Tactical Training Facility	2013
The Indoor Firing Range	2013
The Interagency Wildfire Center at Technical Area 49	2013

New projects that were still under construction or were completed in calendar years 2015 and 2016 are discussed in the following paragraphs.

2.16.1.1 Technical Area 49 Training Facility Expansion

Description. DOE/NNSA proposed to expand and improve the emergency response training facility infrastructure at Technical Area 49. Security and emergency personnel at LANL offer periodic bomb threat preparation and other training courses to local, state, and federal first responders. The facility has expanded to the east of the existing area and encompasses a footprint of approximately 12 acres. Construction work included the installation of new roads, utilities, and base coarse for props needed for different training scenarios. Examples could include railcars, aircraft, and residential areas

Status. Facility improvement and modifications to the Technical Area 49 training facility began in calendar year 2015 and were completed in calendar year 2016.

2.16.1.2 Unmanned Aerial Systems User Facility

Description. LANS conducts radiation and detector monitoring training at various locations at LANL. DOE/NNSA proposed to use unmanned aerial systems (i.e., drones) to support training at Technical Area 60, Building 17. The training would use sealed radiological sources inside the building.

Status. In January 2016, DOE/NNSA categorically excluded the use of unmanned aerial systems for training purposes (DOE 2016d). Training with unmanned aerial systems was conducted in calendar year in 2016 and will continue in the future.

2.16.1.3 Technical Area 72 Armory Cleaning Facility

Description. The Laboratory Protection Force personnel operate an outdoor firing range at Technical Area 72 to satisfy DOE/NNSA and LANL training requirements. The firing range required a new cleaning facility for firearms. The Armory Cleaning Facility is a prefabricated structure.

Status. The Armory Cleaning Facility was completed in calendar year 2016 and began operations in 2017.

2.16.1.4 Oppenheimer Collaboration Center Renovation

Description. The Oppenheimer Collaboration Center (LANL's research library) at Technical Area 03, Building 207 is being renovated. The proposed project would renovate 8,280 square feet of the first floor and establish multiple collaboration, meeting, seating, and private workspaces. The second floor would be modified to meet American Disabilities Act requirements and update the existing lobby and meeting spaces. The basement floor will be converted from the traditional library configuration with book stacks to a modern office area for LANL students and new employees awaiting security clearances.

Status. Construction began in calendar year 2015 and is still in progress.

2.16.1.5 Fire Station One Upgrades at Technical Area 03, Building 41

Description. Fire Station One at Technical Area 03, Building 41 will be remodeled and upgraded. This will include upgrades for the bathrooms, removal of asbestos on old insulation, and re-insulation of piping.

Status. Construction work began in calendar year 2016 and was completed in January 2017.

2.16.1.6 Technical Area 3 Substation Replacement Project

Description. DOE/NNSA proposed to construct a new 115-kilovolt substation to replace the existing substation. The replacement of the antiquated and deteriorating Technical Area 3 substation will achieve full compliance with current codes and safety requirements; provide back-up, redundant, and reliable feeder sources to LANL and Los Alamos County electrical distribution systems; address the concurrent needs of LANL and Los Alamos County for safe and reliable electric services; and provide additional capacities for future growth.

Status. In February 2016, DOE/NNSA categorically excluded this project (DOE 2016c). Construction began in in 2017.

2.16.2 Operations at the Non-Key Facilities

The Non-Key Facilities occupy more than half of LANL's 25,754 acres. Non-Key Facilities are host to seven of the eight categories of activities at LANL, as shown in Table A-31. The eighth category, environmental cleanup, is discussed in section 2.17. During calendar years 2015 and 2016, no new capabilities were added to the Non-Key Facilities and none of the eight existing capabilities were deleted.

2.16.3 Operations Data for the Non-Key Facilities

In calendar year 2015, the Non-Key Facilities generated about 73 percent of the total LANL chemical waste volume, about 5 percent of the total LLW volume, and none of the total MLLW and total TRU waste volumes. Chemical waste in 2015 exceeded annual volumes projected in the 2008 SWEIS. This was due to the disposition of press filter cakes from the Sanitary Effluent Reclamation Facility, which accounted for about 71 percent of the total chemical waste generated at Non-Key Facilities. The volume of LLW waste exceed 2008 SWEIS projections because of waste generated from the demolition of Technical Area 18, Casa 2 and 3. This accounted for about 42 percent of the total LLW generated at Non-Key Facilities. In calendar year 2016, the Non-Key Facilities generated about 98 percent of the total LANL chemical waste volume, about 57 percent of the total LLW volume, about 4 percent of the total MLLW volume, and none of the total TRU waste volume.

In calendar year 2016, chemical waste volumes exceeded annual volumes projected in the 2008 SWEIS. This was due to the disposition of press filter cakes and reject water from the Sanitary Effluent Reclamation Facility. The facility processes sanitary wastewater effluent for the removal of unwanted constituents through a reverse osmosis process. A byproduct of the reverse osmosis process is reject water containing dissolved solids. These waste products from the Sanitary Effluent Reclamation Facility made up 98 percent of the total waste from Non-Key Facilities. Operations data levels at the Non-Key Facilities remained below levels projected in the 2008 SWEIS with the exception of chemical waste in 2015 and 2016 and LLW in 2016. Table 2-9 presents operations data details.

In calendar year 2015, the combined flows of the Technical Area 46 Sanitary Wastewater System and the Technical Area 03 Power Plant account for about 86 percent of the total water discharges from Non-Key Facilities and about 64 percent of all water discharged by LANL. In calendar year 2016, the combined flows of the Technical Area 46 Sanitary Wastewater System and the Technical Area 03 Power Plant account for about 86 percent of the total water discharges from Non-Key Facilities and about 64 percent of all water discharged by LANL. Section 3.2 provides more details.

Table 2-9. Operations at the Non-Key Facilities

Capability	Examples
Theory, Modeling, and High-Performance Computing	Modeling of atmospheric and oceanic currents. Theoretical research in areas such as plasma and beam physics, fluid dynamics, and superconducting materials.
Experimental Science and Engineering	Experiments in nuclear and particle physics, astrophysics, chemistry, and accelerator technology. Also includes laser and pulsed-power experiments (e.g., Atlas).
Advanced and Nuclear Materials Research and Development and Applications	Research and development into physical and chemical behavior in a variety of environments; development of measurement and evaluation technologies.
Waste Management	Management of municipal solid wastes. Sewage treatment. Recycling programs.
Infrastructure and Central Services	Human resources activities. Management of utilities (natural gas, water, electricity). Public interface.
Maintenance and Refurbishment	Painting and repair of buildings. Maintenance of roads and parking lots. Erecting and demolishing support structures.
Management of Environmental, Ecological, and Cultural Resources	Research into, assessment of, and management of plants, animals, historic properties, and environmental media (groundwater, air, surface waters).

2.17 Environmental Cleanup

The Laboratory, through the Environmental Management Directorate, performs cleanup of sites and facilities formerly involved in weapons research and development and other LANL operations.

The Environmental Management Directorate includes the operations and responsibilities of the previous Environmental Restoration Project, which generates a significant amount of waste during characterization and remediation activities; therefore, the Environmental Management cleanup programs are included as a section in Chapter 2. The 2008 SWEIS projected that implementation of the Consent Order would contribute 80 percent chemical waste, 65 percent LLW, 97 percent MLLW, and 44 percent TRU and mixed TRU waste at the Laboratory. Section 3.3 provides more details on waste generation amounts.

2.17.1 History of Corrective Action Sites at LANL

DOE established the Environmental Management Directorate to characterize and, if necessary, remediate solid waste management units (SWMUs) and areas of concern (AOCs), areas known or suspected to be contaminated from historical Laboratory operations. Many of the SWMUs and AOCs are located on DOE/NNSA property, and some properties containing SWMUs and AOCs have been conveyed to Los Alamos County or to private (within Los Alamos town site) ownership. Characterization and remediation efforts are regulated by NMED for hazardous constituents under the New Mexico Hazardous Waste Act (HWA1978, § 74-4-10) and New Mexico Solid Waste Act (NMSA 1978, §74-9-36[D]) and by DOE/NNSA for radionuclides under the Atomic Energy Act implemented through DOE Order 458.1 *Radiation Protection of the Public and the Environment* and DOE Order 435.1 *Radioactive Waste Management*.

On March 1, 2005, NMED, DOE, and the University of California entered into the Consent Order, which superseded Module VIII of the Laboratory's 1994 Hazardous Waste Facility Permit. Under the Consent Order, all 2,123 original corrective action sites, six newly identified sites, an additional site resulting from the split of SWMU 00-033, and the 24 sites split during a consolidation effort were subject to the new Consent Order requirements. Of these, 166 sites were removed from Module VIII by NMED. In addition, 25 AOCs previously approved for no further action by NMED and 541 sites approved for no further action by the Environmental Protection Agency were excluded from regulation by the Consent Order. Therefore, 1,422 sites were originally regulated under the Consent Order. The Consent Order provides that the status of all 1,422 sites (those requiring corrective action and those with completed corrective actions) will be tracked in LANL's Hazardous Waste Facility Permit.

In June 2016, NMED and DOE entered into a new Consent Order that supersedes the March 2005 Consent Order. Changes from the 2005 Consent Order included removal of many of the detailed technical requirements so that the focus was more on process. In addition, 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 on a yearly basis. The 2016 Consent Order also provides for increased communication and collaboration between NMED and DOE during planning and execution of work.

The Consent Order replaced the determination for no further action with a Certificate of Completion. Since the start of the Consent Order through the end of 2016, NMED issued 202 Certificates of Completion without Controls and 77 Certificates of Completion with Controls. Of the 279 Certificates of Completion issued, two overlap former Environmental Protection Agency or NMED approvals for no further action and two overlap NMED removals from Module VIII of LANL's Hazardous Waste Facility Permit; thus, only 275 are subtracted. This administrative action reduced the total number of corrective action sites remaining in the investigation process at LANL to 1,147.

In 2010, two previously unknown corrective action sites were identified and reported to the administrative authority, and the Laboratory received its new Hazardous Waste Facility Permit, which removed 20 Resource Conservation and Recovery Act hazardous waste management units as corrective action sites. In 2012, one SWMU was split into two new SWMUs to facilitate completion of a corrective action associated with land development. In 2013, two LLW disposal pits at Area G were identified as two new SWMUs. In 2016, an additional four SWMUs and one AOC were split into 10 new SWMUs and two new AOCs to facilitate completion of a corrective action associated with land development. Combined, these administrative actions reduced the total number of corrective action sites remaining in the investigation process at LANL to 1,139.

In Appendix A of the Consent Order, 127 sites are deferred for investigation and corrective action. These include sites within Testing Hazard Zones of active firing sites, which are deferred until the firing site used to delineate the relevant Testing Hazard Zone is closed or inactive and DOE determines that it is not reasonably likely to be reactivated. The deferred sites in Appendix A also include sites for which NMED has approved delayed investigation because the sites are currently active units or investigation is not feasible until future decontamination and decommissioning of associated operational facilities is completed. Corrective actions for the deferred sites will be implemented under LANL's Hazardous Waste Facility Permit if not completed prior to the end date of the Consent Order.

2.17.2 Environmental Cleanup Operations

The Environmental Management Directorate developed and/or revised two annual monitoring plans, two work plans, five progress reports, six monitoring reports, one investigation report, and nine supplemental investigation reports, which were submitted to NMED in calendar years 2015 and 2016. In addition, five sites within former Technical Area 01 were remediated. A work plan proposes investigation or remediation activities designed to characterize or clean-up sites, aggregate areas, and/or canyons or canyon segments. The data are presented in a report that presents and assesses the sampling results and recommends additional sampling, remediation, monitoring, or no further action, as appropriate. In addition to the work plans and reports, documents related to groundwater, surface water, storm water, and well installations were written and submitted to NMED. These documents included periodic monitoring reports, drilling work plans, and well reconfiguration reports as well as the annual update to the Interim Facility-Wide Groundwater Monitoring Plan.

Table 2-8 provides summaries of the site, aggregate area, and canyon investigations conducted and/or reported in calendar years 2015 and 2016. In addition, the 2015 and 2016 vapor monitoring results at Material Disposal Area C are summarized.

Material Disposal Area C Subsurface Vapor Monitoring. Subsurface vapor (pore-gas) monitoring was conducted during calendar year 2014 at 80 sampling ports within 18 vapor monitoring wells beneath and surrounding Material Disposal Area C. The monitoring network includes sampling points within and below the plume to determine whether contaminants are migrating vertically downward toward the regional aquifer and shallow sampling points near the disposal units to assess whether new releases have occurred. The first sampling event was conducted during April and May 2014, the second sampling event was conducted during October and November 2014. Subsurface vapor monitoring samples have been collected at the site since 2004, and vapor monitoring data indicate volatile organic compounds and tritium are present in the subsurface. The data collected from vapor monitoring wells are used to evaluate whether volatile organic compounds and tritium may be a potential threat to groundwater and whether corrective actions may be required.

Table 2-8. Summary of Site, Aggregate Area, and Canyon Investigations Conducted and/or Reported on in Calendar Years 2015 and 2016 under the Environmental Remediation Program

Document/Activity	Technical Areas	Number of Sites Investigated	Number of Samples Collected	Number of Sites where Cleanup Conducted	Number of Sites where Extent Defined/ Not Defined	Conclusions/ Recommendations
Sandia Wetland Performance Report, Performance Period April 2014–December 2014 (LANL 2015c)	03	Monitoring conducted at wetland in Sandia Canyon	539 samples collected in 2014	n/a[a]	n/a	The monitoring performed during the performance period indicates that the Sandia wetland is stable following the installation of the grade control structure, even with declining effluent volumes entering the wetlands. Within the alluvial system, wetland sediments continue to reduce and no obvious temporal trends in chemistry have been noted. Water levels have not dropped below the levels observed in 2013, despite reduced effluent volumes, and remain sufficiently high to sustain obligate wetland vegetation.
2014 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project (LANL 2015d)	n/a	Monitoring conducted at 12 gage stations located throughout the watershed.	47 sampling events (a sampling event is defined as the collection of one or more samples from a specific gage station during a specific run-off event) resulting in ~ 800 samples collected; storm water samples were also collected above and below the detention basins below the SWMU 01-001(f) drainage.	n/a	n/a	Mitigation structures and features are performing as designed. Net sediment deposition occurred in most surveyed areas in the Pueblo, Los Alamos, and DP canyons experiencing monsoonal flood events in 2014, which is consistent with the goal of the sediment transport mitigation work plans. Analytical data collected from storm water samples in 2014 indicate that unfiltered copper, lead, and zinc are generally greater than natural background sediment upper tolerance limits and may be associated with run-off from developed landscapes. Radionuclides including americium-241, strontium-90, cesium-137, plutonium-239/240, and plutonium-238 were generally higher than background upper tolerance limits and are derived from legacy Laboratory operations. The Los Alamos Canyon detention basin and weir, the DP Canyon grade control structure, and the Pueblo Canyon wetland and grade control structure were effective in substantially reducing this transport.

Document/Activity	Technical Areas	Number of Sites Investigated	Number of Samples Collected	Number of Sites where Cleanup Conducted	Number of Sites where Extent Defined/ Not Defined	Conclusions/ Recommendations
Supplemental Investigation Report for Upper Sandia Canyon Aggregate Area, Revision 1 (LANL 2015e)	03, 60, 61	42	737 samples collected from 1994 through 2009	0	31/11	The Laboratory recommended no further investigation or remediation activities are warranted for 31 sites: 17 sites are appropriate for corrective actions complete without controls, and 14 sites are appropriate for corrective actions complete with controls. Additional sampling is needed to define the extent of contamination at 10 sites and one site will be included in another aggregate area report. No sites are recommended for remediation. A revised Phase II investigation work plan will be developed based on the conclusions and recommendations presented in this supplemental investigation report.
Supplemental Investigation Report for Potrillo and Fence Canyons Aggregate Area (LANL 2015f)	15, 36	17	414 samples collected from 1994 through 2010	0	9/8	The Laboratory recommended no further investigation or remediation activities are warranted for seven sites: six sites are appropriate for corrective actions complete without controls and one site is appropriate for corrective actions complete with controls. Additional sampling is recommended for eight sites, one of which will also require remediation. Remediation is recommended for two additional sites.
Interim Measures Progress Report for Soil-Vapor Extraction of Volatile Organic Compounds from Material Disposal Area L, Technical Area 54 (LANL 2016c)	54	1	292 pore gas samples collected from vapor monitoring wells from August 2014 through April 2015	n/a	n/a	During the first six months of soil vapor extraction operation, the two soil vapor extraction units removed 424 kilograms (932 pounds) of total organic vapor mass. The mass was primarily removed from within an approximately 150-foot radius surrounding the extraction boreholes. Mass removal was higher initially, and continued at a removal rate of nearly 100 pounds/month after six months of operation. The long-term ability of the soil vapor extraction system to remove significant quantities of organic vapor has been demonstrated. Further operation followed by rebound analysis was recommended, along with a gas tracer test.
Supplemental Investigation Report for Upper Mortandad Canyon Aggregate Area (LANL 2015g)	03, 35, 42, 48, 50	31	1,033 samples collected from 1992 through 2009	0	27/4	The Laboratory recommended no further investigation or remediation activities are warranted for 25 sites: 24 sites are appropriate for corrective actions complete without controls and one site is appropriate for corrective actions complete with controls. Additional sampling is needed to define the extent of contamination at four sites, and six sites are recommended for remediation. A revised Phase II investigation work plan will be developed based on the conclusions and recommendations presented in this supplemental investigation report.

Document/Activity	Technical Areas	Number of Sites Investigated	Number of Samples Collected	Number of Sites where Cleanup Conducted	Number of Sites where Extent Defined/ Not Defined	Conclusions/ Recommendations
Supplemental Investigation Report for S-Site Aggregate Area (LANL 2015h)	16	63	994 samples collected from 1995 through 2010	0	46/17	The Laboratory recommended no further investigation or remediation activities are warranted for 44 sites: 43 sites are appropriate for corrective actions complete without controls and one site is appropriate for corrective actions complete with controls. No further sampling was recommended for two additional investigation areas that are not SWMUs or AOCs. Additional sampling is needed to define the extent of contamination at 17 sites. Investigation of six of these sites will be deferred until associated firing site activities cease. Three sites cannot be investigated because they are historical sites. No sites are recommended for remediation. A revised Phase II investigation work plan will be developed based on the conclusions and recommendations presented in this supplemental investigation report.
2015 Biennial Asphalt Monitoring and Removal Report for Area of Concern C-00-041, Guaje/ Barrancas/Rendija Canyons Aggregate Area (LANL 2015i)	00	1	n/a	1	n/a	The amount of asphalt and tar removed from the site during previous biennial events decreased from approximately 10 cubic yards removed in 2007 to one-half 55-gallon drum removed in 2013. In 2015, two to three 55-gallon drums filled with 1,160 pounds of asphalt and tar were removed from AOC C-00-041.

Document/Activity	Technical Areas	Number of Sites Investigated	Number of Samples Collected	Number of Sites where Cleanup Conducted	Number of Sites where Extent Defined/ Not Defined	Conclusions/ Recommendations
Semiannual Progress Reports for Corrective Measures Evaluation/ Corrective Measures Implementation for Consolidated Unit 16-021(c)-99 (LANL 2015j)[b]	16	1	Best management practices inspected (no significant rain events recorded between October 2014 and March 2015; nine significant rain events recorded between April and September 2015); two periodic monitoring events conducted as part of the Technical Area 16 260 monitoring group	n/a	n/a	Best management practices were inspected and found to be in good condition; no maintenance or repairs were necessary. Interim measures source-removal testing was conducted at deep perched-intermediate well CdV-16-4ip to determine whether source removal from this zone can be conducted to limit potential migration of RDX (1,3,5-trinitro-1,3,5-triazacyclohexane or royal demolition explosive) and other constituents to the underlying regional aquifer and to determine if long-term pumping in the perched-intermediate zone is a viable source-removal option. Long-term pumping at CdV-16-4ip with the sole objective of removing mass from the deep perched groundwater is not cost-effective because of the relatively low yield of this well (3 gallons per minute) and the limited mass of RDX that would be produced. The extended source-removal test at CdV-16-4ip demonstrated that long-term pumping at the well would remove RDX from the deep perched-intermediate aquifer at Technical Area 16 at a rate of approximately 1 kilogram per year. Perched-intermediate wells CdV-9-1(i) and R-63i and regional aquifer wells R-47 and R-58 were drilled and completed. A Laboratory study of groundwater tracers proposed for use in a tracer test showed the tracers to be stable and to not influence RDX concentrations.
Technical Area 57 Aggregate Area (Fenton Hill), Revision 1 (LANL 2015k)	57	2	52 surface and subsurface samples collected in 2014	~ 1.5 cubic yards of soil excavated at AOC 57-007 to remove elevated arsenic	2/0	There is no potential unacceptable risk or dose under the industrial, construction worker, and residential scenarios; no potential ecological risks for any receptor; and the nature and extent of contamination is defined and/or no further sampling for extent is warranted. The Laboratory recommended no further investigation or remediation activities are warranted, and the sites are appropriate for corrective actions complete without controls.
Upper Los Alamos Canyon Aggregate Area High-Angle Remediation Project (LANL 2016d)	32	1	22	1	1/0	Approximately 158 cubic yards of mercury-contaminated soil was excavated and confirmation samples were collected from 11 locations at SWMU 32 002(b2) in calendar year 2015. Additional samples were collected for an earthworm bioaccumulation study.

Document/Activity	Technical Areas	Number of Sites Investigated	Number of Samples Collected	Number of Sites where Cleanup Conducted	Number of Sites where Extent Defined/ Not Defined	Conclusions/ Recommendations
Sampling of solid waste management units and areas of concern within the Upper Los Alamos Canyon Aggregate Area	01, 43	6	206	n/a	1/5	Surface and subsurface samples were collected from SWMU 01-001(g), 01-003(a), 01 003(b), 01-006(b), and 01-007(b) and AOC C-43-001 to determine if remediation is warranted, and, if appropriate, to delineate area(s) to be remediated. Based on the sampling results, the AOC does not require remediation, while the five SWMUs will be remediated.
Supplemental Investigation Report for Threemile Canyon Aggregate Area (LANL 2016e)	12, 14, 15, 36	25	771 samples collected from 1994 through 2010	0	21/4	The Laboratory recommended no further investigation or remediation activities are warranted for 21 sites, all of which are appropriate for corrective actions complete without controls. Additional sampling is needed to define the extent of contamination at four sites and two of these sites are also recommended for remediation. A revised Phase II investigation work plan will be developed based on the conclusions and recommendations presented in this supplemental investigation report.
2015 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project (LANL 2016f)	n/a	Monitoring is conducted at 12 gage stations located throughout the watershed.	52 sampling events (a sampling event is defined as the collection of one or more samples from a specific gage station during a specific run-off event) resulting in ~ 1,100 samples collected; storm water samples were also collected above the detention basins below the SWMU 01-001(f) drainage	n/a	n/a	The 2015 monitoring data in the Los Alamos/Pueblo watershed indicate that, in general, the mitigations are performing as designed. Geomorphic changes are monitored at one background area, five sediment transport mitigation sites, and two sediment retention basin areas that have been established in the Los Alamos/Pueblo watershed. Overall, little to no geomorphic change occurred in and around the mitigation sites between 2014 and 2015, indicating the mitigations are performing as designed. Based on the correlations between concentrations of metals, radioisotopes, and polychlorinated biphenyl (PCB)s in unfiltered storm water and suspended sediment concentration, the Laboratory recommended discontinuing certain constituents (aluminum, arsenic, beryllium, cadmium, chromium, copper, iron, lead, nickel, vanadium, zinc, thallium, isotopic uranium, antimony, barium, cobalt, and manganese) from monitoring of storm water at Los Alamos and Pueblo watershed gaging stations E026, E030, E038, E039.1, E040, E042.1, E055, E055.5, E056, E059.5, and E059.8.

Document/Activity	Technical Areas	Number of Sites Investigated	Number of Samples Collected	Number of Sites where Cleanup Conducted	Number of Sites where Extent Defined/ Not Defined	Conclusions/ Recommendations
2015 Sandia Wetland Performance Report (LANL 2016g)	03	Monitoring conducted at wetland in Sandia Canyon	248 samples collected in 2015	n/a	n/a	The monitoring performed during the performance period indicates that the Sandia wetland is stable following the installation of the grade control structure, even with declining effluent volumes entering the wetlands. Within the alluvial system, wetland sediments remain highly reducing and no detrimental temporal trends in chemistry have been noted. Despite reduced effluent discharge over most of the post-Sanitary Effluent Reclamation Facility expansion record, water levels have generally been stable, although periods of increased water levels related to monsoons and decreased water levels, likely related to high periods of evapotranspiration, have been observed. Even in wells where water levels dropped temporarily, reducing conditions were maintained. Despite overall reduced effluent volumes, water levels remain sufficiently high to sustain obligate wetland vegetation. No large-scale systematic erosion has been noted in the wetland and the system seems to be highly stable from a physical perspective.
Interim Measures Progress Report for Soil-Vapor Extraction of Volatile Organic Compounds from Material Disposal Area L, Technical Area 54 (LANL 2016c)	54	1	63 pore gas samples collected from vapor monitoring wells in July and November 2015	n/a	n/a	During the first year of soil vapor extraction operation, the two soil vapor extraction units removed 553 kilograms (1,217 pounds) of total organic vapor mass. The mass was primarily removed from within an approximately 150-foot radius surrounding each of the extraction wells. Mass removal was higher initially and continued at a removal rate of nearly 17 pounds/month after 10 months of operation. The long-term ability of the soil vapor extraction system to remove significant quantities of organic vapor has been demonstrated. Further operation followed by rebound analysis was recommended, along with a gas tracer test.
Supplemental Investigation Report for Upper Cañada del Buey Aggregate Area (LANL 2016h)	04, 46	49	657 samples collected in 1998 and 2010	0	40/9	The Laboratory recommended no further investigation or remediation activities are warranted for 40 sites: 32 of these sites are appropriate for corrective actions complete without controls, seven sites are appropriate for corrective action complete with controls, and one requires remediation. Additional sampling is needed to define the extent of contamination at nine sites, and one of these sites is also recommended for remediation A revised Phase II investigation work plan will be developed based on the conclusions and recommendations presented in this supplemental investigation report.

Document/Activity	Technical Areas	Number of Sites Investigated	Number of Samples Collected	Number of Sites where Cleanup Conducted	Number of Sites where Extent Defined/ Not Defined	Conclusions/ Recommendations
Supplemental Investigation Report for Sites at Technical Area 49 Inside the Nuclear Environmental Site Boundary (LANL 2016i)	49	10	879 samples collected from 1995 through 2010	0	10/0	The Laboratory recommended no further investigation or remediation activities are warranted for five sites: four sites are appropriate for corrective actions complete without controls and one site is appropriate for corrective actions complete with controls. For the five remaining sites, extent of contamination is defined or no further sampling is warranted and there is no unacceptable risk from surface and shallow contamination. These five sites are part of Material Disposal Area AB and subsurface contamination at these sites will be evaluated as part of the Corrective Measures Evaluation for Material Disposal Area AB. No sites are recommended for remediation.
Supplemental Investigation Report for Sites at Technical Area 49 Outside the Nuclear Environmental Site Boundary (LANL 2016i)	49	3	285 samples collected in 1995 and 2009	0	1/2	The Laboratory recommended no further investigation or remediation activities are warranted for one site, which is also appropriate for corrective actions complete with controls. Additional sampling for nature and extent is recommended for the other two sites. No sites are recommended for remediation. A revised Phase II investigation work plan will be developed based on the conclusions and recommendations presented in this supplemental investigation report.
Supplemental Investigation Report for Cañon de Valle Aggregate Area, Technical Area 14 (LANL 2016j)	14	18	282 samples collected in 1997 and 2011	0	17/1	LANS recommended no further investigation or remediation activities are warranted for 17 sites, all of which are appropriate for corrective actions complete without controls. Additional sampling is needed to define the extent of contamination at one site, but will be deferred until associated firing site activities cease. No sites are recommended for remediation.

Document/Activity	Technical Areas	Number of Sites Investigated	Number of Samples Collected	Number of Sites where Cleanup Conducted	Number of Sites where Extent Defined/ Not Defined	Conclusions/ Recommendations
Annual Progress Reports for Corrective Measures Evaluation/ Corrective Measures Implementation for Consolidated Unit 16-021(c)-99 (LANL 2016k)	16	1	Best management practices inspected (six significant rain events recorded between October 2015 and September 2016); four periodic monitoring events conducted as part of the Technical Area 16, Building 260 monitoring group	n/a	n/a	Best management practices were inspected and found to be in good condition; no maintenance or repairs were necessary. Tracers were deployed in five screened intervals in monitoring wells R-25b, CdV-9-1(i) screen 1, CdV-9-1(i) Piezometers 1 and 2, and CdV-16-1(i). The tracer sampling results have demonstrated the importance of vertical flow paths at CdV-9-1(i) between the two piezometers and screen 1. Cross-borehole extended aquifer testing was conducted at three perched intermediate wells to evaluate the degree of hydraulic connectivity within the perched groundwater system and to improve the understanding of contaminant transport pathways. The estimated RDX inventory in soils, the vadose zone, perched-intermediate, and regional groundwater was revised in 2016 and found to range from 1,467 kilograms to 2,669 kilograms. Geological studies to support the Corrective Measures Evaluation were completed in 2016. Major findings included: 1) percolation of groundwater through the vadose zone will tend to stair-step towards the east and southeast along bedding contacts before entering the upper deep perched groundwater zone, 2) flow directions for perched groundwater in the upper deep perched groundwater zone are likely to be towards the southeast based on the orientation of potential confining or semiconfining beds, and 3) faults and fractures are likely to be primary pathways for recharge through strongly welded tuffs that underlie Cañon de Valle.
2016 Triennial Ordnance Survey Report, Solid Waste Management Units 00-011(a, d, and e), Guaje/ Barrancas/ Rendija Canyons Aggregate Area (LANL 2016l)	00	3	n/a	n/a	n/a	No unexploded ordnance was found at SWMU 00-011(a, d, and e). LANS unexploded ordinance technicians determined that no explosive hazards were located during the visual sweep. Several pieces of munitions debris were identified at SWMU 00-011(a and e). All identified munitions debris was removed by Laboratory Emergency Response personnel.

Document/Activity	Technical Areas	Number of Sites Investigated	Number of Samples Collected	Number of Sites where Cleanup Conducted	Number of Sites where Extent Defined/ Not Defined	Conclusions/ Recommendations
Investigation and Cleanup of Town Site Solid Waste Management Units 01-001(d), 01-001(g), 01-003(b), 01-006(b), 01-006(h), 01-007(a), and 01-007(b)	01	7	108	4	4/3	Characterization sampling was performed at seven sites as part of the Phase II investigation of Upper Los Alamos Canyon Aggregate area. A total of 133 cubic yards of plutonium-239/240-contaminated soil was removed from SWMUs 01-001(g), 01-006(b), 01-007(a), and 01-007(b). Nature and extent of contamination has been defined at four sites and these sites are appropriate for corrective action complete with controls. Additional sampling and/or remediation is needed at three sites.

a. n/a = Not applicable.

b. Both progress reports summarized together.

There were 22 volatile organic compounds and tritium detected in pore gas at Material Disposal Area C during the first sampling event and 17 volatile organic compounds and tritium detected in pore gas during the second sampling event. The screening evaluation of the 2014 data identified four volatile organic compounds with vapor concentrations above their respective Tier I screening values based on protection of groundwater: 2-hexanone, methylene chloride, 1,1,2-trichloroethane, and trichloroethene (TCE). The Tier I screening levels are very conservative screening levels intended to identify whether vapor-phase chemicals could result in contamination of groundwater in excess of cleanup levels. TCE is the only volatile organic compound detected at concentrations above the less conservative Tier II groundwater protection screening values in three monitoring wells at the eastern end of Material Disposal Area C. Samples with TCE above the Tier II screening levels were all collected at over 800 feet above the regional aquifer indicating groundwater has not been impacted. The locations with the highest TCE concentrations are consistent with vapor monitoring data from previous years. The similarity of the volatile organic compound results across several years of monitoring indicates there have been no new releases from the disposal units and volatile organic compounds have not migrated to groundwater.

At most locations, the tritium activity decreased with depth, and most values were below the Tier I and Tier II screening values. Tritium exceeded either the Tier I or the Tier II screening value in monitoring wells at the eastern end and along the northern boundary of Material Disposal Area C for the two sampling events. The 2014 tritium results are consistent with previous monitoring data and indicate there have been no new releases from the disposal units and tritium has not migrated to groundwater.

Vapor monitoring at Material Disposal Area C will continue on a semiannual basis to support remedy selection.

2.17.3 Site/Facility Categorization

No new nuclear environmental sites were added to or removed from the DOE listing of LANL Nuclear Facilities List during 2015 and 2016 (Table 2-9). Additionally, there were no changes to the hazard categories of any nuclear environmental sites.

Table 2-9. Environmental Sites with Nuclear Hazard Classification

Site	Description	2008 SWEIS	LANL 2015 and 2016*
Technical Area 21; SWMU 21-014	Material Disposal Area A (General's Tanks)	2	2
Technical Area 21; Consolidated Unit 21-016(a)-99	Material Disposal Area T	2	2
Technical Area 35; AOC 35-001	Material Disposal Area W	3	3
Technical Area 49; SWMUs 49-001(a), 49-001(b), 49-001(c), and 49-001(d)	Material Disposal Area AB	2	2
Technical Area 54; SWMU 54-004	Material Disposal Area H	3	3
Technical Area 54; Consolidated Unit 54-013(b)-99	Material Disposal Area G, as an element of Technical Area 54 Waste Storage and Disposal Facility, Area G	2	2

* List of LANL nuclear facilities (LANL 2017a).

3.0 SITE-WIDE 2015 AND 2016 OPERATIONS DATA AND AFFECTED RESOURCES

This chapter summarizes operational data at the site-wide level. It compares actual operating data to projected environmental effects for the parameters discussed in the 2008 SWEIS, including effluent, workforce, regional, and long-term environmental effects.

3.1 Air Emissions

3.1.1 Radiological Air Emissions

Radiological airborne emissions from point sources (i.e., stacks) during calendar year 2015 totaled approximately 126 curies and approximately 254 curies during calendar year 2016, about 0.4 percent and 0.7 percent respectively of the annual projected radiological air emissions of 34,000 curies[14] projected in the 2008 SWEIS.

The two largest contributors to radioactive air emissions were tritium from the Tritium Facilities (both Key and Non-Key) and activation products from LANSCE. Stack emissions from the Tritium Key Facility were about 38 curies in calendar year 2015 and 63 curies in calendar year 2016.

The total point source emissions from LANSCE were approximately 88 curies in calendar year 2015 and 191 curies in calendar year 2016.

Non-point sources of radioactive air emissions are present at LANSCE, Area G, and other locations around LANL. In most years, non-point emissions are generally small compared with stack emissions. In calendar year 2015 and in calendar year 2016, diffuse emissions were relatively small compared with point sources. In calendar year 2015, diffuse emissions were approximately 54 curies while in calendar year 2016 they were about 34 curies.

Maximum offsite dose to the maximally exposed individual was 0.13 millirem in 2015 and 0.12 millirem in 2016. The Environmental Protection Agency radioactive air emissions limit for DOE facilities is 10 millirem per year. This dose is calculated to the theoretical maximally exposed individual who lives at the nearest offsite receptor location 24 hours per day, eating food grown at that same site. These are highly conservative assumptions intended to maximize the potential dose.

In the 2008 SWEIS, radiological air emissions are projected to remain at levels similar to those projected in the 1999 SWEIS. However, short-term increases could occur during construction or DD&D activities, as well as material disposal area remediation, canyon cleanup, and other actions related to the implementation of the Consent Order.

3.1.2 Non-Radiological Air Emissions

Emissions of Criteria Pollutants. The 2008 SWEIS projected that criteria pollutants would be less than those shown in the operating permit and well below the ambient standards established

14 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. Annual radiological air emissions from 1999–2005 were used to project the air emissions in the 2008 SWEIS. Emissions of activation products from LANSCE were much higher in those years because of a failure in one component of the emissions control system. The system was repaired in calendar year 2006, which has significantly decreased emissions.

to protect human health with an adequate margin of safety. Minor non-radiological air quality impacts are projected to occur during construction and DD&D activities, as well as during implementation of the Consent Order.

Criteria pollutants include nitrogen oxides, sulfur oxides, carbon monoxide, and particulate matter. Compared with industrial sources and power plants, LANL is a relatively small source of these non-radioactive air pollutants. As such, LANL is required to estimate emissions, rather than perform actual stack sampling. As Table 3-1 shows, calendar years 2015 and 2016 emissions for three of the four categories (carbon monoxide, nitrogen oxides, and particulate matter) were within the 2008 SWEIS projection. Sulfur dioxide emissions were above the 2008 SWEIS projections.

Table 3-1. Emissions of Criteria Pollutants as Reported on LANL's Annual Emissions Inventory*

Pollutants	2008 SWEIS (tons/year)	2015 Operations (tons/year)	2016 Operations (tons/year)
carbon monoxide	58.0	11.4	10.0
nitrogen oxides	201.0	19.9	16.8
particulate matter	11.0	0.54	0.41
sulfur oxides	0.98	2.0	2.2

* Emissions included on the annual Emissions Inventory Report do not include insignificant sources (e.g., small, exempt boilers and heaters and exempt standby emergency generators).

Criteria pollutant emissions from LANL's fuel-burning equipment are reported in the annual Emissions Inventory Report as required by the New Mexico Administrative Code, Title 20, Chapter 2, Part 73. The report provides emission estimates for non-exempt boilers, the Technical Area 03 Power Plant, the Combustion Gas Turbine Generator, and the Technical Area 60 Asphalt Batch Plant. Emissions from the data disintegrator, degreasers, and permitted beryllium machining operations are also reported. For more information, refer to the LANL Annual Emissions Inventory Report for 2015 and 2016 (LANL 2017b, 2016m). In calendar years 2015 and 2016, more than half of the criteria pollutants (nitrogen oxides and carbon monoxide) originated from the Technical Area 03 Power Plant.

In February 2015, LANL received a new Title V Operating Permit from NMED. This permit included facility-wide emission limits and additional recordkeeping and reporting requirements. Table 3-2 summarizes the facility-wide emission limits in the Title V Operating Permit, the 2008 SWEIS emission projections, and calendar years 2015 and 2016 actual emissions from all sources included in the permit. Emissions from insignificant sources of boilers, heaters, and emergency generators are included in these totals. In both years, all emissions were below the levels projected in the 2008 SWEIS and the Title V Operating Permit.

Chemical Usage and Emissions. Chemical usage and calculated emissions for Key Facilities are reported using ChemDB, LANL's chemical management database. The quantities presented here represent all chemicals procured or brought onsite in calendar years 2015 and 2016. This methodology is identical to that used by LANL for reporting under Section 3.1.2.3 of the Emergency Planning and Community Right-to-Know Act (42 USC 11023) and for reporting regulated air pollutants estimated from research and development operations in the annual Emissions Inventory Reports (LANL 2015l, 2016n).

Table 3-2. 2015 and 2016 Emissions for Criteria Pollutants as Reported on LANL's Title V Operating Permit Emissions Reports*

Pollutants	2008 SWEIS (tons/year)	Title V Facility-Wide Emission Limits (tons/year)	2015 Emissions (tons/year)	2016 Emissions (tons/year)
carbon monoxide	58.0	225	26.9	24.3
nitrogen oxides	201.0	245	35.9	32.4
particulate matter	11.0	120	0.47	0.38
sulfur oxides	0.98	150	3.5	3.5

* The Title V Operating Permit Emissions Report includes two categories of sources not required in the annual Emission Inventory Report: small, exempt boilers and heaters and exempt standby emergency generators.

Air emissions presented in Appendix B are listed as emissions by Key Facility. Emission estimates (expressed as kilograms per year) were performed in the same manner as those reported in previous SWEIS Yearbooks. First, usage of listed chemicals was calculated per Key Facility. It was then estimated that 35 percent of the chemical used was released into the atmosphere. Emission estimates for some metals, however, were based on an emission factor of less than 1 percent. This is appropriate because these metal emissions are assumed to result from cutting or melting activities. Fuels such as propane and acetylene were assumed to be completely combusted; therefore, no emissions were reported.

Table 3-3 gives information on total volatile organic compounds and hazardous air pollutants estimated from research and development operations. Projections in the 2008 SWEIS for volatile organic compounds and hazardous air pollutants were expressed as concentrations rather than emissions; therefore, direct comparisons cannot be made, and projections from the 2008 SWEIS are not presented. The volatile organic compound emissions reported from research and development activities reflect quantities procured in each calendar year. The hazardous air pollutant emissions reported from research and development activities generally reflect quantities procured in each calendar year. In a few cases, however, procurement values and operational processes were further evaluated so that actual air emissions could be reported instead of procurement quantities. In calendar years 2015 and 2016, the hazardous air pollutant and volatile organic compound emissions were well below Title V Operating Permit limits.

Table 3-3. Emissions of Volatile Organic Compounds and Hazardous Air Pollutants from Chemical Use in Research and Development Activities

Pollutant	Emissions (tons/year)		
	Title V Operating Permit Limits	Calendar Year 2015	Calendar Year 2016
hazardous air pollutants	24	4.4	6.4
volatile organic compounds	200	9.1	12.7

Greenhouse Gas Emissions. LANL reports its annual greenhouse gas emissions from stationary combustion sources to the Environmental Protection Agency for the previous calendar year. The stationary combustion sources at LANL include permitted generators, standby stationary generators, the Technical Area 60 Asphalt Batch Plant, the Technical Area 03 Power Plant, the Combustion Gas Turbine Generator, and all boilers. In calendar year

2015, these stationary combustion sources emitted 46,264.5 metric tons of carbon dioxide equivalents. In calendar year 2016, these stationary combustion sources emitted 43,837.9 metric tons of carbon dioxide equivalents. Methane has approximately 25 times the global warming potential of carbon dioxide, and nitrous oxide has approximately 298 times the global warming potential of carbon dioxide. Methane and nitrous oxide are weighted respectively when calculating the mass of carbon dioxide equivalents emitted. Table 3-4 shows the breakdown of greenhouse gas emissions from LANL's stationary combustion sources by emission type in metric tons per year.

Table 3-4. Emissions from LANL's Stationary Sources[a]

Gas	Units	2008 SWEIS[b]	2015 Emissions	2016 Emissions
methane	metric tons/year	–	0.87	0.83
nitrous oxide	metric tons/year	–	0.088	0.085
carbon dioxide	metric tons/year	–	46,264.5	43,791.8
Total Emissions	**metric tons carbon dioxide equivalents/year**	–	**46,312.5**	**43,837.9**

a. LANL Greenhouse Gas Emissions Electronic Submitted to the Environmental Protection Agency (LANL 2017c).
b. The 2008 SWEIS did not project greenhouse gas emissions.

3.2 Liquid Effluents

To reduce the potential impacts of LANL activities on water resources, LANL has several programs that monitor and protect surface water quality and quantity.

Outfall Reduction Program. From January 1, 2015, through December 31, 2016, LANL had 11 wastewater outfalls (10 industrial outfalls and one sanitary outfall) that were regulated under NPDES Permit No. NM0028355. Based on discharge monitoring reports prepared by LANS, eight permitted outfalls recorded flows in calendar year 2015, totaling an estimated 110.3 million gallons. This is approximately 0.1 million gallons less than the calendar year 2014 total of approximately 110.4 million gallons. In calendar year 2016, eight permitted outfalls recorded flows totaling approximately 108.2 million gallons. This is approximately 2.1 million gallons less than in calendar year 2015, but is well below the annual maximum flow of 279.5 million gallons projected in the 2008 SWEIS. Details on NPDES compliance and noncompliance during calendar years 2015 and 2016 are provided in the 2015 and 2016 Annual Site Environmental Reports (LANL 2016d, 2017d). Calendar years 2015 and 2016 discharges are summarized by watershed and compared with watershed totals projected in the 2008 SWEIS in Table 3-5.

Table 3-5. NPDES Annual Discharges by Watershed (million gallons)

Watershed	No. of Outfalls 2008 SWEIS	No. of Permitted Outfalls 2015 and 2016	Discharge 2008 SWEIS	Discharge Calendar Year 2015	Discharge Calendar Year 2016
Guaje	0	0	0	0	0
Los Alamos	5	1	45.6	20.18	23.02
Mortandad	5	4	44.3	2.78	2.68
Pajarito	0	0	0	0	0
Pueblo	0	0	0	0	0
Sandia	6[a]	5	187.3	87.42	82.59

Watershed	No. of Outfalls 2008 SWEIS	No. of Permitted Outfalls 2015 and 2016	Discharge 2008 SWEIS	Discharge Calendar Year 2015	Discharge Calendar Year 2016
Water[b]	5	1	2.26	0	0
Totals	**21**	**11**	**279.5**	**110.38**	**108.29**

a. Includes Outfall 13S from the Sanitary Wastewater Systems Plant, which is registered as a discharge to Cañada del Buey or Sandia Canyon. The effluent is actually piped to Technical Area 03 and ultimately discharged to Sandia Canyon via Outfall 001 or Outfall 03A027.

b. Includes 05A055 discharge to Cañon de Valle, a tributary to Water Canyon.

Table 3-6 compares NPDES discharges by Key and Non-Key Facilities. In calendar years 2015 and 2016, the bulk of the discharges came from Non-Key Facilities. Key Facilities accounted for approximately 33.5 million gallons of the total in calendar year 2015 and 35.1 million gallons of the total in calendar year 2016. LANSCE discharged approximately 20.5 million gallons in calendar year 2015, about 4.7 million gallons more than calendar year 2014, accounting for about 65.6 percent of the total discharge from all Key Facilities. In 2016, LANSCE discharged approximately 23.2 million gallons, about 2.8 million gallons more than calendar year 2015, accounting for about 66.1 percent of the total discharge from all Key Facilities.

Table 3-6. NPDES Annual Discharges by Facility (million gallons)

Key Facility	No. of Outfalls 2008 SWEIS	No. of Permitted Outfalls in Calendar Years 2015 and 2016	Discharge 2008 SWEIS	Discharge Calendar Year 2015	Discharge Calendar Year 2016
Plutonium Complex	1	1	4.1	1.89	2.17
Tritium Facility	2	None	17.4	0	0
CMR Building	1	None	1.9	0	0
Sigma Complex	2	1	5.8	0.57[a]	0.260[a]
High Explosives Processing	3	1	0.06	0	0
High Explosives Testing	2	None	2.2	0	0
LANSCE	4	2	29.5[b]	20.45	23.24
Metropolis Center	1	1	17.7[c]	10.66	9.50[d]
Biosciences	None	None	0	0	0
Radiochemistry Facility	None	None	0	0	0
RLWTF	1	1	4.0	0	0
Pajarito Site	None	None	0	0	0
Materials Science Laboratory	None	None	0	0	0
Target Fabrication Facility	None	None	0	0	0
Machine Shops	None	None	0	0	0
Solid Radioactive and Chemical Waste Facilities	None	None	0	0	0
Subtotal, Key Facilities	17	7	82.66[e]	33.57	35.17

Key Facility	No. of Outfalls 2008 SWEIS	No. of Permitted Outfalls in Calendar Years 2015 and 2016	Discharge 2008 SWEIS	Discharge Calendar Year 2015	Discharge Calendar Year 2016
Non-Key Facilities	4	4	200.9	76.81	73.12
Totals	**21**[f]	**11**	**283.5**[e]	**110.38**	**108.29**

a. Estimated discharge from unidentified low-volume discharge that began August 13, 2014, and continued through the end of calendar year 2016.

b. In previous Yearbooks, this number was reported inaccurately as 28.2. The total discharge projected for all LANSCE outfalls into both Los Alamos and Sandia canyons is 29.5 million gallons, which is the combined total of 28.2 and 1.3 million gallons, respectively.

c. Previous Yearbooks incorrectly listed the No Action Alternative discharge amount for the Metropolis Center.

d. Discharges to Outfall 03A027 (Metropolis Center) have been directed to Outfall 001 beginning September 9, 2016.

e. Revised total from previous Yearbooks because of the addition of the Expanded Operations Alternative discharge amount for the Metropolis Center.

f. In previous Yearbooks, the number 15 was reported because as of August 1, 2007, there were only 15 permitted outfalls. However, the 2008 SWEIS projected 21 outfalls under the No Action Alternative. Therefore, this number has been updated to accurately reflect that projection.

LANL has three principal wastewater treatment facilities: the Sanitary Wastewater Systems Plant at Technical Area 46 (a Non-Key Facility), the RLWTF at Technical Area 50, and the High Explosive Wastewater Treatment Facility at Technical Area 16 (both Key Facilities). The RLWTF (Outfall 051) discharges into Mortandad Canyon. The High Explosive Wastewater Treatment Facility and RLWTF did not discharge any wastewater in calendar years 2015 and 2016.

As previously stated, discharges from the Non-Key Facilities made up the majority of the total calendar years 2015 and 2016 discharge from LANL. The total for calendar year 2015, 76.81 million gallons, was about 124.09 million gallons less than the 200.9 million gallons total annual discharge from Non-Key Facilities projected in the 2008 SWEIS. The total for calendar year 2016, 73.12 million gallons, was about 127.78 million gallons less than the 200.9 million gallons total annual discharge from Non-Key Facilities projected in the 2008 SWEIS. Two Non-Key Facilities, the Technical Area 46 Sanitary Wastewater Systems Plant and the Technical Area 03 Power Plant (both of which discharge through Outfall 001 and/or 13S), account for about 86 percent of the total discharge from Non-Key Facilities and about 61 percent of all water discharged by LANL in calendar year 2015. In calendar year 2016, the Sanitary Wastewater Systems Plant at Technical Area 46 and the Technical Area 03 Power Plant accounted for about 87 percent of the total discharge from Non-Key Facilities and about 59 percent of all water discharged by LANL, respectively.

Construction General Permit. The NPDES Construction General Permit Program regulates storm water discharges from construction activities disturbing one or more acres of land, including those construction activities that are less than one acre but part of a larger common plan of development collectively disturbing one or more acres of land. The NPDES Construction General Permit is a “general” permit that applies to all eligible construction projects throughout the State of New Mexico.

LANS and the general subcontractor apply individually for NPDES Construction General Permit coverage and are co-permittees at most construction sites. Compliance with the NPDES Construction General Permit includes developing and implementing a Storm Water Pollution Prevention Plan before soil disturbance can begin and conducting site inspections once soil disturbance has commenced. A Storm Water Pollution Prevention Plan describes the project activities and potential pollutants, site conditions, best management practices (sediment and erosion control measures), and permanent control measures required to minimize the discharge of pollutants from the site. Compliance with the NPDES Construction General Permit is documented through site inspections that evaluate control measures, site conditions, and project activities against permit requirements, and identify corrective actions required to minimize pollutant discharges. Data collected from these inspections are tabulated in site inspection compliance reports.

During calendar year 2015, the Laboratory implemented and maintained 27 construction-site Storm Water Pollution Prevention Plans and addendums and performed 620 storm water inspections at construction sites. Of the 620 site inspections performed, 613 inspections were compliant, for an overall compliance rate of 98.8 percent. The majority of non-compliances resulted from the construction subcontractors not meeting the timeframes established in the Construction General Permit for completion of corrective actions. This included meeting site stabilization time requirements and implementing routine maintenance on best management practices. All corrective action items identified in calendar year 2015 were addressed.

During calendar year 2016, the Laboratory implemented and maintained 25 construction-site Storm Water Pollution Prevention Plans and addendums and performed 653 storm water inspections at construction sites. Of the 653 site inspections performed, 650 inspections were compliant, for an overall compliance rate of 95.5 percent. Corrective action reports were prepared for all storm water management issues observed during inspections. All corrective action items identified in calendar year 2016 were addressed.

Multi-Sector General Permit. The NPDES Multi-Sector General Permit Program regulates storm water discharges from specified industrial activities and their associated facilities. These activities include metal fabrication; hazardous waste treatment, storage, and disposal; vehicle and equipment maintenance; recycling activities; electricity generation; and asphalt manufacturing. The intent of the Multi-Sector General Permit is to authorize storm water discharges from permitted industrial facilities and minimize the discharge of potential pollutants.

During calendar years 2015 and 2016, Multi-Sector General Permit-regulated facilities were subject to the Multi-Sector General Permit (NMR05GB21) issued by the Environmental Protection Agency on September 29, 2008. Nation-wide authorization to discharge under this permit expired at midnight on September 29, 2013. However, the Environmental Protection Agency administratively continued the permit, which required continued compliance with the 2008 permit requirements. 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 Multi-Sector General Permit (NMR053195) was renewed in June 2015 and will expire in June 2020.

The 2008 Multi-Sector General Permit requires the development and implementation of site-specific Storm Water Pollution Prevention Plans that must include identification of potential pollutants and the implementation of best management practices. The permit also requires monitoring of storm water discharges from permitted sites for specified constituents, personnel training, site inspections, and implementation of corrective actions.

Compliance with the 2008 Multi-Sector General Permit for LANL-permitted facilities in calendar years 2015 and 2016 was achieved primarily by implementing the following.

- Identifying potential pollutants and activities that may impact surface water quality and identifying and providing structural and non-structural controls (best management practices) to limit the impact of those pollutants.
- Implementing and updating facility-specific Storm Water Pollution Prevention Plans as needed.
- Performing routine facility inspections and conducting required corrective actions.
- Monitoring storm water run-off at facility stand-alone samplers for industrial sector-specific benchmark parameters, impaired water constituents, and effluent limitations.
- Performing required benchmark, impaired waters, and effluent limitations storm water monitoring of specific analytical parameters for the industrial activities listed under the permit.

LANS implemented and maintained 12 Multi-Sector General Permit Storm Water Pollution Prevention Plans covering 14 facilities in calendar year 2015, and also implemented and maintained 12 Multi-Sector General Permit Storm Water Pollution Prevention Plans covering 14 facilities in calendar year 2016. Detailed results of calendar years 2015 and 2016 Multi-Sector General Permit monitoring are summarized in the Annual Site Environmental Reports for 2015 and 2016 (LANL 2016d, 2017d). LANL has completed eight years of required storm water analytical monitoring in accordance with the 2008 Multi-Sector General Permit. Since LANL started monitoring under the 2008 Multi-Sector General Permit in April 2009, the analytical monitoring requirements have been completed for most of the permitted facilities. The permit allows discontinuation of monitoring under the following circumstances:

- constituents are found not to be present,
- constituents/parameters are found to be present below permit defined levels, or
- changes to impaired water constituents (i.e., no longer requiring specific constituent monitoring for impaired water).

NPDES Individual Permit for Storm Water Discharges from SWMUs/AOCs. On February 13, 2009, the Environmental Protection Agency Region 6 issued NPDES Individual Permit No. NM0030759 to co-permittees LANS and DOE. Immediately following issuance of the Individual Permit by the Environmental Protection Agency, the Individual Permit was appealed by a local citizen's group. Following permit modification negotiations in 2009, the Environmental Protection Agency issued a new modified Individual Permit that became effective on November 1, 2010, with an expiration date of March 31, 2014. A draft permit renewal was submitted by DOE/NNSA on March 19, 2015, and the November 2010 permit was administratively continued on July 21, 2015. DOE/NNSA is awaiting the final Individual Permit renewal from the Environmental Protection Agency. The Individual Permit authorizes discharges of storm water from certain SWMUs and AOCs (sites) at the Laboratory. The Environmental Protection Agency has approved two permit renewal application extension requests and the existing permit conditions will be in effect until a new permit is issued.

The Individual Permit lists 405 permitted sites that must be managed in compliance with the terms and conditions of the Individual Permit to prevent the transport of contaminants to surface waters via storm water run-off. Potential contaminants of concern within these sites are metals, organic chemicals, high explosives, and radionuclides. In some cases, these contaminants are present in soils within three feet of the ground surface and can be susceptible to erosion driven by storm events and transport through storm water run-off.

The Individual Permit is a technology-based permit and relies, in part, on non-numeric technology-based effluent limits (storm water control measures). Site-specific storm water control measures that reflect best industry practice, considering their technological availability, economic achievability, and practicability, are required for each of the 405 permitted sites to minimize or eliminate discharges of pollutants in storm water. These control measures include run-on, run-off, erosion, and sedimentation controls, which are routinely inspected and maintained as required.

For purposes of monitoring and management, sites are grouped into small sub watersheds called site monitoring areas. The site monitoring areas have sampling locations identified to most effectively sample storm water run-off. Storm water is monitored from these site monitoring areas to determine the effectiveness of the controls. When target action levels, which are based on New Mexico water quality standards, are exceeded, additional corrective actions are required. In summary, the process of complying with the Individual Permit can be broken down into five categories: 1) installation and maintenance of control measures, 2) storm water confirmation sampling to determine effectiveness of control measures, 3) additional corrective action (if a target action level is exceeded), 4) reporting results of fieldwork and monitoring, and 5) certification of corrective action complete or requests for alternative compliance.

In calendar year 2015, the Laboratory completed the following tasks:

- Published the 2014 update to the Site Discharge Pollution Prevention Plan, Revision one, that 1) identifies pollutant sources, 2) describes the control measures, and 3) describes the monitoring at all regulated sites
- Completed 1,794 inspections of storm water controls at the 250 site monitoring areas
- Completed 1,531 sampling equipment inspections
- Conducted storm water control maintenance at 122 site monitoring areas
- Collected storm water samples at seven site monitoring areas without enhanced controls
- Collected storm water samples at seven site monitoring areas with enhanced controls
- Activated samplers at 35 site monitoring areas with enhanced controls
- Completed installation of enhanced controls at 35 site monitoring areas
- Submitted certification that 10 sites were complete because the sites had no exposure to storm water
- Completed recovery activities from the September 13, 2013, flood event
- Continued negotiations on the permit renewal application for the Individual Permit
- Submitted alternative compliance requests for 77 sites
- Held two public meetings
- Completed website updates and public notifications
- Collected 17 Individual Permit samples at site monitoring areas; 10 site monitoring area samples had 22 target action level exceedances

In calendar year 2016, LANS completed the following tasks:

- Published the 2015 update to the Site Discharge Pollution Prevention Plan, Revision one, that 1) identifies pollutant sources, 2) describes the control measures, and 3) describes the monitoring at all regulated sites
- Completed 1,194 inspections of storm water controls at the 250 site monitoring areas
- Completed 1,292 sampling equipment inspections
- Conducted storm water monitoring at 162 site monitoring areas
- Collected eight Individual Permit samples at site monitoring areas; nine site monitoring areas had a sum of 20 target action level exceedances
    - Completed monitoring at three site monitoring areas with collection of an investigative sample after certification of no exposure
    - Collected corrective action enhanced control confirmation monitoring samples at four site monitoring areas
- Installed control measures to minimize erosion
    - Installed a total of 112 “additional” control measures at 34 site monitoring areas
    - Installed a total of 11 controls to replace existing baseline control measures at eight site monitoring areas
    - Installed a total of 10 enhanced controls at two site monitoring areas
- Completed correction action at four site monitoring areas/site combinations
- Completed two site monitoring areas/site combinations with certification of completion of corrective action under the Consent Order
- Completed two site monitoring areas/site combinations with results less than target action levels from 2015 sampling events
- Submitted alternative compliance requests for 17 sites
- Held one public meeting
- Completed website updates and public notifications
- Piloted the use of radio telemetry equipment in conjunction with automated samplers to aid in prioritizing sample collection and to improve program effectiveness

For more information on the LANL Individual Storm Water Permit visit http://www.lanl.gov/community-environment/environmental-stewardship/protection/compliance/individual-permit-stormwater/index.php.

3.3 Solid Radioactive and Chemical Wastes

Because of the complex array of facilities and operations, LANL generates a wide variety of waste types including solids, liquids, semi-solids, and contained gases. These waste streams are regulated as solid, hazardous, LLW, TRU, or wastewater by a host of state and federal regulations. The institutional requirements relating to waste management at LANL are located in a series of documents that are part of LANL’s institutional procedures. These requirements specify how all process wastes and contaminated environmental media generated at LANL are managed. Wastes are managed by planning for waste generation for each new project through final disposal or permanent storage of those wastes. This ensures that LANL meets all requirements including DOE orders, federal and state regulations, and LANL permits.

LANL's waste management operations capture and track data for waste streams, regardless of their points of generation or disposal. These data include information on waste generating processes, waste quantities, chemical and physical characteristics of the waste, regulatory status of the waste, applicable treatment and disposal standards, and final disposition of the waste. The data are ultimately used to assess operational efficiency, help ensure environmental protection, and demonstrate regulatory compliance.

The 2008 SWEIS projected cumulative waste generation rates for all waste types to be substantially large because of future remediation under the Consent Order and DD&D of facilities. Actual waste volumes from remediation may be smaller, depending on regulatory decisions by NMED and because of waste volume reduction techniques.

LANL generates radioactive and chemical wastes as a result of research, production, maintenance, and construction. In addition, the Environmental Management Directorate performs cleanup operations of sites and facilities formerly involved in weapons research and development. Tables 3-7 and 3-8 summarize waste types and generation for LANL in calendar years 2015 and 2016.

In order to compare the projected annual waste volumes from the 2008 SWEIS, waste generators are assigned to one of three categories: Key Facilities, Non-Key Facilities, and Environmental Management. Waste types are defined by differing regulatory requirements. Compliance with the Consent Order was projected to cause remediation of a large number of potential release sites and material disposal area from fiscal year 2007 through fiscal year 2016. Waste volumes associated with the 2008 SWEIS Removal Option are presented in the 2008 SWEIS, Appendix I, Table I-70. The fiscal year waste volume projection from Table I-70 is used as the projection for Environmental Management waste types for the SWEIS Yearbooks. Future editions of the Yearbook will only compare total waste volumes rather than annual waste volumes since the 2008 SWEIS only projected waste volumes through 2016.

Table 3-7. LANL Waste Types and Generation for Calendar Year 2015

Waste Type	Units	2008 SWEIS[a]	Calendar Year 2015
Chemical	10^3 kilograms per year[b]	3,463	1,546.13
LLW	cubic meters per year[b]	105,647	2,329.32
MLLW	cubic meters per year[b]	11,200	34.65
TRU	cubic meters per year[b]	1,889	30.61
Mixed TRU	cubic meters per year[b]	[c]	44.49[c]

a. Waste projections for Key and Non-Key Facilities were based on 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 based on the 2008 SWEIS, Appendix I (I-185), Table I-70, Removal Option Annual Waste Generation Rates (Implementation of the Consent Order for 2008).

b. The 2008 SWEIS lists waste projections as cubic yards. Waste numbers were converted to cubic meters because those are the units tracked in LANL's Waste Compliance Tracking system.

c. The 2008 SWEIS combines TRU and Mixed TRU wastes into one waste category since they are both managed for disposal at the Waste Isolation Pilot Plant.

Table 3-8. LANL Waste Types and Generation for Calendar Year 2016

Waste Type	Units	2008 SWEIS[a]	Calendar Year 2016
Chemical	10^3 kilograms per year[b]	3,310	4,599.95
LLW	cubic meters per year[b]	28,849	4,539.25
MLLW	cubic meters per year[b]	2,189	69.28
TRU	cubic meters per year[b]	130	43.38
Mixed TRU	cubic meters per year[b]	[c]	170.98[c]

a. Waste projections for Key and Non-Key Facilities were based on 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 based on the 2008 SWEIS, Appendix I (I-185), Table I-70, Removal Option Annual Waste Generation Rates (Implementation of the Consent Order for 2008).

b. The 2008 SWEIS lists waste projections as cubic yards. Waste numbers were converted to cubic meters because those are the units tracked in LANL's Waste Compliance Tracking system.

c. The 2008 SWEIS combines TRU and Mixed TRU wastes into one waste category since they are both managed for disposal at the Waste Isolation Pilot Plant.

Waste quantities from calendar year 2015 LANL operations were below the 2008 SWEIS projections for all waste types, reflecting the levels of operations at both the Key and Non-Key Facilities (Table 3-7).

3.3.1 Chemical Wastes

The 2008 SWEIS defined chemical wastes as hazardous waste (designated under the Resource Conservation Recovery Act regulations), toxic waste (PCBs and asbestos designated under the Toxic Substances Control Act), and special waste (designated under the New Mexico Solid Waste Regulations). The 2008 SWEIS projected chemical waste to decline for normal operations at LANL; however, significant quantities of chemical waste were projected because of future remediation activities under the Consent Order. Chemical waste includes not only construction and demolition debris, but also all other non-radioactive wastes. In addition, construction and demolition debris is a component of those chemical wastes that in most cases are sent directly to offsite disposal facilities. Construction and demolition debris consists primarily of asbestos and construction debris from DD&D projects. Construction and demolition debris is disposed of in solid waste landfills under regulations promulgated pursuant to Subtitle D of Resource Conservation and Recovery Act. (Note: Hazardous wastes are regulated pursuant to Subtitle C of Resource and Conservation Recovery Act.) DD&D waste volumes for calendar years 2015 and 2016 are tracked in Section 3.11.2 of this Yearbook.

In calendar year 2015, the total volume of chemical waste generated at LANL was below the annual volume projected in the 2008 SWEIS (Table 3-8). Chemical waste generated at the Non-Key Facilities for 2015 exceeded 2008 SWEIS projections due to press filter cakes from the Sanitary Effluent Reclamation Facility; however, the total amount of chemical waste generated at LANL was within the projections of the 2008 SWEIS. Chemical waste generation for LANL in calendar year 2015 was about 45 percent of the chemical waste volume projected in the 2008 SWEIS. Non-Key Facilities chemical waste generation accounted for about 73 percent of the total volume of chemical waste generated. Table 3-8 summarizes chemical waste generation during calendar year 2015.

Table 3-8. Chemical Waste Generators and Quantities for Calendar Year 2015

Waste Generator	2008 SWEIS[a]	Calendar Year 2015[a]
Key Facilities	596	113.98
Non-Key Facilities	650	1,129.83
Environmental Management	2,217[b,c]	302.32
LANL	3,463	1,546.13

a. 10^3 kilograms per year.

b. Used conversion 1,100 kilograms per 1 cubic meter. The 1,100 kilograms was derived from adding all of Environmental Management chemical waste for calendar year 2008.

c. Projected annual waste generation for fiscal year 2015 from Implementation of the Consent Order, Removal Option, 2008 SWEIS (Table I-70).

In calendar year 2016, chemical waste volumes exceeded annual volumes projected in the 2008 SWEIS (Table 3-9). This was due to the disposition of press filter cakes and reject water from the Sanitary Effluent Reclamation Facility. The Sanitary Effluent Reclamation Facility processes sanitary wastewater effluent for the removal of unwanted constituents through a reverse osmosis process. A byproduct of the reverse osmosis process is reject water containing dissolved solids. These waste products made up 98 percent of the total waste from Non-Key Facilities. Chemical waste generation from Non-Key Facilities accounted for about 98 percent of the total volume of chemical waste generated. Table 3-9 summarizes chemical waste generation during calendar year 2016.

Table 3-9. Chemical Waste Generators and Quantities for Calendar Year 2016

Waste Generator	2008 SWEIS[a]	Calendar Year 2016[a]
Key Facilities	596	70.19
Non-Key Facilities	650	4,507.93
Environmental Management	2,064[b,c]	21.83
LANL	3,310	4,599.95

a. 10^3 kilograms per year.

b. Used conversion 1,100 kilograms per 1 cubic meter. The 1,100 kilograms was derived from adding all of Environmental Management chemical waste for calendar year 2008.

c. Projected annual waste generation for fiscal year 2016 from Implementation of the Consent Order, Removal Option, 2008 SWEIS (Table I-70).

3.3.2 Low-Level Radioactive Wastes

The 2008 SWEIS projected that LLW generation would increase from waste generated from future remediation of materials disposal areas under the Consent Order, and LLW would exceed the Technical Area 54 Area G capacity, which would require offsite disposal. In calendar year 2015, LLW volumes were well below volumes projected in the 2008 SWEIS (Table 3-10). LLW generation in calendar year 2015 for LANL was about 2 percent of volumes projected in the 2008 SWEIS. Key Facilities LLW accounted for about 85 percent of the total LLW volumes generated. Table 3-10 summarizes LLW generation during calendar year 2015.

Table 3-10. LLW Generators and Quantities for Calendar Year 2015

Waste Generator	2008 SWEIS[a]	Calendar Year 2015[a]
Key Facilities	7,646	1,978.92
Non-Key Facilities	1,529	121.40
Environmental Management	96,472[b,c]	229.00
LANL	105,647	2,329.32

a. cubic meters per year.

b. Includes low-level, alpha low-level, and remote-handled LLW.

c. Projected annual waste generation for fiscal year 2015 from Implementation of the Consent Order, Removal Option, 2008 SWEIS (Table I-70).

In calendar year 2016, LLW volumes were well below volumes projected in the 2008 SWEIS (Table 3-11). LLW generation in calendar year 2016 for LANL was about 16 percent of volumes projected in the 2008 SWEIS. Key Facilities LLW accounted for about 43 percent of the total LLW volumes generated. Table 3-11 summarizes LLW generation during calendar year 2016.

Table 3-11. LLW Generators and Quantities for Calendar Year 2016

Waste Generator	2008 SWEIS[a]	Calendar Year 2016[a]
Key Facilities	7,646	1,942.60
Non-Key Facilities	1,529	2,596.65[b]
Environmental Management	19,674[c,d]	0.00
LANL	28,849	4,539.25

a. cubic meters per year.

b. LLW exceeded 2008 SWEIS projections for Non-Key Facilities because of the demolition of Technical Area 18 Casa 2 and 3 (1,088 cubic meters).

c. Includes low-level, alpha low-level, and remote-handled LLW.

d. Projected annual waste generation for fiscal year 2016 from Implementation of the Consent Order, Removal Option, 2008 SWEIS (Table I-70).

3.3.3 Mixed Low-Level Radioactive Wastes

MLLW generation in calendar year 2015 for LANL was less than 1 percent of volumes projected in the 2008 SWEIS. Key Facilities MLLW accounted for 100 percent of the total MLLW volumes generated. Table 3-12 summarizes MLLW generation during calendar year 2015.

Table 3-12. MLLW Generators and Quantities for Calendar Year 2015

Waste Generator	2008 SWEIS[a]	Calendar Year 2015[a]
Key Facilities	68	33.65
Non-Key Facilities	31	0.00
Environmental Management	11,101[b,c]	1.00
LANL	11,200	34.65

a. cubic meters per year.

b. Includes mixed low-level, mixed alpha low-level, and mixed remote-handled LLW.

c. Projected annual waste generation for fiscal year 2015 from Implementation of the Consent Order, Removal Option, 2008 SWEIS (Table I-70).

MLLW generation in calendar year 2016 for LANL was approximately 3 percent of volumes projected in the 2008 SWEIS. Key Facilities MLLW accounted for about 96 percent of the total MLLW volumes generated. Table 3-13 summarizes MLLW generation during calendar year 2016.

Table 3-13. MLLW Generators and Quantities for Calendar Year 2016

Waste Generator	2008 SWEIS[a]	Calendar Year 2016[a]
Key Facilities	68	66.72
Non-Key Facilities	31	2.56
Environmental Management	2,090[b,c]	0.00
LANL	2,189	69.28

a. cubic meters per year.

b. Includes mixed low-level, mixed alpha low-level, and mixed remote-handled LLW.

c. Projected annual waste generation for fiscal year 2016 from Implementation of the Consent Order, Removal Option, 2008 SWEIS (Table I-70).

3.3.4 TRU and Mixed TRU Waste

The 2008 SWEIS combines TRU and mixed TRU waste into one waste category since they are both managed for disposal at the Waste Isolation Pilot Plant. Therefore, TRU and mixed TRU waste generation are analyzed together in this Yearbook. TRU and mixed TRU generation in calendar year 2015 for LANL was approximately 4 percent of volumes projected in the 2008 SWEIS. Key Facilities TRU and mixed TRU accounted for 100 percent of the total TRU and mixed TRU waste volumes generated. Table 3-14 summarizes TRU and mixed TRU waste generation during calendar year 2015.

Table 3-14. TRU and Mixed TRU Waste Generators and Quantities for Calendar Year 2015

Waste Generator	2008 SWEIS[a]	Calendar Year 2015 TRU and Mixed TRU[a]	Calendar Year 2015 Mixed TRU[a]	Calendar Year 2015 TRU[a]
Key Facilities	413[b]	75.10	44.49	30.61
Non-Key Facilities	23[b]	0.00	0.00	0.00
Environmental Management	1,453[b,c]	0.00	0.00	0.00
LANL	1,889[b]	75.10	44.49	30.61

a. cubic meters per year.

b. The 2008 SWEIS combines TRU and mixed TRU into one waste category since they are both managed for disposal at the Waste Isolation Pilot Plant.

c. Projected annual waste generation for fiscal year 2015 from Implementation of the Consent Order, Removal Option, 2008 SWEIS (Table I-70).

TRU and mixed TRU generation in calendar year 2016 for LANL was approximately 37 percent of volumes projected in the 2008 SWEIS. Key Facilities TRU and mixed TRU accounted for 100 percent of the total TRU and mixed TRU waste volumes generated. Table 3-14 summarizes TRU and mixed TRU waste generation during calendar year 2016.

Table 3-15. TRU and Mixed TRU Waste Generators and Quantities for Calendar Year 2016

Waste Generator	2008 SWEIS[a]	Calendar Year 2016 TRU and Mixed TRU[a]	Calendar Year 2016 Mixed TRU[a]	Calendar Year 2016 TRU[a]
Key Facilities	413[b]	214.36	170.98	43.38
Non-Key Facilities	23[b]	0.00	0.00	0.00
Environmental Management	130[b,c]	0.00	0.00	0.00
LANL	566[b]	214.36	170.98	43.38

a. cubic meters per year.

b. The 2008 SWEIS combines TRU and mixed TRU into one waste category since they are both managed for disposal at the Waste Isolation Pilot Plant.

c. Projected annual waste generation for fiscal year 2016 from Implementation of the Consent Order, Removal Option, 2008 SWEIS (Table I-70).

On February 14, 2014, an airborne radiological release occurred underground at the Waste Isolation Pilot Plant. An Accident Investigation Board (formally appointed by Matthew Moury, Deputy Assistant Secretary for Safety, Security, and Quality Programs, DOE, Office of Environmental Management) identified the direct cause to be due to an exothermic reaction of incompatible materials in LANL waste drum 68660 that led to thermal runaway. This resulted in over-pressurization of the drum, the breach of the drum, and the release of a radioactive material (DOE 2015j). Shipments to the Waste Isolation Pilot Plant were suspended. Drums at LANL similar to the breached drum were stored at Technical Area 54 Area G in standard waste boxes in ventilated containment structures with continuous air monitors and high-efficiency particulate air-filtered (HEPA) exhausts, and the temperatures and gas were monitored by radiological control technicians to check for the first signs of chemical reaction.

In calendar years 2015 and 2016, DOE began plans to treat and repackage the 60 remediated nitrate salt drums. Minor building modifications were implemented at the Waste, Characterization, Reduction and Repackaging Facility to allow for safe handling and storage during the treatment process. In addition, processing tests were conducted to determine appropriate treatment methodologies.

Prior to the radiological release, LANL had shipped 3,327.5 cubic meters (93 percent) of TRU waste under the 3706 TRU Waste Campaign (framework agreement formed by NMED and DOE/NNSA in calendar year 2011) as of the end of June 2014 (LANL 2016o).

3.4 Utilities

Ownership and distribution of utility services continue to be split between DOE/NNSA and Los Alamos County as members of the Los Alamos Power Pool, a partnership agreement with Los Alamos County and LANL established in 1985. DOE/NNSA owns and distributes most utility services to LANL facilities and Los Alamos County provides utility services to the communities of White Rock and Los Alamos.

Demands for electricity and water are projected to increase for LANL throughout the next 10 years. This is due to growth in several mission programs.

3.4.1 Electrical

LANL is supplied with electricity through the Los Alamos Power Pool from a number of providers of hydroelectric, coal, natural gas power generators, and others throughout the western United

States. Import capacity is limited by the physical capability (thermal rating) of the transmission lines, which is nominally 116 megavolt amperes.

Onsite electricity generation capability for the Los Alamos Power Pool is limited to the 20–27 megawatts from the Combustion Gas Turbine Generator shared by the Power Pool under contractual arrangement. The steam turbines at the Co-generation Complex are out of service and not in use. Currently, there are no plans to upgrade the existing steam turbine equipment. Los Alamos County is still operating a 1-megawatt solar photovoltaic power on the LANL Technical Area 61 old landfill site. The system is connected to a 7-megawatt-hour battery storage system, which is connected to the Los Alamos Power Pool infrastructure. The current transmission line configuration is not vulnerable to a single failure taking out both incoming transmission lines due to reconfiguration of the lines when the Southern Technical Area Station was installed. However, the transmission import capacity of 116 megavolt amperes is expected to be exceeded by 2027 by the combined loads of LANL and Los Alamos County. Reconductoring of the Norton Line is planned before this date and will increase the import capacity from 116 to 143 megavolt amperes, allowing loads to be fully served by offsite generation until calendar year 2023. LANL will need to work with the Public Service Company of New Mexico to increase import capacity as necessary. Onsite generation and seasonal transmission line rating increases can be used to supplement import capacity to meet LANL power needs, if necessary, while LANL pursues increases in transmission import capability.

Within the existing underground ducts, LANL's 13.2-kilovolt distribution system must be upgraded to fully realize the capabilities of the Western Technical Area Substation and the upgraded Eastern Technical Area Substation. As discussed in section 2.16.1.6, upgrades will provide for redundant feeders to critical facilities, and upgrading the aging Technical Area 03 substation will improve system reliability and resiliency of the 13.2-kilovolt distribution and 115-kilovolt transmission systems for both LANL and Los Alamos County.

In calendar year 2011, a 3-megawatt turbine at Los Alamos County's Abiquiu hydropower facility was built. This low-flow turbine allows the facility to keep generating power even when flow levels from Abiquiu Dam are below the capacity of the two existing turbines. This low-flow turbine increased renewable energy generation capacity by 22 percent—from 13.8 megawatts to 16.8 megawatts.

In the 2008 SWEIS No Action Alternative, LANL's total electricity consumption was reduced to a number closer to the average actual electricity consumption for the six years analyzed, making the new total 495,000 megawatt-hours. In addition, the electricity peak load under the No Action Alternative is 91,200 kilowatts.

Some elements of the Expanded Operations Alternative were discussed in the two SWEIS RODs. Expansion of the capabilities and operational levels at the Metropolis Center to support additional processors and increase functional capability was one of the few elements of the Expanded Operations Alternative that was approved to go forward. This decision would impact the total electricity peak demand and the total electricity consumption at LANL. Also, the planning, design, and procurement of long-lead-time components for the multiyear LANSCE Risk Mitigation Project was approved by DOE/NNSA in 2010. The scope of this project encompasses the restoration of the LANSCE 800-MeV linear accelerator to historic performance levels (DOE 2010).The LANL total in Table 3-18 under the 2008 SWEIS represents 91,200 kilowatts for LANL plus 18,000 kilowatts operating requirements for the Metropolis Center and 17,000 kilowatts operating requirements for the LANSCE Risk Mitigation project.

Table 3-18. Electricity Peak Coincidental Demand in Calendar Years 2015 and 2016[a]

Category	LANL Base	LANSCE	Metropolis Center	LANL Total	County Total	Pool Total
2008 SWEIS	57,200	51,000[b]	18,000[c]	120,200[d]	19,800	140,000[e]
Calendar Year 2015	59,237	0	12,677	71,914	16,469	88,383
Calendar Year 2016	58,883	0	11,134	70,017	17,824	87,841

a. All figures in kilowatts.

b. Expanded Operations Alternative limit for the LANCE Refurbishment Project. This project was approved under the DOE-approved Categorical Exclusion entitled LANSCE Risk Mitigation (DOE 2010).

c. Expanded Operations Alternative limit for the Metropolis Center.

d. This number represents 91,200 kilowatts for LANL as part of the No Action Alternative in the 2008 SWEIS plus 12,000 kilowatts (18,000 kilowatts Expanded Operations Alternative limit – 6,000 kilowatts No Action Alternative) to expand the capabilities and operational levels of the Metropolis Center as stated in the SWEIS RODs and 17,000 kilowatts (51,000 kilowatts Expanded Operations Alternative limit – 34,000 kilowatts No Action Alternative) for the LANSCE Risk Mitigation Project.

e. The total Power Pool number was updated to reflect the addition of the elements of the Expanded Operations Alternative.

DOE/NNSA and LANL are currently planning an Energy Savings Performance Contract to replace the Technical Area 03 Steam Plant with a combined-heat and power plant that will heat the central campus and be a key source of future electrical generation. As part of this project, a new steam turbine is planned that will increase the generation capacity to 45 megawatts.

Table 3-19 shows annual use of electricity for calendar years 2015 and 2016. LANL's electricity use remains below projections in the 2008 SWEIS. Actual use has fallen below these values.

Table 3-19. Electricity Consumption in Calendar Years 2015 and 2016[a]

Category	LANL Base	LANSCE	Metropolis Center	LANL Total	County Total	Pool Total
2008 SWEIS	356,000	208,000b	131,400[c]	651,400[d]	150,000	801,400[e]
Calendar Year 2015	237,993	111,482	77,306	426,781	122,258	549,040
Calendar Year 2016	250,826	113,439[f]	98,659	462,925	124,016	586,941

a. All figures in megawatt-hours.

b. Expanded Operations Alternative limit for the LANCE Refurbishment Project. This project was approved under the DOE-approved Categorical Exclusion entitled LANSCE Risk Mitigation (DOE 2010).

c. Expanded Operations Alternative limit for the Metropolis Center.

d. This number represents 495,000 megawatt-hours for LANL under the No Action Alternative plus 87,400 megawatt-hours (131,400 megawatt-hours Expanded Operations limit – 44,000 megawatt-hours No Action Alternative) to expand the capabilities and operational levels of the Metropolis Center as stated in the SWEIS ROD dated September 2008 and 69,000 megawatts-hours (208,000 megawatt-hours Expanded Operations Alternative limit – 139,000 megawatt-hours No Action Alternative) for the LANSCE Risk Mitigation Project.

e. The total Power Pool number was updated to reflect the addition of the elements of the Expanded Operations Alternative

f. LANSCE electrical meters have been off-line because of damage sustained May 2015. The consumption value provided is an estimate, no coincidental available.

Energy Efficiency. As in previous years, LANL invested in a number of energy reduction initiatives in calendar years 2015 and 2016. Investments include building automation system upgrades; monitoring using energy analytics software; heating, ventilation, and air conditioning recommissioning; and LED (light-emitting diode) lighting upgrades. As an example of the energy reduction initiatives performed during 2016, Table 3-20 shows a list of buildings and the energy savings from fiscal year 2016 compared with fiscal year 2015.

Table 3-20. List of Buildings and the Energy Savings from Fiscal Year 2016 compared with Fiscal Year 2015

Building	Fiscal Year 2015 (megawatt-hours)	Fiscal Year 2016 (megawatt-hours)	Savings (megawatt-hours)	Fiscal Year 2015 Baseline	Savings
03-0207	1,277,984	1,077,867	200,117	15.66%	$16,009.36
48-0001	5,695,120	5,039,323	655,797	11.52%	$52,463.76
03-1405	741,729	689,110	52,619	7.09%	$4,209.52
46-0535	345,932	324,550	21,382	6.18%	$1,710.56
60-0245	288,845	235,882	52,963	18.34%	$4,237.04

Based on DOE/NNSA sustainability goals, LANS is working toward an energy-reduction goal of 25 percent by the end of fiscal year 2025 from a 2015 baseline. By the end of fiscal year 2016, the Laboratory reduced energy intensity (British thermal unit/square foot) by 1 percent and has reduced energy intensity by over 16 percent compared with fiscal year 2003. High Performance Sustainable Building implementation; heating, ventilation, and air conditioning recommissioning; building automation system upgrades for night set-back capability; and footprint reduction efforts continue to contribute toward energy, water, and greenhouse gas reduction goals.

3.4.2 Water

In September 2001, DOE/NNSA officially turned over the water production system and transferred 70 percent of its water rights to Los Alamos County. DOE/NNSA has a contract with Los Alamos County to supply water to the Laboratory. The distribution system used to supply water to LANL facilities consists of a series of storage tanks, pipelines, and fire pumps. The LANL distribution system is primarily gravity fed with pumps available for high-demand fire situations at select locations.

LANS installed water meters on select Laboratory facilities and has a Supervisory Control and Data Acquisition/Equipment Surveillance System on the water distribution system to keep track of water tank levels and usage. LANS continues to maintain the distribution system by replacing portions of the system in need of repair identified during leak detection surveys.

Elements of the Expanded Operations Alternative in the 2008 SWEIS were discussed in the two RODs. Expansion of the capabilities and operational levels at the Metropolis Center to support additional processors and material disposal area remediation were two of the elements of the Expanded Operations Alternative that were approved. Expansion of the Metropolis Center to support projected future supercomputing would impact water usage at LANL. The 2008 SWEIS projected that expanding to a 15-megawatt maximum operating platform would potentially increase water usage at the Metropolis Center to 51 million gallons (193 million liters) per year. This higher usage would include the additional water lost to cooling tower evaporation and blowdown. Improvements to the Sanitary Effluent Reclamation Facility operations have led to increased use of recycled effluent in the cooling towers since calendar year 2012, leading to a significant decrease in Metropolis Center potable water use. Water consumption at the Metropolis Center was 5.2 million gallons in calendar year 2015 and 5.4 million gallons in calendar year 2016. The Sanitary Effluent Reclamation Facility provided over 30 million gallons of makeup water to the Metropolis Center in 2015 and over 23 million gallons in calendar year 2016.

Table 3-21 shows water consumption for calendar years 2015 and 2016. Under the 2008 SWEIS RODs, water use at LANL was projected to be 380 million gallons from the No Action Alternative plus elements of the Expanded Operations Alternative. LANL consumed approximately 265 million gallons of water in calendar year 2015 and 285 million gallons of water in calendar year 2016. Total use by LANL in 2016 was about 175 million gallons less than the 2008 SWEIS projection of 459.8 million gallons.

Table 3-21. Water Consumption (million gallons) in Calendar Years 2015 and 2016

Category	LANL Total	Metropolis Center	LANSCE	Los Alamos County	Total
2008 SWEIS	459.8[a]	51	119	1,241	1,621
Calendar Year 2015	265	5	47	N/A[b]	N/A[b]
Calendar Year 2016	285	5	49	N/A[b]	N/A[b]

a. This number represents 380 million gallons for LANL under the No Action Alternative plus 32 million gallons (51 million gallons Expanded Operations limit – 19 million gallons No Action Alternative) to expand the capabilities and operational levels of the Metropolis Center and 5.8 million gallons of water to be used during material; disposal area remediation activities, as stated in the SWEIS RODs. This number also represents 42 million gallons (119,000 million gallons for the Expanded Operations Alternative limit - 77 million gallons for the No Action Alternative) for the LANSCE Risk Mitigation Project.

b. In September 2001, Los Alamos County acquired the water supply system and LANL no longer collects this information.

3.4.3 Gas

LANL receives their natural gas through the New Mexico Gas Company transmission system. LANL has a combustion gas turbine generator that serves as one of LANL's onsite energy sources by producing electricity from the combustion of natural gas. The combustion gas turbine generator is capable of producing 20 to 27 megawatts and is available to serve the Los Alamos Power Pool on an as-required basis to meet peak-load and back-up situations.

Table 3-22 presents LANL's calendar years 2015 and 2016 gas usage. Approximately 94 percent of the gas used by LANL in 2015 was for heat production. Approximately 90 percent of the gas used by LANL in 2016 was for heat production. The remainder was used for electricity production mainly by the combustion gas turbine generator. LANL onsite electricity generation is primarily used for peak-load and back-up situations and for turbine operation training.

Total gas consumption for calendar years 2015 and 2016 was less than projected in the 2008 SWEIS.

Table 3-22. Gas Consumption (decatherms[a]) at LANL in Calendar Years 2015 and 2016

Category	Total LANL Consumption Base	Total Used for Electricity Production	Total Used for Heat Production	Total Steam Production (klb)[b]
2008 SWEIS	1,197,000	Not projected	Not projected	Not projected
Calendar Year 2015	917,265	50,769	866,496	262,159
Calendar Year 2016	899,205	66,220	832,985	255,812

a. A decatherm is equivalent to 1,000 cubic feet of natural gas.

b. klb = thousands of pounds.

c. Technical Area 03 steam production has two components: that used for electricity production (0 klb in calendar year 2015 and 2016) and that used for heat (225,926 klb in calendar year 2015 and 228,949 klb in calendar year 2016).

3.5 Worker Safety

The LANL Safety Policy is as follows:

> *We conduct our work safely and responsibly to achieve our mission. We ensure a safe and healthful work environment for workers, contractors, visitors, and other onsite personnel. We protect the health, safety, and welfare of the general public. We do not compromise safety for personal, programmatic, or operational reasons.*

An Institutional Worker Safety and Security Team was established at LANL with the mission to improve safety and security through direct involvement of all people performing work. The team represents all workers and reports directly to the Laboratory Director. Team membership includes a representative and alternate from each directorate within the Laboratory and from each of the primary contractors. Specific team objectives include:

- Advocate safety and security as core values at the Laboratory.
- Promote communication of safety and security concerns and actions across organizations.
- Engage all people conducting business on behalf of the Laboratory in personal and corporate safety and security.
- Encourage ideas and actions that reduce risk and occurrence of incidents and accidents.
- Serve as points of contact for any worker at the Laboratory with a safety or security concern or idea.
- Track and address individual safety and security concerns raised by the worker, institutional safety, or security data.
- Evaluate and recommend improvements for the effectiveness of safety and security in everyday work activities.
- Mentor peers in achieving and demonstrating a cooperative attitude for a Laboratory-wide safe and secure environment.
- Celebrate successes in demonstrating safe and secure behavior among workers at the Laboratory.
- Collaborate with managers and workers to address safety and security concerns over work practices, and the implementation of proposed policies, work packages and/or standard operating procedures.
- Assist in the development of institutional goals, organizational goals, objectives, and measures with regard to safety and security.

Worker Safety and Security Teams reside within the associate directorates and act as conduits for sharing information, participating in identifying and addressing organization-specific and/or Laboratory-wide improvements and to share lessons learned. There are approximately 60 worker safety and security teams at the directorate, division, and group level. The purpose is to achieve employee ownership of personal and institutional safety and security. To achieve this goal, the team provides input and receives feedback on safety, health, and security issues. Employee involvement helps drive behaviors that support the Laboratory's Operational Leadership principles and the Integrated Safety Management System and that embraces the five tenets of Voluntary Protection Program: management leadership, employee involvement, worksite analysis, hazard prevention and control, and health and safety training to strengthen and sustain its world-class safety program.

In 2010, LANL was accepted into the DOE Voluntary Protection Program at merit status. LANL has maintained merit status by demonstrating continued improvements during two subsequent DOE assessments in 2011 and 2013. LANL was originally awarded star status in August 2014. Most recently, DOE assessed the Laboratory Voluntary Protection Program in September 2017. As a result, the DOE Voluntary Protection Program assessment team noted that the Laboratory was now meeting star status expectations in all five tenets and had several best business practices that the evaluation team would share across the complex. The DOE Voluntary Protection Program assessment team recommended that LANL continue as a star site. LANL is the largest site within the DOE complex to be awarded star status.

3.5.1 Injuries and Illnesses

Analysis of LANL's injury and illness performance shows a decrease of 33.3 percent in calendar year 2016 compared with calendar year 2015 for the days away, restricted or transferred rate and an increase of 6.5 percent in the total recordable case rate.

Table 3-23 summarizes two calendar years of occupational injury and illness rates. These rates correlate to reportable injuries and illnesses during the year for 200,000 hours worked or roughly 100 workers. Although the total number of recordable cases has increased, the number of days away, restricted or transferred decreased by 33 percent.

Table 3-23. Total Recordable Case and Days Away, Restricted or Transferred Rates at LANL*

Rate	Total 2015 Cases	Calendar Year 2015	Total 2016 Cases	Calendar Year 2016	Percent Change
Total Recordable Case	114	1.21	123	1.32	6.5% increase
Days Away, Restricted or Transferred	34	0.36	26	0.28	33.3% decrease

* Calendar year rates reflect the rolling average rate at the end December of each year.

3.5.2 Ionizing Radiation and Worker Exposures

Occupational radiation exposures for workers at LANL during calendar years 2015 and 2016 are summarized in Table 3-24. The collective total effective dose for the LANL workforce during calendar year 2015 was 97.9 person-rem, a decrease of less than 1 percent from calendar year 2014, and during calendar year 2016 was 95.6 person-rem, a decrease of 2 percent from calendar year 2015. Data in Table 3-24 show 273 fewer radiation workers received a measurable dose in calendar year 2015 and 22 fewer in calendar year 2016. With fewer workers but similar collective dose, the average non-zero dose per worker was higher by 17 millirem in 2015, then lower by 1 millirem in 2016. Of the 97.9 person-rem collective total effective dose reported for calendar year 2015, 0.6 person-rem was from internal exposures to radioactive materials, resulting from intakes involving plutonium and low-level intakes of uranium and tritium from routine operations. Of the 95.6 person-rem collective total effective dose reported for calendar year 2016, 0.1 person-rem was from internal exposures to radioactive materials, resulting from low-level intakes of uranium and tritium from routine operations. These reported doses could change with time because estimates of committed effective dose from radioactive material intakes in many cases are based on several years of bioassay results. As new results are obtained, the dose estimates may be modified accordingly.

Table 3-24. Radiological Exposure to LANL Workers

Parameter	Units	2008 SWEIS	Calendar Year 2015	Calendar Year 2016
Collective total effective dose (external + internal)	person-rem	280	97.9	95.6
Number of workers with measurable dose	number	2,018	1,128	1,106
Average non-zero dose (external + internal radiation exposure)	millirem	139	87	86

The highest individual doses in calendar years 2015 and 2016 indicate relatively higher maximum doses over the last two years following a steady decrease since calendar year 2000. These higher doses were primarily associated with plutonium-238 work. LANS senior management and the Institutional Radiation Safety Committee set expectations and put in place mechanisms to drive individual and collective doses as low as reasonably achievable (ALARA) through performance goals and other ALARA measures. For calendar years 2015 and 2016, no worker exceeded DOE's 5-rem per year dose limit, and no worker exceeded the 2-rem per year LANL administrative control level established for external exposures. Table 3-25 summarizes the five highest individual dose data for calendar years 2015 and 2016 compared with 2008 when the LANL 2008 SWEIS was finalized.

Table 3-25. Highest Individual Annual Doses (Total Effective Dose) to LANL Workers (rem)

Calendar Year 2008	Calendar Year 2015	Calendar Year 2016
2.106	1.238	1.293
1.198	1.056	1.293
1.132	1.028	1.281
1.096	0.999	1.170
0.952	0.942	0.989

Comparison with the 2008 SWEIS Baseline. The collective total effective dose for calendar years 2015 and 2016 was 35 and 34 percent, respectively, of the 280 person-rem per year projection in the 2008 SWEIS.

Work and Workload: Changes in workload and types of work at nuclear facilities, particularly the Technical Area 55 Plutonium Facility, Technical Area 53 LANSCE, and the Technical Area 50 and 54 waste facilities tend to drive increases or decreases in the LANL collective total effective dose. Worker exposure under the 2008 SWEIS No Action Alternative was projected to increase because of the dose associated with achieving a production level of 20 pits per year at Technical Area 55. In addition, collective worker dose and annual average worker dose were projected to increase because of the implementation of the actions related to the Consent Order, but the long-term effect of material disposal area cleanup and closure of waste management facilities at Technical Area 54 would result in a reduced worker dose.

Technical Area 55, Building 04 operations accounted for the majority of occupational dose at LANL in calendar years 2015 and 2016, which is historically consistent for LANL. Occupational dose was accrued from weapons manufacturing and related work, plutonium-238 work, repackaging materials, and providing radiological control technician and other infrastructure support for radiological work and facility maintenance at Technical Area 55. A primary contributor to dose was work with plutonium-238 involving producing general purpose heat sources for use individually and in radioisotope thermoelectric generators. The top 25 doses at LANL in both calendar years 2015 and 2016 were accrued at Technical Area 55. Doses at Technical Area 55 would have been significantly higher because of planned programmatic work in all of these areas; however, programmatic work was in the process of being resumed from the 2013 pause associated with the criticality safety program.

In addition to Technical Area 55 operations, a portion of LANL dose was accrued by workers performing retrieval, repackaging, and shipping of radioactive solid waste at LANL waste facilities at Technical Areas 50 and 54. Most of this work was curtailed in early 2014 in response to the Waste Isolation Pilot Plant radiological contamination event. There was also a significant portion of LANL dose accrued by workers performing programmatic and maintenance work at LANSCE commensurate with associated radiological work.

Internal doses were similar from calendar year 2015 (0.6 rem) and calendar year 2016 (0.1 millirem). The 2015 internal dose included plutonium intakes and low-level uranium and tritium intakes consistent with routine operations. The 2016 internal dose consisted of low-level uranium and tritium intakes consistent with routine operations.

LANL extremity dose increased by 20 percent in calendar year 2015 then another 24 percent in calendar year 2016 since calendar 2014. These increases correlate with increasing top worker doses, reflecting relatively more hands-on work at Technical Area 55 as operations resumed in calendar years 2015 and 2016. Extremity doses remain commensurate with handling significant quantities of radioactive material.

ALARA Program: LANL occupational exposure continues to be deliberately managed under an aggressive ALARA Program within the LANL Radiation Protection Program, with emphasis on dose optimization during design and work control, ALARA goals, performance measurement, line management engagement, and oversight by the Institutional Radiation Safety Committee and LANL senior management. Based on established ALARA goals, dose accrued to date, and expected workload, calendar year 2017 collective doses are expected to increase, particularly as Technical Area 55 operations reach anticipated productivity. Improvements in maintaining radiation exposures ALARA, such as improved dose tracking during work activities, additional shielding, better radiological safety designs, worker involvement, and innovative solutions should result in continually lower LANL radiological worker doses relative to the work conducted.

Collective Total Effective Doses for Key Facilities. In general, extracting collective total effective doses by Key Facility or technical area is difficult because 1) these data are collected at the group level, 2) groups are often tenants in multiple facilities, and 3) members of many groups receive doses at several locations. The fraction of a group's collective total effective dose coming from a specific Key Facility or technical area can only be estimated. For example, personnel from the Deployed Environment, Safety, and Health organization and crafts workers are distributed across the Laboratory and these two organizations account for a significant fraction of the LANL collective total effective dose.

Within the constraints described above, the collective total effective dose for Technical Area 55 residents in calendar years 2015 and 2016 represented the majority of the LANL collective total effective dose. Approximately 80 percent of the collective total effective dose that these groups incur is estimated to come from operations at Technical Area 55. As discussed previously, maintenance and programmatic activities at Technical Area 53 and solid waste operations at Technical Areas 50 and 54 also contributed substantially to the LANL total.

3.6 Socioeconomics

LANL continues to be a major economic force in Los Alamos, Santa Fe, and Rio Arriba counties.

The LANL-affiliated workforce continues to include LANS employees and subcontractors. Under the 2008 SWEIS No Action Alternative, the 2005 levels of employment were assumed to remain steady at 13,504 employees. As shown in Table 3-26, the total number of employees in calendar year 2015 was 23 percent lower than 2008 SWEIS projections. The 10,446 total employees at the end of calendar year 2015 shows a minor increase from the 10,196 employees reported in the 2014 SWEIS Yearbook. The total number of employees in calendar year 2016 was 21 percent lower than 2008 SWEIS projections. The 10,730 total employees at the end of calendar year 2016 shows a minor increase from the number of employees reported in the calendar year 2015.

Table 3-26 LANL-Affiliated Workforce

Category	LANS Employees	Technical Contractors	Non-Technical Contractors	SOC[a]	Total
2008 SWEIS[b]	12,019	945	Not projected[c]	540	13,504
Calendar Year 2015	9,728	418	No longer included	300	10,446
Calendar Year 2016	10,051	386	No longer included	293	10,730

a. SOC = Securing Our Country (formerly Protection Technology-Los Alamos).

b. Total number of employees was presented in the 2008 SWEIS, the breakdown was calculated based on the percentage distribution shown in the 1999 SWEIS for the base year.

c. Data were not presented for non-technical contractors or consultants.

LANL has a positive economic impact on northern New Mexico. A University of New Mexico report (UNM 2011) indicated that in 2009 the economic impact on northern New Mexico included $2.47 billion indirect output (operation and construction) and $1.4 billion on labor income. The report indicated an additional $1.6 billion in value added income to northern New Mexico (e.g., employee compensation, proprietor income, other property income, and indirect business income). No updated data for 2015 and 2016 have been published.

The residential distribution of the LANL-affiliated workforce reflects the housing market dynamics of three counties. Approximately 78 percent of LANS employees reside in Los Alamos, Santa Fe, and Rio Arriba counties (Table 3-27).

Table 3-27. County of Residence for LANL-Affiliated Workforce[a]

Category	Los Alamos	Rio Arriba	Santa Fe	Other New Mexico	Total New Mexico	Outside New Mexico	Total
2008 SWEIS[b]	6,617	2,701	2,566	1,080	12,964	540	13,504
Calendar Year 2015	4,350	1,783	2,121	1,060	9,314	1,132	10,446
Calendar Year 2016	4,409	1,804	2,138	1,080	9,431	1,299	10,730

a. Includes both regular and temporary employees, including students who may not be at LANL for much of the year.

b. Total number of employees was presented in the 2008 SWEIS; the breakdown was calculated based on the percentage distribution calculated from the 1999 SWEIS.

3.7 Land Resources

Most of LANL is undeveloped grassland, shrubland, woodland, and forests that serve as security and safety buffer zones, and lands for future expansion. Much of this land is canyon cliffs and drainages that are not readily developable. There are no agricultural activities present on the LANL site, nor are there any prime farmlands in the vicinity. In 1977, DOE designated LANL as a National Environmental Research Park; in 1999, the 1,000-acre White Rock Canyon Reserve managed jointly by DOE and the National Park Service was dedicated. LANL is surrounded by the lands of other federal agencies (National Park Service, U.S. Forest Service, and the Bureau of Land Management), Santa Clara Pueblo, and the Pueblo de San Ildefonso.

2008 SWEIS Analysis

The 2008 SWEIS noted that LANL occupied about 40 square miles (25,600 acres) spread across 48 technical areas (this did not include leased space or land in Rendija Canyon). At that time, LANL's facilities comprised 8.6 million gross square feet of laboratory, production, administrative, storage, service, and miscellaneous space. There were 952 permanent structures, 373 temporary structures (such as trailers, transportables, and transportainers), and 897 miscellaneous structures (such as sheds and utility structures). About 2,400,000 gross square feet of space in 409 buildings was designed to house personnel in an office environment. About 450,000 gross square feet of space was leased within Los Alamos and White Rock to provide workspace for an additional 1,683 people. 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 of excess space would be decontaminated, decommissioned, and demolished.

The 2008 SWEIS No Action Alternative assumed that the conveyance of land from LANL to Los Alamos County and to the New Mexico Department of Transportation, along with the transfer of land to the Bureau of Indian Affairs to be held in trust for the Pueblo de San Ildefonso, would continue. The 2008 SWEIS noted that these land conveyances and transfers could impact site and regional land use.

Since 1999, the land resources (i.e., undeveloped and developed lands) available for use at LANL have been reduced as a direct result of Public Law 105 119 1 (42 USC 2391). Since calendar year 2001, approximately 3,000 acres (3.9 square miles) have been transferred to other federal or tribal entities or conveyed to local governments. Approximately 2,100 acres of land have been transferred to the Bureau of Indian Affairs to be held in trust for the Pueblo de

San Ildefonso, and approximately 920 acres of land have been conveyed to Los Alamos County and the Los Alamos School District (DOE 1999c).

Ten original tracts identified for conveyance or transfer were later subdivided into 32 tracts (DOE 1999c). Seventeen tracts have been conveyed to Los Alamos County, three tracts were conveyed to the Los Alamos County School District, and three tracts were transferred to the Bureau of Indian Affairs. The remaining tracts total 1,320 acres (2.1 square miles) and all would be conveyed to Los Alamos County.

In calendar years 2015 and 2016, DOE/NNSA conveyed most of Tract A-18-A (Lower Pueblo Canyon) and all of Tract C-3 (Front Hill Road) to Los Alamos County. Tract A-18-A includes the southern reach of Pueblo Canyon between the White Rock "Y" and the Airport Site, approximately 520 acres. Work continued on preparing Tracts A-5-2 (Airport-3 South in DP Canyon), A-5-3 (Airport-3 South in DP Canyon), A-14 (Rendija Canyon), and A-16-A (Technical Area 21 West) to be conveyed Los Alamos County. Table 3-28 provides location and size information on the land tracts remaining to be conveyed.

Table 3-28. Remaining Tracts Analyzed for Potential Conveyance

Land Tract	Approximate Acreage	Location
Technical Area 21/A-16	250	On the eastern end of the same mesa on which the central business district of Los Alamos is located. Subdivided into smaller tracts in order to prepare for conveyance to Los Alamos County.
Rendija Canyon/A-14a, c, d	890	North of and below Los Alamos town site's Barrancas Mesa residential subdivision. Deed restrictions require resolution prior to conveyance.
Airport-3 South 2/A-5-2	44	The Airport Site, situated north of Technical Area 21 and south of State Road 501. To be used primarily for recreation.
Airport Road South 2/A-5-3	15	Part of the Airport-3 (South) tract, situated east of A-5-2, north of Technical Area 21, and south of State Road 501. To be used primarily for recreation.
Technical Area 21 West 2/A-15-2	1	DP Road
C-2 and C-4	150	Highway 501 (White Rock "Y" and New Mexico State Road 4 south to East Jemez Road).

3.8 Groundwater

Under the No Action Alternative in the 2008 SWEIS, LANL operational levels would remain similar to current levels; therefore, there would be little change in the flow of contaminants to the alluvial or regional aquifers. Material disposal area remediation, canyon cleanup, and other actions related to the implementation of the Consent Order in calendar years 2015 and 2016 would not appreciably change the rate of transport of contaminants in the short term, but are part of a set of actions that collectively are expected to reduce long-term contaminant migration and impacts on the environment.

In 2015, DOE prepared an environmental assessment (DOE 2015a) 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 NMED Ground Water Quality Bureau permit requirements before it is 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 2015a). In calendar 2016, equipment and additional infrastructure was installed in Mortandad Canyon to prepare for the implementation of the chromium plume control interim measures.

In calendar years 2015 and 2016, groundwater monitoring, groundwater investigations, and installation of monitoring wells were performed pursuant to the Consent Order. In calendar year 2015, DOE completed installation of three new regional aquifer wells (R58, R67, and San Ildefonso Monitoring Regional SIMR-2) and four regional aquifer piezometers, (CrPZ-2 S1, CrPZ-2 S2, CrPZ-4, and CrPZ-5). In calendar year 2016, DOE completed installation of one new regional aquifer well (R68), one chromium extraction well, (CrEX-3), five chromium injection wells (CrIN-1, CrIN-2, CrIN-3, CrIN-4, CrIN-5), and eight Sandia Wetland Alluvial wells (SWA-1-1, SWA-1-3, SWA-2-4, SWA-2-5, SWA-3-7, SWA-3-9, SWA-4-10, and SWA-4-11) (Figure 3-1).

Groundwater characterization and monitoring beneath Cañon de Valle in Technical Area 16 for RDX (1,3,5-trinitro-1,3,5-triazacyclohexane or royal demolition explosive) continued in calendar years 2015 and 2016. A multi-well tracer injection test was initiated in three wells in Technical Areas 09 and 16. Data collected indicate that characterization of nature and extent of RDX in the perched-intermediate and regional groundwater is incomplete.

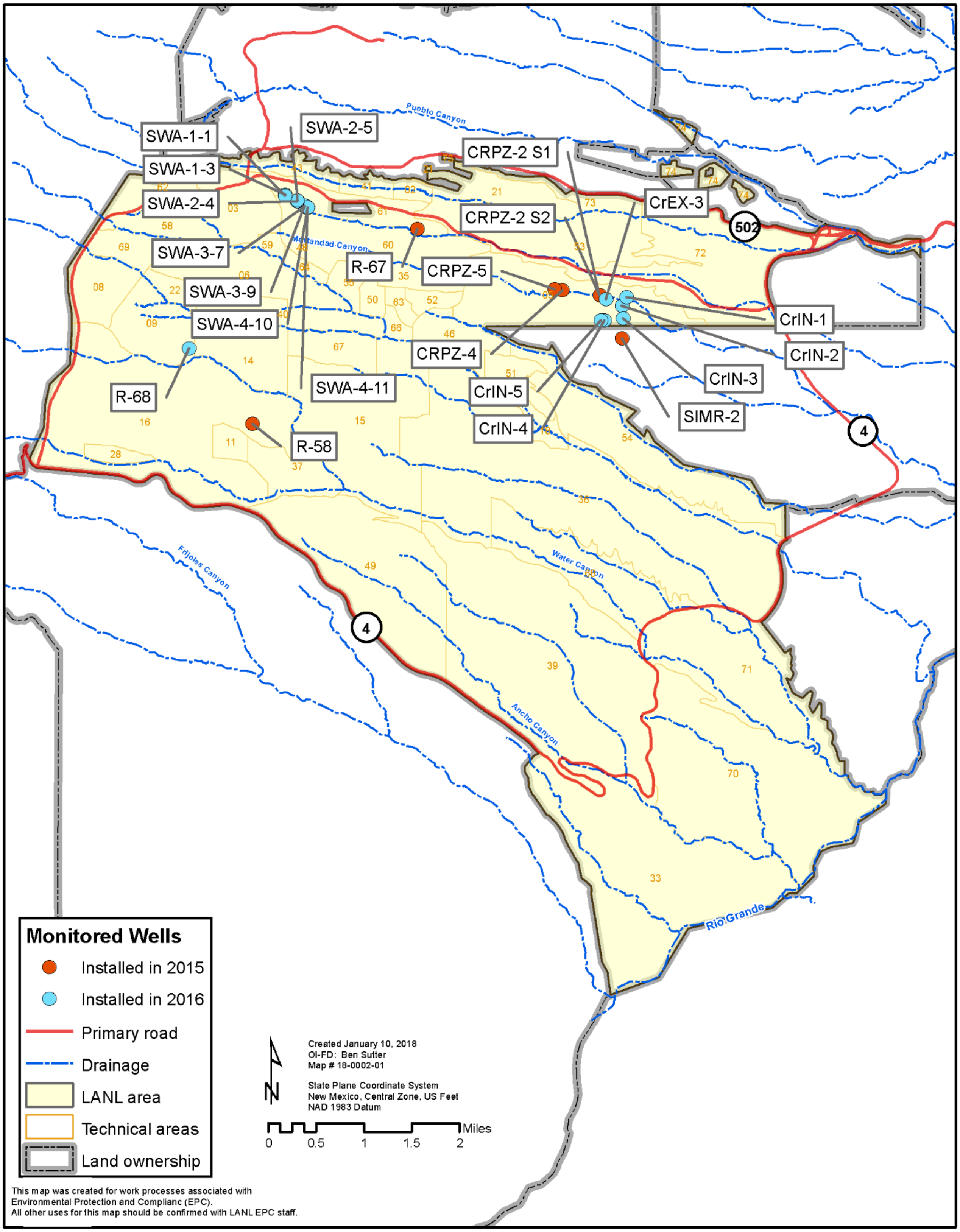


Figure 3-1. Location of wells installed in calendar years 2015 and 2016

3.9 Cultural Resources

LANL has a large and diverse number of historic and prehistoric properties. Approximately 90 percent of DOE/NNSA-administered land in Los Alamos and Santa Fe counties has been surveyed for prehistoric and historic cultural resources. Prior to 2007, more than 1,800 prehistoric sites had been recorded at LANL (Table 3-29). However, during 2007, sites excavated since the 1950s were removed from the site count numbers, slightly lowering LANL's number of recorded sites. In 2011, sites that were removed from the overall site count numbers included those destroyed by early construction activities, those that were recorded pre-1966 National Historic Preservation Act, and those removed per consultations with the New Mexico State Historic Preservation Office. Seventy-two percent of the archaeological sites at LANL date between the thirteenth and fifteenth centuries. Most of the sites are situated in the piñon-juniper vegetation zone, with more than 75 percent lying between 5,800 and 7,100 feet in elevation. More than 58 percent of all sites are found on mesa tops. Within LANL's limited access boundaries, there are ancestral villages, shrines, petroglyphs, sacred springs, trails, and traditional use areas that could be identified by Pueblo and Athabascan[15] communities as traditional cultural properties.

Table 3-29. Acreage Surveyed, Prehistoric Cultural Resource Sites Recorded, and Cultural Resource Sites Eligible for the National Register of Historic Places at LANL in Fiscal Years 2008, 2015, and 2016[a]

Fiscal Year	Total acreage surveyed by fiscal year	Total acreage systematically surveyed to date	Total prehistoric cultural resource sites recorded to date (cumulative)	Total number of eligible and potentially eligible National Register of Historic Places sites	Percentage of total site eligibility	Number of notifications to Indian Tribes[b]
2008	0	23,130	1,727[c]	1,625[c]	94	2
2015	110.2	22,799[e]	1,741[c]	1639[c]	94.1	1
2016	349.84	23,159[f]	1739[c]	1637[c]	94.1	0

a. Source: Information on LANL provided by DOE/NNSA and LANS to the Secretary of Interior for a Report to Congress on Federal Archaeological Activities annually.

b. As part of the 2008 SWEIS preparation, 23 tribes were consulted in a single notification. Subsequent years, however, show the number of separate projects for which tribal notifications were issued.

c. One site was within the tract of land transferred to the Bureau of Indian Affairs to be held in trust for the Pueblo de San Ildefonso. As part of ongoing work to field-verify sites recorded 20 to 25 years ago, LANL has identified sites that have been recorded more than once and have multiple Laboratory of Anthropology site numbers. This effort will continue over the next several years and more sites with duplicate records will likely be identified.

d. There were 110.2 new acres surveyed during fiscal year 2015 and linear errors in the surveyed area spatial database were corrected. The total number of acres systematically surveyed as of the end of fiscal year 2015 was 22,798.65. No tracts of land were conveyed during fiscal year 2015.

e. There were 349.84 new acres surveyed during fiscal year 2016 and additional linear errors in the surveyed area spatial database were also corrected, bringing the total number of surveyed acres to 23,159.41. No tracts of land were conveyed during fiscal year 2016.

To date, LANS cultural resource staff identified no sites associated with the Spanish Colonial or Mexican periods. In 2004, the historic periods (Historic Pueblo, United States Territorial, Undetermined Athabascan, and Statehood) were combined into one site affiliation code, Early

15 Athabascan refers to a linguistic group of North American Indians. Their range extends from Canada to the American Southwest, including the languages of the Navajo and Apache.

Historic Pajarito Plateau (AD 1500 to 1943). Many of the 2,319 potential historic cultural resources are temporary and modular properties, sheds, and utility features associated with the Manhattan Project and Cold War periods. Since the 2008 SWEIS was issued, these types of properties have been removed from the count of historic properties because they are exempt from review under the terms of the 2017 Programmatic Agreement between the DOE/NNSA Los Alamos Site Office, the State Historic Preservation Office, and the Advisory Council on Historic Preservation (DOE 2017b). Additionally, LANS cultural resource staff have evaluated many Manhattan Project and Early Cold War properties (1943–1963) and those properties built after 1963 that potentially have historical significance, reducing the total number of potential historic cultural resource sites. In fiscal year 2011, historic buildings that had been evaluated and demolished were also removed from the count of potential historic properties. Only those buildings still standing are now included in the total count of 577 (Table 3-30). Most buildings constructed after 1963 are being evaluated on a case-by-case basis as projects arise that have the potential to impact the properties. Therefore, additional buildings may be added to the list of historic properties in the future. During fiscal year 2016, 23 buildings that had reached 50 years of age were added to the historic buildings database requiring consideration and evaluation for historic significance and eligibility under the National Historic Preservation Act.

Table 3-30. Historic Period Cultural Resource Properties at LANL[a]

Fiscal Year	Potential Properties[b]	Properties Recorded[c]	Eligible and Potentially Eligible Properties[d]	Non-Eligible Properties	Percentage of Eligible Properties	Evaluated Buildings Demolished[e]
2008	758	623	346	277	55	144
2015	556	463	356	200	76.9	205
2016	577	469	368	209	78.5	215

a. Source: Information on LANL provided by DOE/NNSA and LANL to the Secretary of Interior for a Report to Congress on Federal Archaeological Activities. Numbers given represent cumulative total properties identified, evaluated, or demolished by the end of the given fiscal year.

b. This number includes historic sites that have not been evaluated and therefore may be potentially National Register of Historic Places eligible. Properties that have reached 50 years of age are included as Potential Properties. In addition, beginning with the calendar year 2002 Yearbook, historic properties that are exempt from review under the terms of the Programmatic Agreement were removed from these totals, substantially reducing the number of potential Historic period cultural resources. During fiscal year 2011, evaluated and demolished historic buildings are no longer included in the total number of historic "potential properties" and any other column in this table.

c. This represents both eligible and non-eligible sites.

d. Eligible for the National Register of Historic Places.

e. This represents the total number of evaluated buildings demolished to date.

LANS cultural resource staff continue to evaluate buildings and structures from the Manhattan Project, the Early Cold War, and the late Cold War periods (1943–1990) for eligibility in the National Register of Historic Places.

There are 145 historic sites recorded at LANL. All have been assigned unique New Mexico Laboratory of Anthropology site numbers. Some of the sites are experimental areas and artifact scatters that date to the Manhattan Project and Early Cold War periods. The majority, 117 sites, are structures or artifact scatters associated with the Early Historic Pajarito Plateau or Homestead periods. Of these 145 sites, 92 are eligible for the National Register of Historic Places. There are 432 Manhattan Project, Early Cold War, and Late Cold War period buildings.

Demolished Buildings. Table 3-31 indicates the extent of historic building documentation conducted under the National Historic Preservation Act and demolition to date. Not all buildings that have been documented as part of the DD&D Program have been demolished yet.

Table 3-31. Historic Building Documentation and Demolition Numbers

Fiscal Year	Number of Buildings for which Documentation was Completed	Number of Buildings Demolished in Fiscal Year
2008	4	6
2015	12	6
2016	12	8

3.9.1 Compliance Overview

Section 106 of the National Historic Preservation Act, Public Law 89-665, implemented by 36 Code of Federal Regulations Part 800 requires federal agencies to evaluate the impact of proposed actions on historic properties. Federal agencies must also consult with the State Historic Preservation Office and/or the Advisory Council on Historic Preservation about possible adverse effects to National Register of Historic Places-eligible resources.

During fiscal years 2015 and 2016[16], LANS cultural resources staff evaluated 947 and 1,107 proposed actions, respectively, and conducted one new field survey in fiscal year 2015 and five new field surveys in fiscal year 2016 to identify archaeological sites. Three new surveys in fiscal year 2015 and eight new surveys in fiscal year 2016 were conducted to identify historic buildings. DOE/NNSA sent eight survey reports in fiscal year 2015 and nine survey reports in fiscal year 2016 to the State Historic Preservation Office for concurrence in findings of effects and determinations of eligibility for cultural resources located during survey projects. The American Indian Religious Freedom Act of 1978 (Public Law 95-341) stipulates that it is federal policy to protect and preserve the right of American Indians to practice their traditional religions (42 USC 1996). Tribal groups must receive notification of possible alteration of traditional and sacred places. During fiscal year 2015, one report was sent to the Governors of San Ildefonso, Santa Clara, Cochiti, Jemez, and Acoma Pueblos and the President of the Mescalero Apache Tribe so that any traditional cultural properties affected by the Proposed Action could be identified. No reports were sent in fiscal year 2016.

The Native American Graves Protection and Repatriation Act of 1990 (Public Law 101-601) states that if burials or cultural objects are inadvertently disturbed by federal activities, work must stop in that location for 30 days and the closest lineal descendant must be consulted for disposition of the remains (25 USC 1996). One discovery of human remains occurred in fiscal year 2015 when a LANS subcontractor was conducting road maintenance work on federal land. The project was stopped while archaeological investigations of the human remains took place. These remains were repatriated on site and erosion control measures were installed along this section of road in coordination with the Pueblo de San Ildefonso. The Archaeological Resources Protection Act of 1979 (Public Law 96-95) provides protection of cultural resources and sets penalties for their damage or removal from federal land without a permit (16 USC 1996). No violations of this Act were recorded on DOE/NNSA land in fiscal year 2015 or 2016.

16 All updates for the Cultural Resources section are reported on a fiscal year basis instead of calendar year. This is because similar data is reported to Congress on a fiscal year basis.

3.9.2 Compliance Activities

Nake'muu. LANL completed its long-term monitoring program to assess the impact of LANL mission activities on cultural resources at the ancestral pueblo of Nake'muu as part of the DARHT Facility Mitigation Action Plan (DOE 1996). Nake'muu is the only Ancestral Pueblo site at LANL with standing walls. The site was occupied from circa AD 1200 to 1325 and contains 55 rooms with walls, some standing up to 6 feet high. During the nine-year monitoring program 1998–2006, the site witnessed a 0.9 percent displacement rate of chinking stones and 0.3 percent displacement of masonry blocks. Statistical analyses indicate that these displacement rates are significantly correlated with annual snowfall, but not with annual rainfall or explosive tests at the DARHT Facility. The site is revisited annually and in 2008 the site experienced an unusually high percentage of new displaced masonry blocks. LANS is in the process of evaluating possible mitigation efforts. Representatives from the Pueblo de San Ildefonso most recently visited Nake'muu on September 26, 2008 (fiscal year 2008); October 23, 2009 (fiscal year 2010); and November 10, 2010 (fiscal year 2011). No requests for Pueblo visits were received, and, therefore, no Pueblo visits were conducted during fiscal year 2015 or 2016.

Land Conveyance and Transfer. The Laboratory continued a multiyear program in support of the Land Conveyance and Transfer Project. During 2002 to 2005, 39 archaeological sites were excavated, with more than 200,000 artifacts and 2,000 samples being recovered (LANL 2008). During fiscal year 2014, LANS cultural resources staff conducted the annual inspection of the curation facility (Museum of Indian Arts and Cultural in Santa Fe, New Mexico) where the artifacts and records from the 39 excavated sites and collections from other earlier projects conducted on lands now administered by DOE are housed. During fiscal years 2015 and 2016, three fences surrounding sensitive cultural areas were monitored. No tracts of land were conveyed by DOE/NNSA to Los Alamos Country or the Pueblo de San Ildefonso during fiscal year 2015 or 2016.

Cerro Grande Fire Recovery. During fiscal years 2015 and 2016, only two traditional cultural property fences were monitored. Erosion controls installed at various sites throughout the burned areas are still effective and continue to support the revegetation of the areas.

Manhattan Project National Historical Park. The 2014 National Defense Authorization Act signed by President Obama provided legislation for the creation of the Manhattan Project National Historical Park (Park). Los Alamos is one of three locations selected to represent the Park, which will be managed jointly by the National Park Service and the DOE under a Memorandum of Agreement between the Department of Interior and DOE signed on November 10, 2015. The agreement defines the respective roles and responsibilities of the two departments in administering the Park and includes provisions for enhanced public access, management, interpretation, and historic preservation.

At LANL, 17 Manhattan Project-era facilities have been identified as contributing to the Park. Located in eight separate areas, the potential Park properties represent key events in the timeline of the Manhattan Project's scientific and engineering history and directly supported the design, assembly, testing, and use of the world's first atomic weapons, including the Trinity test device, the Little Boy weapon detonated over Hiroshima, and the Fat Man weapon detonated over Nagasaki.

During fiscal years 2015 and 2016, an interactive mobile application for Android™ and Apple™ devices were developed and published highlighting the history of the Manhattan Project at

Los Alamos. The app provides several augmented reality experiences at selected Los Alamos sites.

During fiscal year 2016, National Park Service signs were placed at the eight properties officially included in the Park located within Technical Area 08, Technical Area 16, and Technical Area 18. A weather enclosure was placed over one Park building to minimize additional loss of concrete.

3.9.3 Cultural Resources Management Plan

The Cultural Resources Management Plan (LANL 2006) provides a set of guidelines for managing and protecting cultural resources in accordance with requirements of the National Historic Preservation Act, the Archaeological Resources Protection Act, the Native American Graves Protection and Repatriation Act, the American Indian Religious Freedom Act, and other laws, regulations, and DOE policies and directives related to cultural resources at LANL. The Cultural Resources Management Plan provides high-level guidance for implementation of the Traditional Cultural Properties Comprehensive Plan (DOE 2000a) and all other aspects of cultural resources management at LANL. It presents a framework for collaborating with Native American Tribes and other ethnic groups and organizations in identifying traditional cultural properties and sacred sites.

The Cultural Resources Management Plan was finalized and approved by LANL and DOE/NNSA in 2005 and was implemented through a Programmatic Agreement signed in June 2006 by DOE/NNSA, the New Mexico State Historic Preservation Office, and the Advisory Council on Historic Preservation. During fiscal year 2012, an updated Cultural Resources Management Plan was drafted and reviewed by DOE/NNSA. The Draft Final Cultural Resources Management Plan was sent to the New Mexico State Historic Preservation Office for review. During fiscal years 2015 and 2016, the negotiations between the New Mexico State Historic Preservation Office and DOE/NNSA on the updated Cultural Resources Management Plan draft continued.[17]

Fiscal years 2015 and 2016 outreach activities included tours of historical sites at LANL.

- Tours were conducted during fiscal years 2015 and 2016 at LANL historic building areas including V-Site, Gun Site, and the Slotin building. Several public presentations related to LANL history and historic properties dating from the Homestead, Manhattan Project, and Cold War eras were also given during this time.
- Tours of archaeological sites Tsirege and Nake’muu were conducted for the DOE/NNSA Los Alamos Field Office, several LANL organizations, and the public.

3.10 Ecological Resources

LANL is located in a region of diverse landforms, elevation, and climate—features that contribute to producing diverse plant and animal communities. Plant communities range from urban and suburban areas to grasslands, wetlands, shrublands, woodlands, and mountain forest. These plant communities provide habitat for a variety of animal life.

17 The 2017 Cultural Resources Management Plan was finalized in March, 2017 and implemented through an updated Programmatic Agreement signed in August 2017 by DOE/NNSA, the New Mexico State Historic Preservation Officer, and the Advisory Council on Historic Preservation.

The 2008 SWEIS projected no significant adverse impacts to biological resources, ecological processes, or biodiversity (including threatened and endangered species) resulting from LANL operations. Data collected for calendar year 2015 and calendar year 2016 support this projection. These data are reported in the 2015 and 2016 Annual Site Environmental Reports (LANL 2016d, 2017d).

The SWEIS biological assessment, completed in 2006, covers actions that were described in the 2008 SWEIS No Action Alternative and some actions that were included as part of the Expanded Operations Alternative. Actions included elements of the Expanded Operations Alternative such as remediation of several material disposal areas, DD&D of Technical Area 21, and elimination or reduction of outfall releases in Mortandad Canyon and its tributaries. Other biological assessments are completed as needed (see section 3.10.3).

LANS management approved a LANL Biological Resources Management Plan in September 2007 (LANL 2007). LANS biologists updated a source document for migratory bird protection best management practices (LANL 2011) in calendar year 2011. The sensitive species protection source document was updated during calendar year 2015 (LANL 2015m).

3.10.1 Conditions of the Forests and Woodlands

The forests and woodlands in and around the LANL area have undergone significant changes that began with the Cerro Grande fire in 2000. Wildfire, insect activity, and drought have greatly reduced tree densities in the area. Forest thinning activities have also reduced tree density in treated areas.

LANL is located in a fire-prone region, and there is a high potential for wildfires. Recent modeling of wildfire risks indicates that the greatest potential for lightning to ignite fires occurs along the western and southwestern boundary of LANL and in the adjacent mountainous areas. Because of this risk, LANL reduces forest fuels in these areas and within defensible space around buildings. In calendar year 2016, LANS prepared the LANL Five-Year Wildland Fire Management Plan (2016–2020) (LANL 2016p). The Wildland Fire Management Program goal is to protect life, infrastructure, and the environment from the devastating effects from wildfire.

Fuels management is completed in compliance with the Wildfire Hazard Reduction and Forest Health Environmental Assessment and associated Finding of No Significant Impacts (DOE 2000b).

During calendar year 2014, LANL finalized its Forest Management Plan (LANL 2014a). Current climate modeling indicates that northern New Mexico will experience continually increasing temperatures, with stresses of severe heat, heavy precipitation, and declining snowpack (IPCC 2015), but with no concurrent increase in precipitation. LANL researchers predict that most native conifer trees will be dead by 2050. Projected climate changes and mortality of trees will lead to loss of forest cover, continued high risks of severe wildfire, and higher soil erosion rates. The purpose of the Forest Management Plan is to prioritize and provide treatment prescriptions for forest and woodland areas not currently treated under LANL’s Wildland Fire Program to meet the following objectives.

1) Minimize soil erosion.
2) Maintain piñon-juniper, ponderosa pine, and mixed conifer woodland and forest types in a healthy condition for as long as possible.
3) Support wildfire fuel mitigation efforts.

3.10.2 Threatened and Endangered Species Habitat Management Plan

In calendar years 2015 and 2016, under the Threatened and Endangered Species Habitat Management Plan (DOE 2104a), LANL continued annual surveys for the Mexican Spotted Owl, the Southwestern Willow Flycatcher, and the Jemez Mountains Salamander. LANS biologists continue to provide guidance for minimizing disturbance and habitat alteration impacts on federally listed species to project and operations personnel through the LANL Integrated Review Tool.[18]

3.10.3 Biological Assessments and Compliance Packages

DOE/NNSA submits biological assessments to the U.S. Fish and Wildlife Service to review proposed activities and projects for potential impacts to federally listed threatened or endangered species. These assessments are necessary when a project is not able to follow the existing guidelines in the Threatened and Endangered Species Habitat Management Plan (LANL 2015n). These assessments evaluate and document the amount of development or disturbance at proposed construction sites and the amount of disturbance within designated core and buffer habitat. DOE/NNSA prepares floodplain and/or wetlands assessments in accordance with 10 Code of Federal Regulations Part 1022.

During calendar years 2015 and 2016, the following biological assessments were prepared.

- *Biological Assessment of the Effects of the Recreational Use of Los Alamos Canyon on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory* (LANL 2014b).
- *Biological Assessment of the Effects of the Decommissioning and Removal of Infrastructure at the Technical Area 57 Fenton Hill Site at Los Alamos National Laboratory* (LANL 2015o).
- *Biological Assessment for the 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* (LANL 2015p).
- *Biological Assessment of the Effects of the Paleoseismic Trenching Project to Conduct a Probabilistic Seismic Hazard Analysis of the Pajarito Fault System around Los Alamos National Laboratory* (LANL 2016q).

The following floodplain and/or wetland assessments were prepared.

- *Floodplain Assessment for Enhanced Storm Water Controls in Three-mile Canyon at Technical Area 18 at Los Alamos National Laboratory (LANL 2015q)*.
- *Floodplain Assessment of the Chromium Plume Control Interim Measure and Plume-Center Characterization in Mortandad Canyon, Los Alamos National Laboratory* (LANL 2015r).
- *Floodplain Assessment of the Erosion Corrective Actions in Potrillo Canyon at Los Alamos National Laboratory* (LANL 2016r).

18 The Integrated Review Tool is a web portal that helps determine what, if any, project reviews, permits, and approvals may be required for a project or activity. It provides links to a mapping application and other tools, and integrates and streamlines the Laboratory’s permits and requirements Identification process and excavation/fill/soil disturbance permit requests.

- *Floodplain Assessment for Corrective Actions in Ancho Canyon, Technical Area 39, Los Alamos National Laboratory, Los Alamos, New Mexico* (LANL 2016s).

3.11 Footprint Reduction and DD&D

3.11.1 Footprint Reduction

Footprint reduction is a cornerstone facility strategy necessary to achieve the robust sustainable infrastructure required for current and future missions. The goal of footprint reduction efforts is the consolidation of people and functions into facilities that represent a better-built environment, coupled with the elimination of aged permanent and temporary structures. This strategy reduces operational and maintenance costs of the eliminated facilities so that they can be allocated to more appropriately fund the remaining sustainable facilities. It also avoids energy and water usage and associated deferred maintenance backlog of the eliminated facilities.

The institutionally-funded Footprint Reduction Project is dedicated to moving specific facilities toward their ultimate elimination. Project activities include:

- Funding the moves of functions and people to vacate a building.
- Funding modifications in enduring facilities to house organizations that are vacating obsolete structures.
- Addressing the specific institutional requirements necessary to formally declare a facility "excess," to maintain a backlog of structures ready for elimination once DD&D funding is acquired (approximately 0.75 million gross square feet) and, in some cases, removing small structures.

In calendar year 2015, DOE/NNSA removed approximately 24 structures, eliminating 29,025 square feet of LANL's footprint. In calendar year 2016, DOE/NNSA removed approximately 11 structures, eliminating 27,345 square feet of LANL footprint.[19] Table 3-32 shows the total number of gross square feet of the LANL footprint eliminated since calendar year 2008.

Table 3-32. 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.

19 The total number of structures removed does not include leased space.

3.11.2 Decontamination, Decommissioning, and Demolition

DD&D are those actions taken at the end of the useful life of a building or structure to reduce or remove substances that pose a substantial hazard to human health or the environment, retire it from service, and ultimately eliminate all or a portion of the building or structure. When DOE/NNSA declares a LANL facility as surplus (no longer needed), it is shut down and prepared for DD&D. DD&D activities at LANL are covered under the 2008 SWEIS and all waste volumes generated from these activities are tracked in the SWEIS Yearbooks. The 2008 SWEIS projected DD&D actions would produce large quantities of demolition debris, bulk LLW, and smaller quantities of TRU, MLLW, sanitary, asbestos, and hazardous wastes. Most waste would be disposed of offsite.

In calendar years 2015 and 2016, DOE/NNSA demolished several structures. Tables 3-33 and 3-34 summarize the waste volumes for all buildings that went through the DD&D process in calendar years 2015 and 2016.

Table 3-33. Calendar Years 2015 and 2016 DD&D Facilities Construction and Demolition Debris[a]

Building Number[b]	DD&D Completed	Waste Volumes (cubic meters)						
		Construction/ Demolition Debris	Asbestos[c]	Universal Waste	Recyclable Metal[d]	Recyclable Asphalt/ Concrete	Recyclable Wood	Equipment Salvaged[d]
46-0041	03/23/2015	49.7	6.12	1.91	79	252.3	0	0
53-0527	06/04/2015	16.29	0	0.04	11	16.82	0	0
53-0396	06/12/2015	39.37	0	0.46	1	39.76	0	0
53-0397	06/12/2015	39.45	0	0.46	1	39.99	0	0
53-0398	06/12/2015	39.37	0	0.46	1	39.76	0	0
63-0052	06/23/2015	84.1	0	0.5	0.4	15	0	0
63-0053	06/23/2015	84.1	0	0.5	0.4	15	0	0
63-0054	06/23/2015	84.9	0	0.5	0.5	15	0	0
53-0553	07/01/2015	7.49	0	0.1	1.35	0	0	0
48-0129	08/06/2015	9.71	0	0.1	0.25	15.29	0	0
48-0002	08/13/2015	9.17	2	0.2	0.25	19.11	0	0
48-0143	08/13/2015	2.29	0	0.1	0.25	11.47	0	0
16-0542	08/19/2015	7.34	1.15	0.1	0.8	6.12	0	0
33-0290	09/01/2015	4.97	0	0.1	0.6	3.82	0	2
46-0420	09/16/2015	64.07	8.8	0.31	31.5	125	0	0
54-1004	09/16/2015	46.62	1.53	0.57	9.7	71.67	0	0
16-0201	10/07/2015	0.76	0.38	0.1	0.5	5	0	0
35-0257	10/15/2015	0.76	3.44	0.1	0.5	5.35	0	0
03-1814	10/29/2015	0.38	0	0.1	1.35	0	0	0
54-1009	12/09/2015	142.4	1	0.4	12.7	143	0	0
18-0168	12/18/2015	0	0	0.1	0	0	0	0
43-0036	07/10/2015	1.15	0	0	1.5	0	0	0
59-0183	07/15/2015	0	0	0.1	1.3	5.35	0	0
53-0576	06/24/2015	4.51	0	0.05	0.35	0	0	0

Building Number[b]	DD&D Completed	Waste Volumes (cubic meters)						
		Construction/ Demolition Debris	Asbestos[c]	Universal Waste	Recyclable Metal[d]	Recyclable Asphalt/ Concrete	Recyclable Wood	Equipment Salvaged[d]
46-0549	03/23/2015	0.36	0	0.2	0.5	1.9	0	0
46-0548	03/23/2015	0.38	0	0.2	0.5	1.9	0	0
35-0375	01/29/2015	0	0	0	2.3	0	0	0
35-0373	01/29/2015	0	0	0	2.3	0	0	0
35-0372	01/29/2015	0	0	0	3.0	0	0	0
53-0621	10/13/2015	3	0	0	15	0	0	0
39-0183	01/26/2016	1.5	1.5	0.3	1.75	7.65	0	0
39-0002	01/26/2016	168.97	46.64	6.12	80.43	273.18	0	0
39-0010	01/27/2016	1.15	0.76	0.15	1.5	6.12	0	0
46-0202	09/20/2016	156.96	2.29	0.38	25.99	38.99	N/A[e]	N/A
46-0128	09/20/2016	156.96	2.29	0.38	25.99	38.99	N/A	N/A
46-0120	09/20/2016	156.96	2.29	0.38	25.99	38.99	N/A	N/A
03-2147	09/20/2016	N/A	N/A	N/A	N/A	N/A	N/A	N/A
60-0197	06/30/2016	N/A	N/A	N/A	N/A	N/A	N/A	N/A
46-0307	09/12/2006	N/A	N/A	N/A	N/A	N/A	N/A	N/A
60-0228	12/6/2016	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total		**1,385.14**	**80.19**	**15.47**	**342.45**	**1,252.53**	**0**	**2**
2008 SWEIS		**246,409[a]**						

a. Construction/demolition debris includes uncontaminated wastes such as steel, brick, concrete, pipe, and vegetation from land clearance. This number represents 151,382 cubic meters from the No Action Alternative, 2,293 cubic meters from the RLWTF upgrade, 2,133 cubic meters from the Plutonium Refurbishment, 35,934 cubic meters from the Technical Area 21 DD&D Option, 12,998 cubic meters from the Technical Area 18 DD&D Option, and 41,669 cubic meters from the Waste Management Facilities Transition.

b. DD&D operations covered under existing environmental assessments are not included here.

c. Asbestos volumes are tracked within the LANL waste database at Technical Area 54.

d. Recyclable metal and equipment salvaged volumes are only tracked in tons (not in cubic meters). All other waste volumes were tracked in cubic meters.

e. N/A = not available.

Table 3-34. DD&D Waste Projections for Calendar Years 2015 and 2016

Building Number	DD&D Completed	Waste Volumes			
		Chemical Waste[a]	LLW[b,c]	Mixed LLW[b]	TRU[b]
TA-46-41	03/23/2015	0	36	0	0
TA-21-286, -387, -229, -227	09/17/2015 11/04/2015 11/12/2015 12/10/2015	0	31	0	0
TA-18-168	12/18/2015	0	61	0	0
TA-39-02	01/26/2016	0	15	0	0
TA-18-32, -116	08/01/2016 09/19/2016	0	1,088	1	0
Total 2015		**0**	**128**	**0**	**0**
Total 2016		**0**	**1,103**	**1**	**0**
2008 SWEIS Projections		**1,417,000**[d]	**91,891**[e]	**649**[f]	**437**[g]

a. Units = kilograms per year.

b. Units = cubic meters per year.

c. LLW included bulk and packaged low-level radioactive waste.

d. This number represents the following numbers from the 2008 SWEIS: 837,781 kilograms from the No Action Alternative, 96,161 kilograms from the RLWTF Upgrade, 907 kilograms from the Plutonium Refurbishment, 34,019 kilograms from the Technical Area 21 DD&D Option, 191,415 kilograms from the Technical Area 18 DD&D Option, and 256,732 kilograms from the Waste Management Facilities Transition.

e. This number represents the following numbers from the 2008 SWEIS: 29,588 cubic meters from the No Action Alternative, 7,875 cubic meters from the RLWTF Upgrade, 986 cubic meters from the Plutonium Refurbishment, 26,453 cubic meters from the TA-21 DD&D Option, 3,593 cubic meters from the Technical Area 18 DD&D Option, and 23,396 cubic meters from the Waste Management Facilities Transition.

f. This number represents the following numbers from the 2008 SWEIS: 306 cubic meters from the No Action Alternative, 115 cubic meters from the RLWTF Upgrade, 168 cubic meters from the Plutonium Refurbishment, 50 cubic meters from the Technical Area 21 DD&D Option, 4 cubic meters from the Technical Area 18 DD&D Option, and 6 cubic meters from the Waste Management Facilities Transition.

g. This number represents the following numbers from the 2008 SWEIS: 176 cubic meter from the Radioactive Liquid Waste Treatment Facility Upgrade, 260 cubic meters from the Plutonium Refurbishment, 0.76 cubic meters from the Technical Area 21 DD&D Option.

4.0 CONCLUSION

Data from LANL operations mostly fell within the 2008 SWEIS projections. Operations data that exceeded projections, such as the additional radioactive liquid waste bottoms shipped to an offsite commercial facility for treatment, resulted in no impact on site because these radioactive liquid waste bottoms were shipped offsite. In addition, the ability to reduce the volume and concentrate radioactive liquid prior to shipment will restart once the new RLWTF that was projected in the 2008 SWEIS and associated RODs is operational.

The purpose of this Yearbook is to compare calendar year 2015 and 2016 LANL operations data with the 2008 SWEIS projections to determine if LANL was still operating within the environmental envelope established by the 2008 SWEIS and associated RODs. Overall, the calendar year 2015 and 2016 data indicate that the Laboratory was operating within the 2008 SWEIS envelope.

The Yearbook will continue to be prepared on an annual basis, with operations and relevant parameters in a given year compared with the 2008 SWEIS projections for activity levels chosen in the RODs.

REFERENCES

DOE 1992. "Environmental Assessment for the Materials Science Laboratory (MSL) at Los Alamos National Laboratory," Los Alamos National Laboratory DOE/EA-0493, 1992.

DOE 1996. "Dual Axis Radiographic Hydrodynamic Test Facility Final Environmental Impact Statement Mitigation Action Plan," DOE/EIS-0228, 1996.

DOE 1997. "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports, Change Notice 1," Department of Energy, DOE STD 1027-92, September 1997.

DOE 1998. "Environmental Assessment for the Proposed Strategic Computing Complex," Department of Energy, DOE/EA-1250, 1998.

DOE 1999a. "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 1999b. "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 1999c. "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. "A Comprehensive Plan for the Consideration of Traditional Cultural Properties and Sacred Sites at Los Alamos National Laboratory," Department of Energy, August 2000.

DOE 2000b. "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 2002a. "Final Environmental Impact Statement for the Proposed Relocation of Technical Area 18 Capabilities and Materials at the Los Alamos National Laboratory," Department of Energy, DOE/EIS-0319, August 2002.

DOE 2002b. "Record of Decision for the Final Environmental Impact Statement for the Relocation of Technical Area 18 Capabilities and Materials at the Los Alamos National Laboratory," Department of Energy, DOE/EIS-0319 ROD, 78 FR 75913, August 2002.

DOE 2003. "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 2004a. "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 2004b. "Supplement Analysis for the 1999 Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory for the Proposed Disposition of Certain Large Containment Vessels," Department of Energy DOE/EIS-0238-SA-03, February 12, 2004.

DOE 2005. "Supplement Analysis: Environmental Impact Statement for the Chemistry and Metallurgy Research Building Replacement (CMRR) Project at Los Alamos National Laboratory—Changes to the Location of the CMRR Facility Components," DOE/EIS-0350-SA-01, January 2005.

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. "Final Complex Transformation Supplemental Programmatic Environmental Impact Statement Summary," Department of Energy, DOE/EIS-0236-S4, October 28, 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 2010. "Categorical Exclusion for Replacement of Los Alamos Neutron Science Center (LANSCE) Operational Equipment," Department of Energy, LAN-11-0001, December 2010.

DOE 2011a. "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 2011b. "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 2011c. "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 2011d. "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 2015a. "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 2015b. "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 2015c. "Categorical Exclusion for the Pueblo Grade Control Structure Revitalization and Wetlands Stabilization, TA-74," Department of Energy, LAN-14-17, Accession Number 19629, February 18, 2015.

DOE 2015d. "Categorical Exclusion for the Lease Extension for the Operation of a Telecommunications Tower at Los Alamos," Department of Energy, LAN-15-01, Accession Number 20188, February 9, 2015.

DOE 2015e. "Categorical Exclusion for Domestic Source Recovery FY 2016," Department of Energy, LAN-15-07, Accession Number 20889, December 10, 2015.

DOE 2015f. "Categorical Exclusion for Foreign Location Source Recovery FY 2016," Department of Energy, LAN-15-06, Accession Number 20888, December 10, 2015.

DOE 2015g. "NA-LA NEPA Compliance Determination Form for the Formulation and Thermal Behavior Investigations of Surrogate Waste," Department of Energy, LAN-15-02, Accession Number 20358, July 8, 2015.

DOE 2015h. "NA-LA NEPA Compliance Determination Form for the Radioactive Liquid Waste Treatment Facility (RLWTF) Upgrade Project," Department of Energy, LAN-15-05, Accession Number 18236, September 29, 2015.

DOE 2015i. "Final Surplus Plutonium Disposition Supplemental Environmental Impact Statement," Department of Energy, DOE/EIS-0283-S2, April 2015.

DOE 2015j. "Accident Investigation Report. Phase 2, Radiological Release Event at Waste Isolation Pilot Plant," Department of Energy, April 2015.

DOE 2016a. "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 2016b. "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 2016c. "Categorical Exclusion for the TA-3 Substation Replacement Project," Department of Energy, LAN-16-09, Accession Number 15448, February 16, 2016.

DOE 2016d. "Categorical Exclusion for the Unmanned Aerial Systems User Facility," Department of Energy, LAN-16-01, Accession Number 20887, January 7, 2016.

DOE 2016e. "Categorical Exclusion for the Detection and Analysis of Chemicals," Department of Energy, LAN-16-08, Accession Number 21610, July 27, 2016.

DOE 2016f. "NA-LA NEPA Compliance Determination Form for the Metropolis Center Computer Cooling and Power Computing Infrastructure Upgrade in Support of the Stockpile Stewardship Program," Department of Energy, LAN-16-06, Accession Number 21072, October 11, 2016.

DOE 2016g. "NA-LA NEPA Compliance Determination Form for the Technical Area 59 Building 0001 Modifications and Activities for Uranium, Plutonium and Other Radionuclide Processing," Department of Energy, LAN-16-03 Accession Numbers 20821 and 21066, October 5, 2016.

DOE 2016h. "NA-LA NEPA Compliance Determination Form for the Removal Of The Bounding Number Of Safety And Mechanical Tests Conducted Annually On High Explosives And Weapons Systems Components," Department of Energy, LAN-14-16, Accession Number 20511, September 12, 2016.

DOE 2016i. "Increase Production of Medical and Industrial Radioisotopes," Department of Energy, LAN-14-11, Accession Number 19526, February 19, 2016.

DOE 2017a. "FY 2018 Congressional Budget Request," Department of Energy, DOE/CF-0128, May 2017.

DOE 2017b. "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.

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.

LANL 2006. "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 2007. "Biological Resources Management Plan for Los Alamos National Laboratory," Los Alamos National Laboratory, LA-UR-07-2595, April 2007.

LANL 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.

LANL 2011. "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 2014a. "Los Alamos National Laboratory Forest Management Plan," Los Alamos National Laboratory, LA-UR-14-27513, October 2014.

LANL 2014b. "Biological Assessment of the Effects of the Recreational Use of Los Alamos Canyon on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory," Los Alamos National Laboratory, LA-UR-14-29595, December 2014.

LANL 2015a. "Safety Assessment Document for the Los Alamos Neutron Scince Center User Facility; Volume I-VIII," Los Alamos National Laboratory, TA53-SB-SAD-Vol.I-113-004, May 2015.

LANL 2015b. "Accelerator Safety Envelope for the Los Alamos Neutron Science Center Facility," Los Alamos National Laboratory, TA53-SB-ASE-113-005, June 2015.

LANL 2015c. "Sandia Wetland Performance Report, Performance Period April 2014–December 2014," Los Alamos National Laboratory, LA-UR-15-22463, April 2015.

LANL 2015d. "2014 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," Los Alamos National Laboratory, LA-UR-15-21413, Februrary 2015.

LANL 2015e. "Supplemental Investigation Report for Upper Sandia Canyon Aggregate Area, Revision 1," Los Alamos National Laboratory, LA-UR-15-26598, August 2015.

LANL 2015f. "Supplemental Investigation Report for Potrillo and Fence Canyons Aggregate Area," Los Alamos National Laboratory, LA-UR-15-27131, September 2015.

LANL 2015g. "Supplemental Investigation Report for Upper Mortandad Canyon Aggregate Area," Los Alamos National Laboratory, LA-UR-15-28015, November 2015.

LANL 2015h. "Supplemental Investigation Report for S-Site Aggregate Area," Los Alamos National Laboratory, LA-UR-15-28016, October 2015.

LANL 2015i. "2015 Biennial Asphalt Monitoring and Removal Report for Area of Concern C-00-041, Guaje/Barrancas/Rendija Canyons Aggregate Area," Los Alamos National Laboratory, November 2015.

LANL 2015j. "Semiannual Progress Report for Corrective Measures Evaluation/Corrective Measures Implementation for Consolidated Unit 16-021(c)-99," Los Alamos National Laboratory, LA-UR-15-28017, October 2015.

LANL 2015k. "Aggregate Area (Fenton Hill), Revision 1," Los Alamos National Laboratory, LA-UR-15-29322, December 2015.

LANL 2015l. "2014 LANL Radionuclide Air Emissions Report," Los Alamos National Laboratory, LA-UR-15-24260, July 21, 2015.

LANL 2015m. "Sensitive Species Best Management Practices Source Document," Los Alamos National Laboratory, LA-UR-15-20981, May 27, 2015.

LANL 2015n. "Threatened and Endangered Species Habitat Management Plan for Los Alamos National Laboratory," Los Alamos National Laboratory, LA-UR-15-28610, October 2015.

LANL 2015o. "Biological Assessment of the Effects of the Decommissioning and Removal of Infrastructure at the Technical Area 57 Fenton Hill Site at Los Alamos National Laboratory," Los Alamos National Laboratory, LA-CP-15-20378, July 2015.

LANL 2015p. "Biological Assessment for the 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," Los Alamos National Laboratory, LA-UR-15-23445, May 2015.

LANL 2015q. "Floodplain Assessment for Enhanced Storm Water Controls in Threemile Canyon at Technical Area 18 at Los Alamos National Laboratory," Los Alamos National Laboratory, LA-UR-15-23666, May 2015.

LANL 2015r. "Floodplain Assessment of the Chromium Plume Control Interim Measure and Plume-Center Characterization in Mortandad Canyon, Los Alamos National Laboratory," Los Alamos National Laboratory, LA-UR-15-28814, November 2015.

LANL 2016a. "SWEIS Yearbook 2014," Los Alamos National Laboratory, LA-UR-16-24711, September 16, 2016.

LANL 2016b. "TA-55 Documented Safety Analysis, Los Alamos National Laboratory," Los Alamos National Laboratory, TA-55-DSA-2015-R 1, January 2016.

LANL 2016c. "Interim Measures Progress Report for Soil-Vapor Extraction of Volatile Organic Compounds from Material Disposal Area L, Technical Area 54," Los Alamos National Laboratory, LA-UR-16-23065, May, 2016.

LANL 2016d. "Los Alamos National Laboratory 2015 Annual Site Environmental Report," Los Alamos National Laboratory, LA-UR-16-26788, October 2016.

LANL 2016e. "Supplemental Investigation Report for Threemile Canyon Aggregate Area," Los Alamos National Laboratory, LA-UR-16-20567, February 2012.

LANL 2016f. "2015 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," Los Alamos National Laboratory, LA-UR-16-22705, April 2016.

LANL 2016g. "2015 Sandia Wetland Performance Report," Los Alamos National Laboratory, LA-UR-16-22618, April 2016.

LANL 2016h. "Supplemental Investigation Report for the Upper Canada del Buey Aggregate Area," Los Alamos National Laboratory, LA-UR-16-26150, August 2016.

LANL 2016i. "Supplemental Investigation Report for Sites at Technical Area 49 Inside the Nuclear Environmental Site Boundary," Los Alamos National Laboratory, LA-UR-16-25263, July 2016.

LANL 2016j. "Supplemental Investigation Report for Cañon de Valle Aggregate Area, Technical Area 14," Los Alamos National Laboratory, LA-UR-16-29216, December 2016.

LANL 2016k. "Annual Progress Reports for Corrective Measures Evaluation/ Corrective Measures Implementation for Consolidated Unit 16-021(c)-99," Los Alamos National Laboratory, LA-UR-16-28862, November 2016.

LANL 2016l. "2016 Triennial Ordnance Survey Report, Solid Waste Management Units 00-011(a, d, and e), Guaje/Barrancas/Rendija Canyons Aggregate Area," Los Alamos National Laboratory, LA-UR-16-29284, December 2016.

LANL 2016m. "Emissions Inventory Report for Calendar Year 2015," LA-UR-16-28894, November 2016.

LANL 2016n. "2015 LANL Radionuclide Air Emissions Report," Los Alamos National Laboratory, LA-UR-16-23902, June 16, 2016.

LANL 2016o. "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 2016p. "LANL Five-Year Wildland Fire Management Plan (2016–2020)," Los Alamos National Laboratory, LA-UR-16-20979, February 18, 2016.

LANL 2016q. "Biological Assessment of the Effects of the Paleoseismic Trenching Project to Conduct a Probabilistic Sesimic Hazard Analysis of the Pajarito Fault System around Los Alamos National Laboratory," Los Alamos National Laboratory, LA-CP-16-20525, October 2016.

LANL 2016r. "Floodplain Assessment of the Erosion Corrective Actions in Potrillo Canyon at Los Alamos National Laboratory," Los Alamos National Laboratory, LA-UR-16-20393, March 2016.

LANL 2016s. "Floodplain Assessment for Corrective Actions in Ancho Canyon, Technical Area 39, Los Alamos National Laboratory, Los Alamos, New Mexico," Los Alamos National Laboratory, LA-UR-16-26253, October 2016.

LANL 2017a. "Los Alamos National Laboratory Nuclear Facilities," Los Alamos National Laboratory, LIST-SBD-503-R0.1, June 1, 2017.

LANL 2017b. "Emissions Inventory Report for Calendar Year 2016," Los Alamos National Laboratory, LA-UR-17-22005, March 2017.

LANL 2017c. "2016 Greenhouse Gas Emissions Electronic Submittal," Los Alamos National Laboratory, LA-UR-17-22654, March 30, 2017.

LANL 2017d. "Los Alamos National Laboratory 2016 Annual Site Environmental Report " Los Alamos National Laboratory, LA-UR-17-27987, September 2016.

NNSA 2004. "Memorandum from Ed Wilmot, Manager Los Alamos Site Office, to Carolyn Mangeng, Acting Associate Director for Technical Services, Los Alamos National Laboratory, Subject: Preparation of a Supplemental Site-Wide Environmental Impact Statement for the Continued Operation of the Los Alamos National Laboratory (LANL), Los Alamos, New Mexico," National Nuclear Security Administration, October 28, 2004.

NNSA 2005. "Memorandum from Ed Wilmot, Manager Los Alamos Site Office, to Carolyn Mangeng, Acting Associate Director for Technical Services, Los Alamos National Laboratory, Subject: Preparation of a new Site-Wide Environmental Impact Statement for the Continued Operation of the Los Alamos National Laboratory (LANL), Los Alamos, New Mexico," National Nuclear Security Administration, August 16, 2005.

UNM 2011. "Impact of Los Alamos National Laboratory on the Economies of Northern New Mexico and the State as a Whole," University of New Mexico Bureau of Business and Economic Research, March 2011.

Appendix A of the SWEIS Yearbook– Calendar Years 2015 and 2016 Capability and Operations Tables for Key and Non-Key Facilities

This page intentionally left blank.

Table A-1. CMR Building (Technical Area 03) Comparison of Operations

Capability	2008 SWEIS Projections	2015 Operations	2016 Operations
Analytical Chemistry	Support actinide research and processing activities by processing approximately 7,000 samples per year.	Received less than 400 samples and conducted approximately 3,000 analytical processes involving microgram to grams quantities of nuclear material.	Received less than 400 samples and conducted approximately 3,000 analytical processes involving microgram to grams quantities of nuclear material.
Uranium Processing	Recover, process, and store LANL's highly enriched uranium inventory.	Highly enriched uranium items processed to meet disposal/shipping requirements.	Highly enriched uranium items processed to meet disposal/shipping requirements.
Destructive and Nondestructive Analysis (Design Evaluation Project)	Evaluate up to 10 secondary assemblies per year through destructive/non-destructive analyses and disassembly.	No activity.	No activity.
Nonproliferation Training	Conduct nonproliferation training using special nuclear material.	No activity. This activity has been suspended indefinitely at the CMR Building.	No activity. This activity has been suspended indefinitely at the CMR Building.
Actinide Research and Development[a]	Characterize approximately 100 samples per year using microstructural and chemical metallurgical analyses.	No activity. Process activity was moved to Technical Area 55 in 2007.	No activity. Process activity was moved to Technical Area 55 in 2007.
	Perform compatibility testing of actinides and other metals to study long-term aging and other material effects.	No activity. This activity was suspended in 2011.	No activity. This activity was suspended in 2011.
	Analyze TRU waste disposal related to validation of Waste Isolation Pilot Plant performance assessment models.	No activity. Project was completed in 2001.	No activity. Project was completed in 2001.
	Perform TRU waste characterization.	No activity.	No activity.
	Analyze gas generation as could occur in TRU waste during transportation to the Waste Isolation Pilot Plant.	No activity.	No activity.
	Demonstrate actinide decontamination technology for soils and materials.	No activity.	No activity.
	Develop actinide precipitation method to reduce mixed wastes in LANL effluents.	No activity.	No activity.

Capability	2008 SWEIS Projections	2015 Operations	2016 Operations
Actinide Research and Development[a] (cont.)	Process up to 400 kilograms of actinides per year between Technical Area 55 and the CMR Building.	No activity.	No activity.
Fabrication and Processing	Process up to 5,000 curies of neutron sources per year (both plutonium-238 and beryllium and americium-241 and beryllium sources).	No activity. Project was terminated in calendar year 1999.	No activity. Project was terminated in calendar year 1999.
	Process neutron sources other than sealed sources.	No activity.	No activity.
	Stage a total of up to 1,000 plutonium-238 and beryllium and americium-241 and beryllium neutron sources in Wing 9 floor holes.	No activity.	No activity.
	Produce 1,320 targets per year for isotope production.	No activity.	No activity.
	Separate fission products from irradiated targets.	No activity.	No activity.
	Support fabrication of metal shapes using highly enriched uranium (as well as related uranium processing activities) with an annual throughput of approximately 2,200 pounds (1,000 kilograms).	No activity.	No activity.
Large Vessel Handling[b]	Process up to two large vessels from the Dynamic Experiments Program annually.	One vessel processed.	Two vessels processed.

a. The actinide activities at the CMR Building and at Technical Area 55 are expected to total 400 kilograms per year. The future split between these two facilities is not known, so the facility-specific impacts at each facility are conservatively analyzed at this maximum amount. Waste projections, which are not specific to the facility (but are related directly to the activities themselves), are only projected for the total of 400 kilograms per year.

b. Currently referred to as the Confinement Vessel Disposition Project.

Table A-2. CMR Building (Technical Area 03) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2015 Operations	2016 Operations
Radioactive Air Emissions				
Total Actinides[b]	Ci/yr	7.60E-4	1.29E-5	7.58E-6
Krypton-85	Ci/yr	1.00E+2	Not measured[c]	Not measured[c]
Xenon-131m	Ci/yr	4.50E+1	Not measured[c]	Not measured[c]
Xenon-133	Ci/yr	1.50E+3	Not measured[c]	Not measured[c]
NPDES Discharge				
No outfalls[d]	MGY	1.9	No outfalls	No outfalls
Wastes				
Chemical	kg/yr	10,886	167	520
LLW	m^3/yr	1,835	11	37
MLLW	m^3/yr	19	0	0
TRU	m^3/yr	42[e]	1	0
Mixed TRU	m^3/yr	[e]	2	14

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m^3/yr = cubic meters per year.

b. Includes plutonium -239; radioactive progeny (daughter products) are not included.

c. These radionuclides are not considered to be significant to offsite dose from this stack and do not require measurement under Environmental Protection Agency regulations.

d. Outfall 03A021 was removed from the NPDES Permit (NM0028355) in October 2011.

e. 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Plant.

Table A-3. Sigma Complex (Technical Area 03) Comparison of Operations

Capability	2008 SWEIS Projections	2015 Operations	2016 Operations
Research and Development on Materials Fabrication, Coating, Joining, and Processing	Fabricate items from metals, ceramics, salts, beryllium, enriched and depleted uranium, and other uranium isotope mixtures.	Activity performed as projected.	Activity performed as projected.
Characterization of Materials	Perform research and development on properties of ceramics, oxides, silicides, composites, and high-temperature materials.	Total of 183 assignments and approximately 625 specimens were characterized.	Total of 164 assignments and approximately 550 specimens were characterized.
	Analyze up to 36 tritium reservoirs per year.	No activity.	No activity.
	Develop a library of aged non-special nuclear material from stockpiled weapons and develop techniques to test and predict changes. Store and characterize up to 2,500 non-special nuclear material component samples, including uranium.	Develop a library of aged non-special nuclear material from stockpiled weapons and develop techniques to test and predict changes. Store and characterize a significant number of non-special nuclear material component samples, including uranium.	Develop a library of aged non-special nuclear material from stockpiled weapons and develop techniques to test and predict changes. Store and characterize a significant number of non-special nuclear material component samples, including uranium.
Fabrication of Metallic and Ceramic Items	Fabricate stainless steel and beryllium components for up to 80 pits per year.	Fabricated approximately less than 10 stainless steel and specialty alloy pit components.	Fabricated approximately 25 stainless steel and specialty alloy pit components.
	Fabricate up to 200 reservoirs for tritium per year.	No activity.	No activity.
	Fabricate components for up to 50 secondary assemblies per year (of depleted uranium, depleted uranium alloy, enriched uranium, deuterium, and lithium).	Fabricated components for fewer than 10 secondary assemblies.	Fabricated components for fewer than 10 secondary assemblies.
	Fabricate non-nuclear components for research and development: about 100 major hydrotests and 50 joint test assemblies per year.	Fabricated components for fewer than 20 major hydrotests and for less than five joint test assemblies.	Fabricated components for approximately 25 major hydrotests and for less than five joint test assemblies.

Capability	2008 SWEIS Projections	2015 Operations	2016 Operations
Fabrication of Metallic and Ceramic Items (cont.)	Fabricate beryllium targets.	Provided material for the production of inertial confinement fusion targets and fabricated fewer than two targets.	Provided material for the production of inertial confinement fusion targets and fabricated fewer than two targets.
	Fabricate targets and other components for accelerator production of tritium research.	No activity.	No activity.
	Fabricate test storage containers for nuclear materials stabilization.	No activity.	No activity.

Table A-4. Sigma Complex (Technical Area 03) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2015 Operations	2016 Operations
Radioactive Air Emissions[b]				
Uranium-234	Ci/yr	6.60E-5	Not measured[b]	Not measured[b]
Uranium-238	Ci/yr	1.80E-3	Not measured[b]	Not measured[b]
NPDES Discharge				
04A022	MGY	5.8	0.57[c]	0.260[c]
Wastes				
Chemical	kg/yr	9,979	354	485
LLW	m^3/yr	994	0	8
MLLW	m^3/yr	4	0	2
TRU	m^3/yr	0[d]	0	0
Mixed TRU	m^3/yr	0[d]	0	0

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m^3/yr = cubic meters per year.

b. Emissions levels from this site are below levels that require monitoring

c. Estimated discharge from unidentified low-volume discharge that began August 13, 2014, and continued through the end of calendar year 2016.

d. 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Plant.

Table A-5. Machine Shops (Technical Area 03) Comparison of Operations

Capability	2008 SWEIS Projections	2015 Operations	2016 Operations
Fabrication of Specialty Components	Provide fabrication support for the dynamic experiments program and explosives research studies.	Activity performed as projected.	Activity performed as projected.
	Support up to 100 hydrodynamic tests per year.	Fewer than 10 hydrodynamic tests were supported.	Fewer than 10 hydrodynamic tests were supported.
	Manufacture up to 50 joint test assembly sets per year.	Fewer than 10 joint test assembly sets were manufactured.	No activity.
	Provide general laboratory fabrication support as requested.	Activity performed as projected.	Activity performed as projected.
Fabrication Utilizing Unique Materials	Fabricate items using unique and unusual materials such as depleted uranium and lithium.	Fabrication with unique materials was conducted at levels below those projected.	Fabrication with unique materials was conducted at levels below those projected.
Dimensional Inspection of Fabricated Components	Perform dimensional inspection of finished components.	Activity performed as projected.	Activity performed as projected.
	Perform other types of measurements and inspections.	No activity.	No activity.

Table A-6. Machine Shops (Technical Area 03) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2015 Operations	2016 Operations
Radioactive Air Emissions				
Uranium isotopes[b]	Ci/yr	1.50E-04	Not measured[c]	Not measured[c]
NPDES Discharge				
No outfalls	MGY	No outfalls	No outfalls	No outfalls
Wastes				
Chemical	kg/yr	474,002	4,203	6,128
LLW	m^3/yr	604	0	98
MLLW	m^3/yr	0	0	0
TRU	m^3/yr	0[d]	0	0
Mixed TRU	m^3/yr	0[d]	0	0

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m^3/yr = cubic meters per year.

b. No uranium-238 was measured at Machine Shops. However, uranium isotopes uranium-234 and uranium-235 were measured. This may reflect an operations focus on low-enriched uranium fuel instead of depleted uranium.

c. The main stack at Technical Area 03, building 0129 was shut down in calendar year 2011. Remaining radiological operations are not vented to the environment, but are vented back into the workspace.

d. 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Plant.

Table A-7. Materials Science Laboratory (Technical Area 03) Comparison of Operations

Capability	2008 SWEIS Projections	2015 Operations	2016 Operations
Materials Processing	Support development and improvement of technologies for materials formulation.	Activity was performed as projected.	Activity was performed as projected.
	Support development of chemical processing technologies, including recycling and reprocessing techniques to solve environmental problems.	Activity was performed as projected.	Activity was performed as projected.
Mechanical Behavior in Extreme Environments	Study fundamental properties of materials and characterize their performance, including research on the aging of weapons.	Activity was performed as projected.	Activity was performed as projected.
	Develop and improve techniques for these and other types of studies.	Activity was performed as projected.	Activity was performed as projected.
Advanced Materials Development	Synthesize and characterize single crystals and nanophase and amorphous materials.	Activity was performed as projected.	Activity was performed as projected.
	Perform ceramics research, including solid-state, inorganic chemical studies involving materials synthesis. A substantial amount of effort in this area would be dedicated to producing new high-temperature superconducting materials.	Activity was performed as projected.	Activity was performed as projected.
	Provide facilities for synthesis and mechanical characterization of materials systems for bulk conductor applications. Develop and improve techniques for development of advanced materials.	Activity was performed as projected.	Activity was performed as projected.
Materials Characterization	Perform materials characterization activities to support materials development.	Activity was performed as projected.	Activity was performed as projected.
Applied Energy Research*	Perform materials, including nanomaterials, development for catalysis, sensing photovoltaics, energy production, hydrogen storage, and functional polymer membranes.	Activity was performed as projected.	Activity was performed as projected.

* Not projected in the 2008 SWEIS. The Materials Science Laboratory Infill project was included in the Environmental Assessment for the construction of the Materials Science Laboratory building (DOE 1992).

Table A-8. Materials Science Laboratory (Technical Area 03) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2015 Operations	2016 Operations
Radioactive Air Emissions	Ci/yr	Negligible	Not measured[b]	Not measured[b]
NPDES Discharge				
No outfalls	MGY	No outfalls	No outfalls	No outfalls
Wastes				
Chemical	kg/yr	590	271	129
LLW	m^3/yr	0	0	0
MLLW	m^3/yr	0	0	0
TRU	m^3/yr	0[c]	0	0
Mixed TRU	m^3/yr	0[c]	0	0

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m^3/yr = cubic meters per year.

b. Emissions levels from this site are below Environmental Protection Agency levels that require monitoring.

c. 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Plant.

Table A-9. Metropolis Center (Technical Area 03) Comparison of Operations

Capability	2008 SWEIS Projections	2015 Operations	2016 Operations
Computer Simulations	Perform complex three-dimensional computer simulations to estimate nuclear yield and aging effects to demonstrate nuclear stockpile safety. Apply computing capability to solve other large-scale, complex problems.	Activity performed as projected.	Activity performed as projected.

Table A-10. Metropolis Center (Technical Area 03) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2015 Operations	2016 Operations
Radioactive Air Emissions				
Not projected[b]	Ci/yr	Not projected[b]	Not measured[b]	Not measured[b]
NPDES Discharge				
03A027	MGY	17.7[c,d]	10.66	9.50
Wastes				
Chemical	kg/yr	0	0	0
LLW	m^3/yr	0	0	0
MLLW	m^3/yr	0	0	0
TRU	m^3/yr	0[e]	0	0
Mixed TRU	m^3/yr	0[e]	0	0

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m3/yr = cubic meters per year.

b. No radiological operations occur at this site.

c. Discharges to Outfall 03A027 (Metropolis Center) have been directed to Outfall 001 beginning September 9, 2016)

d. Previous Yearbooks incorrectly listed the No Action Alternative discharge amount for the Metropolis Center.

e. 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Plant.

Table A-11. High-Explosives Processing Facilities (Technical Areas 08, 09, 11, 16, 22, and 37) Comparison of Operations

Capability	2008 SWEIS Projections	2015 Operations	Operations 2016
Volume of Explosives Required[a]	High explosives processing activities would use approximately 82,700 pounds (37,500 kilograms) of explosives and 2,910 pounds (1,320 kilograms) of mock explosives annually.	Less than 7,500 pounds (3,402 kilograms) of high explosives and less than 600 pounds (272 kilograms) of mock explosives materials were used in the fabrication of test components. Mock material is being recycled when possible.	Less than 10,000 pounds (4,536 kilograms) of high explosives and less than 800 pounds (363) of mock explosives materials were used in the fabrication of test components. Mock and some high explosives material are being recycled when possible.
High-Explosives Synthesis and Production	Perform high explosives synthesis and production research and development. Produce new materials for research, stockpile, security interest, and other applications. Formulate, process test, and evaluate explosives.	Activity performed as projected.	Activity performed as projected.
High-Explosives and Plastics Development and Characterization	Evaluate stockpile returns and materials of specific interest. Develop and characterize new plastics and high explosives for stockpile, military, and security interest improvements. Improve predictive capabilities. Research high explosives waste treatment methods.	Activity performed as projected. Plastics research and development capability is no longer being performed at this Key Facility.	Activity performed as projected. Plastics research and development capability is no longer being performed at this Key Facility.
High-Explosives and Plastics Fabrication	Perform stockpile surveillance and process development. Supply parts to the Pantex Plant for surveillance and stockpile rebuilds and joint test assemblies. Fabricate materials for specific military, security interest, hydrodynamic, and environmental testing.	Less than 2,500 high explosive parts and less than 200 mock parts were inspected at Technical Area 16, Building 260. Less than 3,500 parts were fabricated at Technical Area 16, Building 260 and several parts manufactured at Pantex were modified in support of hydrotest activities.	Less than 3,000 high explosive parts and less than 300 mock parts were inspected at Technical Area 16, Building 260. Less than 4,000 parts were fabricated at Technical Area 16, Building 260 and several parts manufactured at Pantex were modified in support of hydrotest activities.

Capability	2008 SWEIS Projections	2015 Operations	Operations 2016
Test Device Assembly	Assemble test devices. Perform radiographic examination of assembled devices to support stockpile related hydrodynamic tests, joint test assemblies, environmental and safety tests, and research and development activities. Support up to 100 major hydrodynamic test device assemblies per year.	174 device assemblies for support of the hydrodynamic program, proton radiography, Nevada National Security Site, joint tests fielded to various external facilities, and local tests fielded to various tests sites at LANL.	219 device assemblies for support of the hydro program, proton radiography, Nevada National Security Site, joint tests fielded to various external facilities, and local tests fielded to various tests sites at LANL.
Safety and Mechanical Testing[b]	Conduct safety and environmental testing related to stockpile assurance and new materials development. Conduct up to 15 safety and mechanical tests per year.	Conducted safety and environmental testing related to stockpile assurance and new materials development as projected. Fewer than thirty safety and mechanical tests were performed in Technical Area 11.	Conducted safety and environmental testing related to stockpile assurance and new materials development as projected. Fewer than thirty safety and mechanical tests were performed in Technical Area 11.
Research, Development, and Fabrication of High-Power Detonators	Continue to support stockpile stewardship and management activities. Manufacture up to 40 major product lines per year. Support DOE-wide packaging and transport of electro-explosive devices.	Continued to support stockpile stewardship and management activities as projected. Detonator lot builds started on two weapons programs delivering zero assemblies for production.	Continued to support stockpile stewardship and management activities as projected. Two detonator two lot builds completed supporting stockpile program deliverables to Pantex, delivering a classified number of two product detonator cable assemblies along with less than 100 special design assemblies. Began production prove in activities for third program with assembly of less than 550 prototype and general use detonators for local testing requirements.

a. This is not a capability. The total amount of explosives and mock explosives used across all activities is an indicator of overall activity levels for this Key Facility.

b. In 2016, DOE/NNSA determined that the number of safety and mechanical test per year (15) was not a good parameter to use as measurement of environmental effects and removed the limitation (DOE 2016h).

Table A-12. High-Explosives Processing Facilities (Technical Areas 08, 09, 11, 16, 22, and 37) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2015 Operations	2016 Operations
Radioactive Air Emissions				
Uranium-238	Ci/yr	9.96E-7	Not measured[b]	Not measured[b]
Uranium-235	Ci/yr	1.89E-8	Not measured[b]	Not measured[b]
Uranium-234	Ci/yr	3.71E-7	Not measured[b]	Not measured[b]
NPDES Discharge				
Total Discharges	MGY	0.06	0	0
No outfalls[c]	MGY	[d]	No outfalls	No outfalls
05A055 (Technical Area 16)	MGY	0.06	0	0
Wastes				
Chemical	kg/yr	13,154	40,244[e]	31,745[f]
LLW	m^3/yr	15	3	0
MLLW	m^3/yr	<1	0	0
TRU	m^3/yr	0[g]	0	0
Mixed TRU	m^3/yr	0[g]	0	0

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m^3/yr = cubic meters per year.

b. LANS does not measure these non-point (diffuse) emissions at their source; rather, LANS uses ambient air measurements at public receptor locations to evaluate compliance from diffuse emissions.

c. Outfall 03A130 was removed from the NPDES Permit (NM0028355) in October 2011.

d. The 2008 SWEIS did not calculate individual flow per outfall.

e. In calendar year 2015, chemical waste generation at the High Explosives Processing Facility exceeded 2008 SWEIS projections because of rain water and snow melt that collected in the old truck sump east of Technical Area 22, Building 91, which accounted for approximately 34 percent (13,607.8 kilograms) of chemical waste generated at the High Explosives Processing Facility, and water and sodium thiosulfate used to flush liquid resistors to control any biological growth, which accounted for approximately 34 percent (13,606.9 kilograms) of chemical waste generated at the High Explosives Processing Facility.

f. In calendar year 2016, chemical waste generation at the High Explosives Processing Facility exceeded 2008 SWEIS projections because of propylene glycol/ water mixture used for Waste Facilities Operations maintenance operations, which accounted for approximately 43 percent (13,607.77 kilograms) of chemical waste generated at the High Explosives Processing Facility. An additional 16 percent (4,981 kilograms) of chemical waste was generated from recirculating water containing ferric chloride etchant (2,504 kilograms) or sodium hydroxide and water (2,477 kilograms) from the Technical Area 22 etching shop holding tank.

g. 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Project.

Table A-13. High-Explosives Testing Facilities (Technical Areas 14, 15, 36, 39, and 40) Comparison of Operations

Capability	SWEIS Projections	2015 Operations	2016 Operations
Volume of Materials Required*	Conduct about 1,800 experiments per year. Use up to 6,900 pounds (3,130 kilograms) of depleted uranium in experiments annually.	191 experiments conducted. 463 pounds (210 kilograms) expended.	253 experiments conducted. 328 pounds (140 kilograms) expended.
Hydrodynamic Tests	Develop containment technology. Conduct baseline and code development tests of weapons configuration. Conduct 100 major hydrodynamic tests per year.	Four hydrodynamic tests were conducted.	Six hydrodynamic tests were conducted.
Dynamic Experiments	Conduct dynamic experiments to study properties and enhance understanding of the basic physics and equation of state and motion for nuclear weapons materials, including some special nuclear material experiments.	Activity performed as projected.	Activity performed as projected.
Explosives Research and Testing	Conduct tests to characterize explosive materials.	Activity performed as projected.	Activity performed as projected.
Munitions Experiments	Support the U.S. Department of Defense with research and development of conventional munitions. Conduct experiments to study external-stimuli effects on munitions.	Activity performed as projected.	Activity performed as projected.
High-Explosives Pulsed-Power Experiments	Conduct experiments using explosively driven electromagnetic power systems.	Parts and assembly modeling only. No testing performed.	Parts and assembly modeling only. No testing performed.
Calibration, Development, and Maintenance Testing	Perform experiments to develop and improve techniques to prepare for more involved tests.	Activity performed as projected.	Activity performed as projected.
Other Explosives Testing	Conduct advanced high explosives or weapons evaluation studies.	Activity performed as projected.	Activity performed as projected.

* This is not a capability. The total volume of materials required across all activities is an indicator of overall activity levels for this Key Facility.

Table A-14. High-Explosives Testing Facilities (Technical Area 14, 15, 36, 39, and 40) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2015 Operations	2016 Operations
Radioactive Air Emissions				
Depleted Uranium[b]	Ci/yr	1.5E-1	Not measured[c]	Not measured[c]
Uranium-234	Ci/yr	3.4E-2	Not measured[c]	Not measured[c]
Uranium-235	Ci/yr	1.5E-3	Not measured[c]	Not measured[c]
Uranium-238	Ci/yr	1.4E-1	Not measured[c]	Not measured[c]
Chemical Usage[d]				
Aluminum[d]	kg/yr	45,720	<4000	<6000
Beryllium	kg/yr	90	<10	<10
Copper[d]	kg/yr	45,630	<10	<10
Depleted Uranium	kg/yr	3,931.4	<200	<300
Iron[d]	kg/yr	30,210	n/a	n/a
Lead	kg/yr	241.4	n/a	n/a
Tantalum	kg/yr	450	<100	<150
Tungsten	kg/yr	390	<300	<400
NPDES Discharge				
No outfalls[e]	MGY	2.2	No outfalls	No outfalls
Wastes				
Chemical	kg/yr	35,380	38,668[f]	2,240
LLW	m^3/yr	918	170	183
MLLW	m^3/yr	8	0	0
TRU[e]	m^3/yr	<1[g]	0	0
Mixed TRU	m^3/yr	[g]	0	0

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m3/yr = cubic meters per year.

b. The isotopic composition of depleted uranium is approximately 72 percent uranium-238, approximately 1 percent uranium-235, and approximately 27percent uranium-234. Because there are no historic measurements of emissions from these sites, projections are based on estimated release fractions of the materials used in tests.

c. LANS does not measure these non-point (diffuse) emissions at their source; rather, LANS uses ambient air measurements at public receptor locations to evaluate compliance from diffuse emissions.

d. The quantities of copper, iron, and aluminum involved in these tests are used primarily in the construction of support structures. These structures are not expended in the explosive tests and, thus, do not contribute to air emissions.

e. Outfall 03A185 was removed from the NPDES Permit (NM0028355) in October 2011.

f. In calendar year 2015 chemical waste generation exceeded the 2008 SWEIS projections because of extra low conductivity water from the pulsed power system at DARHT used for its electrical properties, which accounted for approximately 35 percent (13,480.8 kilograms) of chemical waste generated at the High Explosives Testing facilities.

g. 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Plant.

Table A-15. Tritium Facilities (Technical Area 16) Comparison of Operations

Capability	2008 SWEIS Projections	2015 Operations	2016 Operations
High-Pressure Gas Fills and Processing	Handle and process tritium gas in quantities of about 100 grams approximately 65 times per year.	No activity.	One high pressure gas processing operation.
Gas Boost System Testing and Development	Conduct gas boost system research and development and testing and gas processing operations approximately 35 times per year using quantities of about 100 grams of tritium.	No activity.	Three gas boost system tests and analysis were conducted.
Diffusion and Membrane Purification	Conduct research on gaseous tritium movement and penetration through materials—perform up to 100 major experiments per year. Use this capability for effluent treatment.	No activity.	No activity.
Metallurgical and Material Research	Conduct metallurgical and materials research and applications studies and tritium effects and properties research and development. Small amounts of tritium would be used for these studies.	No activity.	No activity.
Gas Analysis	Measure the composition and quantities of gases (in support of tritium operations).	Activity performed as projected.	Activity performed as projected.
Calorimetry	Perform calorimetry measurements in support of tritium operations.	Activity performed as projected.	Activity performed as projected.
Solid Material and Container Storage	Store about 1,000 grams of tritium inventory in process systems and samples, inventory for use, and waste.	Activity performed less than projected (less than 240 grams of tritium).	Activity performed less than projected (less than 240 grams of tritium).
Hydrogen Isotopic Separation	Perform research and development of tritium gas purification and processing in quantities of about 200 grams of tritium per test.	No activity.	No activity.

Table A-16. Tritium Facilities (Technical Area16) Operations Data

Parameter	Units[a]	2008 SWEIS	2015 Operations	2016 Operations
Radioactive Air Emissions				
Technical Area 16/WETF, Elemental tritium	Ci/yr	300	7.6	12.6
Technical Area 16/WETF, Tritium in water vapor	Ci/yr	500	16.2	27.7
NPDES Discharge				
No Outfalls[b]	MGY	17.4	No outfalls	No outfalls
Wastes				
Chemical	kg/yr	1,724	43	0
LLW	m^3/yr	482	21	19
MLLW	m^3/yr	3	0	0
TRU	m^3/yr	0[c]	0	0
Mixed TRU	m^3/yr	0[c]	0	0

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m^3/yr = cubic meters per year.

b. Outfall 02A129 was removed from the NPDES Permit (NM0028355) in October 2011.

c. 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Plant.

Table A-17. Target Fabrication Facility (Technical Area 35) Comparison of Operations

Capability	2008 SWEIS Projections	2015 Operations	2016 Operations
Precision Machining and Target Fabrication	Provide targets and specialized components for approximately 12,400 laser and physics tests per year.	Activity performed as projected.	Activity performed as projected.
	Perform approximately 100 high-energy-density physics tests per year.	Activity performed as projected.	Activity performed as projected.
	Analyze up to 36 tritium reservoirs per year.	No activity.	No activity.
Polymer Synthesis	Produce polymers for targets and specialized components for approximately 12,400 laser and physics tests per year.	Activity performed as projected.	Activity performed as projected.
	Perform approximately 100 high-energy-density physics tests per year.	No activity.	No activity.
Chemical and Physical Vapor Deposition	Coat targets and specialized components for about 12,400 laser and physics tests per year.	Activity performed as projected.	Activity performed as projected.
	Support approximately 100 high-energy-density physics tests per year. Support plutonium pit rebuild operations.	No activity.	No activity.

Table A-18. Target Fabrication Facility (Technical Area 35) Operations Data

Parameter	Units[a]	2008 SWEIS	2015 Operations	2016 Operations
Radioactive Air Emissions	Ci/yr	Negligible	Not measured[b]	Not measured[b]
NPDES Discharge				
No outfalls	MGY	No outfalls	No outfalls	No outfalls
Wastes				
Chemical	kg/yr	3,810	184	162
LLW	m^3/yr	10	0	0
MLLW	m^3/yr	<1	0	0
TRU	m^3/yr	0[c]	0	0
Mixed TRU	m^3/yr	0[c]	0	0

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m^3/yr = cubic meters per year.
b. Emissions levels from this site are below Environmental Protection Agency levels that require monitoring.
c. 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Plant.

Table A-19. Bioscience Facilities (Technical Areas 03, 16, 35, 43, and 46) Comparison of Operations

Capabilities	2008 SWEIS Projection	2015 Operations	2016 Operations
Biologically Inspired Materials and Chemistry	Determine formation and structure of biomaterials for bioenergy.	Activity performed as projected.	Activity performed as projected.
	Synthesize biomaterials.	Activity performed as projected.	Activity performed as projected.
	Characterize biomaterials.	Activity performed as projected.	Activity performed as projected.
Cell Biology	Study stress-induced effects and responses on cells.	Activity performed as projected.	Activity performed as projected.
	Study host-pathogen interactions.	Activity performed as projected.	Activity performed as projected.
	Determine effects of beryllium exposure.	No activity.	No activity.
Computational Biology	Collect, organize, and manage information on biological systems.	Activity performed as projected.	Activity performed as projected.
	Develop computational theory to analyze and model biological systems.	Activity performed as projected.	Activity performed as projected.
Environmental Microbiology	Study microbial diversity in the environment; collect and analyze environmental samples.	Activity performed as projected.	Activity performed as projected.
	Study biomechanical and genetic processes in microbial systems.	Activity performed as projected.	Activity performed as projected.
Genomic Studies	Analyze genes of living organisms such as humans, animals, microbes, viruses, plants, and fungi.	Activity performed as projected.	Activity performed as projected.
Genomic and Proteomic Science	Develop and implement high-throughput tools. Perform genomic and proteomic analysis.	Activity performed as projected.	Activity performed as projected.
	Study pathogenic and nonpathogenic systems.	Activity performed as projected.	Activity performed as projected.
Measurement Science and Diagnostics	Develop and use spectroscopic tools to study molecules and molecular systems.	Activity performed as projected.	Activity performed as projected.
	Perform genomic, proteomic, and metabolomic studies.	Activity performed as projected.	Activity performed as projected.

Capabilities	2008 SWEIS Projection	2015 Operations	2016 Operations
Molecular Synthesis and Isotope Applications	Synthesize molecules and materials.	Activity performed as projected.	Activity performed as projected.
	Perform spectroscopic characterization of molecules and materials.	Activity performed as projected.	Activity performed as projected.
	Develop new molecules that incorporate stable isotopes.	Activities performed as projected at a reduced level of effort.	Activities performed as projected at a reduced level of effort.
	Develop chem-bio sensors and assay procedures.	No activity.	No activity.
	Synthesize polymers and develop applications for them.	Activity performed as projected.	Activity performed as projected.
	Utilize stable isotopes in quantum computing systems.	No activity.	No activity.
Structural Biology	Research three-dimensional structure and dynamics of macromolecules and complexes. Use various spectroscopy techniques.	Activity performed as projected.	Activity performed as projected.
	Perform neutron scattering.	Activity performed as projected.	No activity.
	Perform x-ray scattering and diffraction.	Activity performed as projected.	No activity.
Pathogenesis	Perform genome-scale, focused, and computationally enhanced experimental studies on pathogenic organisms.	Activity performed as projected.	Activity performed as projected.
Biothreat Reduction and Bioforensics	Analyze samples for biodefense and national security purposes.	Activity performed as projected.	Activity performed as projected.
	Identify pathogen strain signatures using DNA sequencing and other molecular approaches.	Activity performed as projected.	Activity performed as projected.
In Vivo Monitoring*	Performs whole-body scans as a service to the LANL personnel monitoring program, which supports operations with radioactive materials conducted elsewhere at LANL.	Conducted 658 lung and whole-body client counts. Also performed other counts associated with quality control and blind intercomparison programs.	Performed 435 lung and whole-body client counts. Also performed other counts associated with quality control and blind intercomparison programs.

* This is not a Bioscience Division capability; however, it is located at Technical Area 43, Building 01, and is included as a capability within this Key Facility.

Table A-20. Bioscience Facilities (Technical Areas 03, 16, 35, 43, and 46) Operations Data

Parameter	Units[a]	2008 SWEIS	2015 Operations	2016 Operations
Radioactive Air Emissions				
Not estimated	Ci/yr	Not estimated	Not measured[b]	Not measured[b]
NPDES Discharge				
No outfalls	MGY	No outfalls	No outfalls	No outfalls
Wastes				
Chemical	kg/yr	13,154	960	1,922
LLW	m^3/yr	34	0	0
MLLW	m^3/yr	3	0	0
TRU	m^3/yr	0[c]	0	0
Mixed TRU	m^3/yr	0[c]	0	0

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m^3/yr = cubic meters per year.
b. No radiological operations occur at this site.
c. 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Plant.

Table A-21. Radiochemistry Facility (Technical Area 48) Comparison of Operations

Capability	2008 SWEIS Projections	2015 Operations	2016 Operations
Radionuclide Transport Studies	Conduct 80 to 160 actinide transport, sorption, and bacterial interaction studies per year. Develop models for evaluation of groundwater. Assess performance of risk of release for radionuclide sources at proposed waste disposal sites.	Activity performed as projected.	Activity performed as projected.
Environmental Remediation Support	Conduct background contamination characterization pilot studies. Conduct performance assessments, soil remediation research and development, and field support. Support environmental remediation activities.	Activity performed as projected.	Activity performed as projected.
Ultra-Low-Level Measurements	Perform chemical isotope separation and mass spectrometry at current levels.	Activity performed as projected.	Activity performed as projected.
Radiochemical Separations[a]	Conduct radiochemical operations involving quantities of alpha-, beta-, and gamma-emitting radionuclides at current levels for non-weapons and weapons work.	Activity performed as projected.	Activity performed as projected.
Isotope Production[b]	Conduct target preparation, irradiation, and processing to recover medical and industrial application isotopes to support approximately 150 offsite shipments per year.	Conducted target processing for production of radioisotopes, with ~ 200 shipments. Increased diversity in the isotopes produced, and production of elements with Z >86.	Conducted target processing for production of radioisotopes, with ~ 200 shipments. Increased diversity in the isotopes produced, and production of elements with Z >86.
Actinide and TRU Chemistry	Perform radiochemical operations involving alpha-emitting radionuclides.	Activity performed as projected.	Activity performed as projected.
Data Analysis	Re-examine archive data and measure nuclear process parameters of interest to weapons radiochemists.	Activity performed as projected.	Activity performed as projected.

Capability	2008 SWEIS Projections	2015 Operations	2016 Operations
Inorganic Chemistry	Conduct synthesis, catalysis, and actinide chemistry activities: • Chemical synthesis of organo-metallic complexes. • Thermodynamic structural and reactivity analysis, organic product analysis, and reactivity and mechanistic studies. • Synthesis of new ligands for radiopharmaceuticals. • Environmental technology development activities: o Ligand design and synthesis for selective extraction of metals. o Soil washing. o Membrane separator development. o Ultrafiltration.	Activity performed as projected.	Activity performed as projected.
Structural Analysis	Perform synthesis and structural analysis of actinide complexes at current levels. Conduct x-ray diffraction analysis of powders and single crystals.	Activity performed as projected.	Activity performed as projected.
Sample Counting	Measure the quantity of radioactivity in samples using alpha-, beta-, and gamma-ray counting systems.	Activity performed as projected.	Activity performed as projected.

a. In the 2008 SWEIS, this capability was called Nuclear and Radiochemistry Separations

b. In calendar year 2016, DOE/NNSA determined the increase of offsite shipments of radioisotopes from approximately 150 up to 500 was bounded under the 2008 SWEIS analysis (DOE 2016i).

Table A-22. Radiochemistry Facility (Technical Area 48) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2015 Operations	2016 Operations
Radioactive Air Emissions				
Mixed Fission Products[b]	Ci/yr	1.5E-4	Not measured[b]	Not measured[b]
Plutonium-239	Ci/yr	1.2E-5	No emissions[c]	No emissions[c]
Uranium isotopes	Ci/yr	4.8E-7	1.35E-08	1.58E-09
Arsenic-72	Ci/yr	1.2E-4	No emissions	No emissions[c]
Arsenic-73	Ci/yr	2.5E-3	4.58E-05	1.80E-05
Arsenic-74	Ci/yr	1.3E-3	9.66E-05	6.81E-05
Beryllium-7	Ci/yr	1.6E-5	No emissions[c]	No emissions[c]
Bromine isotopes[d]	Ci/yr	9.3E-4	4.21E-03	1.56E-03
Germanium-68[e]	Ci/yr	8.9E-3	1.69E-03	4.42E-03
Rubidium-86	Ci/yr	3.0E-7	No emissions[c]	No emissions[c]
Selenium-75	Ci/yr	3.8E-4	1.92E-04	1.22E-04
Other Activation Products[f]	Ci/yr	5.5E-6	4.70E-02	8.30E-04
NPDES Discharge				
No outfalls	MGY	No outfalls	No outfalls	No outfalls
Wastes				
Chemical	kg/yr	3,311	1,286	761
LLW	m^3/yr	268	36	39
MLLW	m^3/yr	4	1	4
TRU	m^3/yr	0[g]	0	0
Mixed TRU	m^3/yr	0[g]	0	0

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m^3/yr = cubic meters per year.

b. The emission category of “mixed fission products” is no longer used for Environmental Protection Agency compliance reporting; individual nuclides are called out instead. For this table however, the measured value includes emissions of caesium-137, iodine-131, and stronium-90/yttrium-90.

c. Although stack sampling systems were in place to measure these emissions, any emissions were sufficiently small to be below the detection capabilities of the sampling systems.

d. Bromine isotopes that were measured are bromine-76 and bromine-77.

e. Germanium-68 was assumed to be in equilibrium with gallium-68.

f. The emissions category of “mixed activation products” or “other activation products” is no longer used for Environmental Protection Agency compliance reporting; individual radionuclides are called out instead. The measured value in this table includes activation products not included in specific line items.

g. 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Plant.

Table A-23. Radioactive Liquid Waste Treatment Facility (Technical Area 50) Comparison of Operations

Capability	2008 SWEIS Projections*	2015 Operations	2016 Operations
Waste Transport, Receipt, and Acceptance	Collect radioactive liquid waste from generators and transport to the RLWTF at Technical Area 50.	Activity performed as projected.	Activity performed as projected.
	Support, certify, and audit generator characterization programs.	Activity performed as projected.	Activity performed as projected.
	Maintain the waste acceptance criteria for the RLWTF.	Activity performed as projected.	Activity performed as projected.
	Send approximately 300,000 liters of evaporator bottoms to an offsite commercial facility for solidification/year. (Approximately 23 cubic meters of solidified evaporator bottoms would be returned/year for disposal as LLW at Technical Area 54, Area G.)	611,000 liters of radioactive liquid waste bottoms were shipped to an offsite commercial facility. No solidified bottoms were returned for disposal at Area G.	344,000 liters of radioactive liquid waste bottoms were shipped to an offsite commercial facility. No solidified bottoms were returned for disposal at Area G.
	Transport annually to Technical Area 54 for storage or disposal: • 300 cubic meters of LLW • 2 cubic meters of mixed LLW • 14 cubic meters of TRU waste • 500 kilograms of hazardous waste	Wastes transported for storage or disposal: • 0 cubic meters of LLW were shipped to Area G • 105 cubic meters of LLW were shipped to Nevada National Security Site • 0 cubic meters of mixed LLW • 0 cubic meters TRU waste • 0 kilograms of hazardous waste	Wastes transported for storage or disposal: • 0 cubic meters of LLW were shipped to Area G • 41 cubic meters of LLW were shipped to Nevada National Security Site • 0 cubic meters of mixed LLW • 0 cubic meters TRU waste • 17 kilograms of hazardous waste
Radioactive Liquid Waste Treatment	Pretreat 190,000 liters per year of liquid TRU waste.	No activity.	Pretreated 1,480 liters of liquid TRU waste.
	Solidify, characterize, and package 17 cubic meters per year of TRU waste sludge.	No activity.	No activity.
	Treat 20 million liters per year of liquid LLW.	Processed 3.5 million liters of liquid LLW.	Processed 3.3 million liters of liquid LLW

Capability	2008 SWEIS Projections*	2015 Operations	2016 Operations
Radioactive Liquid Waste Treatment (cont.)	Dewater, characterize, and package 60 cubic meters per year of LLW sludge.	6.3 cubic meters LLW sludge (30 drums) were packaged.	11.2 cubic meters of LLW sludge (54 drums) were packaged.
	Process 1,200,000 million liters per year of secondary liquid waste generated by the RLWTF treatment processes through the RLWTF evaporator.	No activity.	No activity.
	Discharge treated liquids through an NPDES outfall.	No water was discharged through the NPDES outfall. 3.1 million liters of treated water were evaporated.	No water was discharged through the NPDES outfall. 3.0 million liters of treated water were evaporated.

* 2008 SWEIS Projection updated to the Expanded Operations Alternative.

Table A-24. Radioactive Liquid Waste Treatment Facility (Technical Area 50) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2015 Operations	2016 Operations
Radioactive Air Emissions				
Americium-241	Ci/yr	Negligible	5.20E-08	No emissions[b]
Plutonium-238	Ci/yr	Negligible	8.71E-08	5.23E-09
Plutonium-239	Ci/yr	Negligible	1.53E-07	1.51E-10
Thorium-228	Ci/yr	Negligible	6.21E-08	No emissions[b]
Thorium-230	Ci/yr	Negligible	No emissions[b]	No emissions[b]
Thorium-232	Ci/yr	Negligible	No emissions[b]	No emissions[b]
Uranium isotopes	Ci/yr	Negligible	4.06E-07	No emissions[b]
NPDES Discharge				
051	MGY	4.0	0	0
Wastes				
Chemical	kg/yr	499	1,766[c]	292
LLW	m^3/yr	298	925[d]	541[e]
MLLW	m^3/yr	2.2	0	0
TRU	m^3/yr	13.7[f]	0	0
Mixed TRU	m^3/yr	[f]	0	0

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m^3/yr = cubic meters per year.

b. Although stack sampling systems were in place to measure these emissions, any emissions were sufficiently small to be below the detection capabilities of the sampling systems.

c. In calendar year 2015, chemical waste generated at RLWTF exceeded 2008 SWEIS projections because of the disposal of MicroBlaze® wastewater used to flush out residual diesel fuel in holding tanks, which accounts for approximately 91 percent (1,605 kilograms) of chemical waste generated at RLWTF.

d. In calendar year 2015, LLW generation at RLWTF exceeded 2008 SWEIS projections because of a wastewater by-product of the treatment process of Radioactive Liquid Waste evaporator bottoms at Technical Area 50, which accounted for approximately 90 percent (837 cubic meters) of the LLW generated at RLWTF.

e. In calendar year 2016, LLW generation at RLWTF exceeded 2008 SWEIS projections because of radioactive liquid waste, a wastewater by-product of the treatment process of Radioactive Liquid Waste evaporator bottoms at Technical Area 50, which accounted for approximately 91 percent (924.70 cubic meters) of the LLW generated at RLWTF.

f. 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Plant

Table A-25. LANSCE (Technical Area 53) Comparison of Operations

Capability	2008 SWEIS Projections	2015 Operations	2016 Operations
Accelerator Beam Delivery, Maintenance, and Development	Operate 800-MeV linac beam and deliver beam to Areas A, B, C, Weapons Neutron Research Facility, Manuel Lujan Center, Dynamic Test Facility, and Isotope Production Facility for 10 months per year (6,400 hours). The H+ beam current would be 1,250 microamperes; the H- beam current would be 200 microamperes.	Activity performed as projected. H+ beam at 250 microamperes was delivered to the Isotope Production Facility. No H+ beam to Area A. H- beam was delivered as follows: (a) to the Lujan Center at 100 microamperes. (b) to Weapons Neutron Research Facility at 4 microamperes (c) on demand was available to Areas B and C Beam was available 6 months of 2015 (up to 3,500 hours, depending on the experimental area).	Activity performed as projected. H+ beam at 250 microamperes was delivered to the Isotope Production Facility. No H+ beam to Area A. H- beam was delivered as follows: (d) to the Lujan Center at 100 microamperes. (e) to Weapons Neutron Research Facility at 4 microamperes (f) on demand was available to Areas B and C Beam was available 6 months of 2016 (up to 3,500 hours, depending on the experimental area).
	Reconfigure beam delivery and support equipment to support new facilities, upgrades, and experiments.	Activity performed as projected.	Activity performed as projected.
Experimental Area Support	Provide support to ensure availability of the beam lines, beam line components, handling and transport systems, and shielding, as well as radio-frequency power sources.	Activity performed as projected.	Activity performed as projected.
	Perform remote handling and packaging of radioactive material, as needed.	Remote handling and packaging was performed at the Isotope Production Facility.	Remote handling and packaging was performed at the Isotope Production Facility.

Capability	2008 SWEIS Projections	2015 Operations	2016 Operations
Neutron Research and Technology*	Conduct 1,000 to 2,000 experiments/year using neutrons from the Lujan Center and Weapons Neutron Research Facility.	124 neutron beam experiments were conducted at the Lujan Center and Weapons Neutron Research Facility.	125 neutron beam experiments were conducted at the Lujan Center and Weapons Neutron Research Facility.
	Support contained weapons-related experiments using small to moderate quantities of high explosives, including: • Approximately 200 experiments per year using nonhazardous materials and small quantities of high explosives. • Approximately 60 experiments per year using up to 4.5 kilograms of high explosives and depleted uranium. • Approximately 80 experiments per year using small quantities of actinides, high explosives, and sources. • Shock wave experiments involving small amounts, up to nominally 50 grams of plutonium. • Support for static stockpile surveillance technology research and development.	No activity.	No activity.
Materials Test Station	Irradiate materials and fuels in a fast-neutron spectrum and in a prototype temperature and coolant environment.	No activity.	No activity.
Subatomic Physics Research	Conduct 5 to 10 physics experiments per year at Manuel Lujan Center and Weapons Neutron Research Facility.	No activity.	No activity.

Capability	2008 SWEIS Projections	2015 Operations	2016 Operations
Subatomic Physics Research (cont.)	Conduct up to 100 proton radiography experiments, including using small to moderate quantities of high explosives, including: • Dynamic experiments in containment vessels with up to 4.5 kilograms of high explosives and 45 kilograms of depleted uranium. • Dynamic experiments in powder launcher with up to 300 grams of gunpowder. Contained experiments using small to moderate quantities of high explosives similar to those discussed under Neutron Research and Technology.*	34 high explosive experiments and 13 static experiments were conducted.	34 high explosive experiments and 13 static experiments were conducted.
	Conduct research using ultracold neutrons; operate up to 10 microamperes per year of negative beam current.	Ultracold neutrons collected data for the UCNB, Nab, SNS-EDM, and UCNTau experiments.	Ultracold neutrons collected data for the UCNB, Nab, SNS-EDM and UCNTau experiments. Parts of the neutron source were replaced to improve production.

Capability	2008 SWEIS Projections	2015 Operations	2016 Operations
Medical, Industrial, and Research Isotope Production	Irradiate up to 120 targets per year for medical isotope production at the Isotope Production Facility.	A total of 41 targets were irradiated in 2015: 23 rubidium chloride targets and two rubidium target for strontium-82; nine gallium targets for gallium-68; one scandium target for titanium-44; one antimony target for tellurium-119; one aluminum target for sodium-22; one depleted uranium target for neptunium-236; one tungsten oxide target for rhenium-186; two thorium targets for actinium-225; and three research samples for cross section measurements, yield determinations, and secondary neutron activation.	A total of 54 targets were irradiated in 2016: 28 rubidium chloride targets and four rubidium targets for strontium-82; 14 gallium targets for gallium-68; one scandium target for titanium-44; one magnesium target for sodium-22; one germanium target for arsenic-73; five thorium targets for actinium-225; and four research samples for cross section measurements and secondary neutron activation.
High-Power Microwaves and Advanced Accelerators	Conduct research and development in high-power microwaves and advanced accelerators in areas including microwave research for industrial and environmental applications.	No activity.	No activity.
Radioactive Liquid Waste Treatment (Solar Evaporation at Technical Area 53)	Treat about 520,000 liters per year of radioactive liquid waste.	LANSCE received 280,840 liters of radioactive liquid waste into its holding tanks; 9,000 liters of this were from other sites. A total of 412,940 liters were discharged to the evaporation tanks.	LANSCE received 277,770 liters of radioactive liquid waste into its holding tanks; 15,090 liters of this were from other sites. A total of 219,020 liters were discharged to the evaporation tanks.

* High explosives quantities used under the Neutron Research and Technology capability include up to 10 pounds of high explosives and/or depleted uranium, small quantities of actinides and sources, and up to 50 grams of plutonium.

Table A-26. LANSCE (Technical Area 53) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2015 Operations	2016 Operations
Radioactive Air Emissions				
Argon-41	Ci/yr	8.87E+2	2.00E+1	3.48E+1
Particulate and Vapor Activation Products	Ci/yr	Not projected[a]	1.49E-03	2.54E-03
Carbon-10	Ci/yr	2.65E+0	1.01E-01	2.18E-01
Carbon-11	Ci/yr	2.25E+4	9.76E+1	1.07E+2
Nitrogen-13	Ci/yr	3.10E+3	1.44E+1	2.71E+1
Oxygen-15	Ci/yr	3.88E+3	9.57E+0	2.12E+1
Tritium as Water	Ci/yr	Not projected[b]	1.30E+1	2.18E+1
NPDES Discharge				
Total Discharges	MGY	29.5[c]	20.45	23.24
03A048	MGY	Not projected [d]	20.18	23.02
03A113	MGY	Not projected [d]	0.27	0.22
Wastes				
Chemical	kg/yr	16,783	2,469	941
LLW	m^3/yr	1,070	0	235
MLLW	m^3/yr	1	0	29[e]
TRU	m^3/yr	0[f]	0	0
Mixed TRU	m^3/yr	0[f]	0	0

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m^3/yr = cubic meters per year.

b. The radionuclide was not projected in the 2008 SWEIS because it was either dosimetrically insignificant or not isotopically identified.

c. In previous Yearbooks, this number was reported inaccurately as 28.2. The total discharge projected for all LANSCE outfalls into both Los Alamos and Sandia canyons is 29.5 million gallons, which is the combined total of 28.2 and 1.3 million gallons, respectively.

d. The 2008 SWEIS did not calculate individual flow per outfall.

e. In calendar year 2016, MLLW generated at LANSCE exceeded 2008 SWEIS projections because of the disposal of legacy beamline components contaminated with mercury, which accounted for approximately 74 percent (21.4 cubic meters) of the MLLW at LANSCE. The disposal of lead blocks used for shielding accounted for approximately 26 percent (7.6 cubic meters) of the MLLW generated at LANSCE.

f. 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Plant.

Table A-27. Solid Radioactive and Chemical Waste Facilities (Technical Areas 50 and 54) Comparison of Operations

Capability	2008 SWEIS Projections*	2015 Operations	2016 Operations
Waste Characterization, Packaging, and Labeling	Characterize 640 cubic meters of newly generated TRU waste.	No activity.	No activity.
	Characterize 8,400 cubic meters of legacy TRU waste.	No activity.	No activity.
	Characterize LLW, MLLW, and chemical waste, including waste from DD&D and remediation activities. Characterize additional LLW, MLLW, and chemical waste, including waste from DD&D and remediation activities	Activity performed as projected.	Activity performed as projected.
	Ventilate TRU waste retrieved from below-ground storage.	No activity.	No activity.
	Perform coring and visual inspection of a percentage of TRU waste packages.	No activity.	No activity.
	Overpack and bulk small waste, as required.	Activity performed as projected.	Activity performed as projected.
	Support, certify, and audit generator characterization programs.	Activity performed as projected.	Activity performed as projected.
	Maintain waste acceptance criteria for LANL waste management facilities.	Activity performed as projected.	Activity performed as projected.
	Maintain waste acceptance criteria for offsite treatment, storage, and disposal facilities.	Activity performed as projected.	Activity performed as projected.
	Maintain Waste Isolation Pilot Plant waste acceptance criteria compliance and liaison with Waste Isolation Pilot Plant operations.	Activity performed as projected.	Activity performed as projected.
	Characterize approximately 2,400 cubic meters of contact-handled and 100 cubic meters of remote-handled legacy TRU waste retrieved from below-ground storage.	No activity.	No activity.
Waste Transport, Receipt, and Acceptance	Ship 540 cubic meters per year of newly generated TRU waste to the Waste Isolation Pilot Plant.	No activity.	No activity.
	Ship 8,400 cubic meters per year of legacy TRU waste to the Waste Isolation Pilot Plant.	No activity.	No activity.
	Ship LLW to offsite disposal facilities.	Shipped approximately 880 cubic meters of LLW for offsite disposal.	Shipped approximately 925 cubic meters of LLW for offsite disposal.

Capability	2008 SWEIS Projections*	2015 Operations	2016 Operations
Waste Transport, Receipt, and Acceptance (cont.)	Ship 55 cubic meters of MLLW for offsite treatment and disposal in accordance with Environmental Protection Agency land disposal restrictions.	Shipped approximately 19 cubic meters of MLLW for offsite disposal.	Shipped approximately 108 cubic meters of MLLW for offsite disposal.
	Ship 6,400 metric tons of chemical wastes for offsite treatment and disposal in accordance with Environmental Protection Agency land disposal restrictions.	Shipped approximately 3,740 cubic meters of chemical waste for offsite disposal.	Shipped approximately 4,163 cubic meters of chemical waste for offsite disposal.
	Ship LLW, MLLW, and chemical waste from DD&D and remediation activities. Ship additional LLW, MLLW, and chemical waste from DD&D and remediation activities.	No activity.	No activity.
	Collect chemical and mixed wastes from LANL generators and transport to Consolidated Remote Storage Sites and Technical Area 54.	Activity performed as projected.	Activity performed as projected.
	Receive, on average, 5 to 10 shipments per year of LLW and TRU waste from offsite locations.	No activity.	No activity.
	Ship approximately 2,340 cubic meters of contact-handled and 100 cubic meters of remote-handled legacy TRU waste to the Waste Isolation Pilot Plant.	No activity.	No activity.
Waste Storage	Stage chemical and mixed wastes before shipment for offsite treatment, storage, and disposal.	Activity performed as projected.	Activity performed as projected.
	Store TRU waste until it is shipped to the Waste Isolation Pilot Plant.	Activity performed as projected.	Activity performed as projected.
	Store MLLW pending shipment to a treatment facility.	Activity performed as projected.	Activity performed as projected.
	Store LLW uranium chips until sufficient quantities are accumulated for stabilization campaigns.	No activity.	No activity.
	Store TRU waste generated by DD&D and remediation activities.	No activity.	No activity.
	Manage and store sealed sources for the Offsite Source Recovery Project at increased types and quantities.	Activity performed as projected.	Activity performed as projected.

Capability	2008 SWEIS Projections*	2015 Operations	2016 Operations
Waste Retrieval	Retrieve remaining legacy TRU waste 2,400 cubic meters of contact-handled and 100 cubic meters of remote-handled legacy TRU waste from below-ground storage in Technical Area 54, Area G, including: Pit 9, above Pit 29, Trenches A–D, and Shafts 200–232, 235-243, 246–253, 262–266, and 302–306.	No activity.	No activity.
Waste Treatment	Compact up to 2,300 cubic meters per year of LLW.	No activity.	No activity.
	Process 2,300 cubic meters of TRU waste through size reduction at the Decontamination and Volume Reduction System.	No activity.	No activity.
	Demonstrate treatment (e.g., electrochemical) of liquid MLLW.	No activity.	No activity.
	Stabilize 870 cubic meters of uranium chips.	No activity.	No activity.
	Process newly generated TRU waste through new TRU Waste Facility.	No activity.	No activity.
Waste Disposal	Dispose 84 cubic meters of LLW in shafts, 23,000 cubic meters of LLW in pits, and small quantities of radioactively contaminated PCBs in shafts in Area G per year.	No activity.	No activity.
	Dispose additional LLW generated by DD&D and remediation activities.	No activity.	No activity.
	Migrate operations in Area G to Zones 4 and 6, as necessary, to allow continued onsite disposal of LLW.	No activity.	No activity.

Capability	2008 SWEIS Projections*	2015 Operations	2016 Operations
Decontamination Operations	Decontaminate approximately 700 personnel respirators and 300 air-proportional probes for reuse per month.	No activity.	No activity.
	Decontaminate vehicles and portable instruments for reuse (as required).	No activity.	No activity.
	Decontaminate precious metals for resale using an acid bath.	No activity.	No activity.
	Decontaminate scrap metals for resale by sandblasting the metals.	No activity.	No activity.
	Decontaminate 200 cubic meters of lead for reuse by grit blasting.	No activity.	No activity.

* 2008 SWEIS Projection updated to the Expanded Operations Alternative.

Table A-28. Solid Radioactive and Chemical Waste Facilities (Technical Areas 54 and 50) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2015 Operations	2016 Operations
Radioactive Air Emissions[b]				
Tritium	Ci/yr	6.09E+1	Not measured[c]	Not measured[c]
Americium-241	Ci/yr	2.87E-6	No emissions[d]	No emissions[d]
Plutonium-238	Ci/yr	2.24E-5	No emissions[d]	No emissions[d]
Plutonium-239	Ci/yr	8.46E-6	No emissions[d]	3.89E-10
Uranium-234	Ci/yr	8.00E-6	9.50E-09	No emissions[d]
Uranium-235	Ci/yr	4.10E-7	9.51E-10	4.88E-09
Uranium-238	Ci/yr	4.00E-6	No emissions[d]	No emissions[d]
Other Radionuclides	Ci/yr	Negligible	1.81E-08	1.47E-09
NPDES Discharge				
No outfalls	MGY	No outfalls	No outfalls	No outfalls
Wastes[e]				
Chemical	kg/yr	907	15,555[f]	10,235[g]
LLW	m^3/yr	229	471[h]	332[i]
MLLW	m^3/yr	8	9[j]	4
TRU	m^3/yr	27[k]	0	0
Mixed TRU	m^3/yr	[k,j]	0	0.6

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m^3/yr = cubic meters per year.

b. Data shown are measured emissions from Waste Characterization, Reduction, and Repackaging Facility and the Actinide Research and Technology Instruction Center Facility at Technical Area 50, and Building 412, Dome 231, and Dome 375 at Technical Area 54. All non-point sources at Technical Areas in 50 and 54 are measured using ambient monitoring.

c. This radionuclide was not considered to be a significant source of emissions or offsite dose from this facility.

d. Although stack sampling systems were in place to measure these emissions, any emissions were sufficiently small to be below the detection capabilities of the sampling systems.

e. Secondary wastes are generated during the treatment, storage, and disposal of chemical and radioactive wastes. Examples include repackaging wastes from the visual inspection of TRU waste, HEPA filters, personnel protective clothing and equipment, and process wastes from size reduction and compaction.

f. In calendar year 2015, chemical waste generation at Solid Radioactive Chemical Waste exceeded 2008 SWEIS projections due the disposal of Area L sump water collected from rain and snow events which contributed to 63 percent (9,767 kilograms) of the waste generated at the Solid Radioactive Chemical Waste Facilities. The removal of empty drums from Technical Area 54 Area G contributed an additional 13 percent (2,050 kilograms) of chemical waste generated at Solid Radioactive Chemical Waste Facilities. The disposal of unused or unspent products contributed to an additional 13 percent (2,021 kilograms) of the total chemical waste at the Solid Radioactive Chemical Waste Facilities.

g. In calendar year 2016, chemical waste generation at Solid Radioactive Chemical Waste exceeded 2008 SWEIS projections due the disposal of Area L sump water collected from rain and snow events which contributed to 60 percent (6,029 kilograms) of the waste generated at the Solid Radioactive Chemical Waste Facilities, soil stabilizer mixed with water to be used as dust suppression at Technical Area 54 contributed 17 percent (1,781 kilograms) of the waste generated

h. In calendar year 2015, LLW generation at Solid Radioactive Chemical Waste exceeded 2008 SWEIS projections because of the disposal of non-compactable, LLW from throughout Technical Area 54, Area G (wood, plastic, cardboard, cloth, etc.), which contributed to 79 percent (372 cubic meters).

i. In calendar year 2016, LLW generation at Solid Radioactive Chemical Waste exceeded 2008 SWEIS projections due the general clean up from Area G at Technical Area 54, which contributed to 20 percent (69 cubic meters) of the total LLW waste, and the removal of empty drums from Technical Area 54 Area G contributed an additional 45 percent (145 cubic meters) of LLW generated at Solid Radioactive Chemical Waste Facilities.

j. MLLW generation at Solid Radioactive Chemical Waste exceeded 2008 SWEIS projections because of the cleanup of miscellaneous electronics and lighting equipment, which contributed to 43 percent (4 cubic meters) of the MLLW at the Solid Radioactive Chemical Waste Facilities.

k. 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Plant.

Table A-29. Plutonium Facility Complex (Technical Area 55) Comparison of Operations

Capability	2008 SWEIS Projection	2015 Operations	2016 Operations
Plutonium Stabilization	Recover, process, and store existing plutonium inventory.	Activity performed as projected.	Activity performed as projected.
Manufacturing Plutonium Components	Produce nominally 20 plutonium pits per year.	Fewer than 20 qualified pits were produced.	Fewer than 20 qualified pits were produced.
	Fabricate parts and samples for research and development activities, including parts for dynamic and subcritical experiments.	Fabrication operations restarted in late 2015.	Activity performed as projected for research and development activities. Fabrication of parts for subcritical experiments have not restarted.
Surveillance and Disassembly of Weapons Components	Disassemble, survey, and examine up to 65 plutonium pits per year.	Fewer than 65 pits were disassembled. Fewer than 40 pits were destructively examined as part of the stockpile evaluation program (pit surveillance).	Fewer than 65 pits were disassembled. Fewer than 40 pits were destructively examined as part of the stockpile evaluation program (pit surveillance).
Actinide Materials Science and Processing Research and Development	Perform plutonium (and other actinide) materials research, including metallurgical and other characterization of samples and measurements of mechanical and physical properties.	Activity performed as projected.	Activity performed as projected.
	Operate the 40-millimeter Impact Test Facility and other test apparatus.	Activities were performed as projected.	Activities were performed as projected.
	Develop expanded disassembly capacity and disassemble up to 200 pits per year.	Fewer than 200 pits were disassembled/converted.	Fewer than 200 pits were disassembled/converted. Fewer than 12 pits were processed through tritium separation.
	Process up to 5,000 curies of neutron sources (including plutonium and beryllium and americium-241).	No activity.	No activity.

Capability	2008 SWEIS Projection	2015 Operations	2016 Operations
Actinide Materials Science and Processing Research and Development (cont.)	Process neutron sources other than sealed sources.	No activity.	No activity.
	Process up to 400 kilograms per year of actinides between Technical Area 55 and the CMR Building.*	Fewer than 400 kilograms of actinides were processed.	Fewer than 400 kilograms of actinides were processed.
	Process pits through the Special Recovery Line (tritium separation).	Fewer than 12 pits were processed through tritium separation.	Fewer than 12 pits were processed through tritium separation.
	Perform or alloy decontamination of 28 to 48 uranium components per month.	Fewer than 48 uranium components were decontaminated per month.	Fewer than 48 uranium components were decontaminated per month.
	Conduct research in support of DOE actinide cleanup activities and on actinide processing and waste activities at DOE sites.	Activity performed as projected.	Activity performed as projected.
	Fabricate and study nuclear fuels used in terrestrial and space reactors.	No activity.	No activity.
	Fabricate and study prototype fuel for lead test assemblies.	No activity.	No activity.
	Develop safeguards instrumentation for plutonium assay.	Activity performed as projected.	Activity performed as projected.
	Analyze samples.	Analysis of actinide samples at Technical Area 55 continued in support of actinide reprocessing and research and development activities.	Analysis of actinide samples at Technical Area 55 continued in support of actinide reprocessing and research and development activities.
Fabrication of Ceramic-Based Reactor Fuels	Make prototype mixed oxide fuel.	No activity.	No activity.
	Build test reactor fuel assemblies.	No activity.	No activity.
	Continue research and development on other fuels.	No activity.	No activity.

Capability	2008 SWEIS Projection	2015 Operations	2016 Operations
Plutonium-238 Research, Development, and Applications	Process, evaluate, and test up to 25 kilograms per year of plutonium-238 in production of materials and parts to support space and terrestrial uses.	Less than 25 kilograms of plutonium-238 was processed, evaluated, and/or tested.	Less than 25 kilograms of plutonium-238 was processed, evaluated, and/or tested.
	Recover, recycle and blend up to 18 kilograms per year plutonium-238.	Less than 18 kilograms of plutonium-238 was recovered, recycled and blended.	Less than 18 kilograms of plutonium-238 was recovered, recycled and blended.
Storage, Shipping, and Receiving	Provide interim storage of up to 6.6 metric tons of the LANL special nuclear material inventory, mainly plutonium.	Activity performed as projected.	Activity performed as projected.
	Store working inventory in the vault in Technical Area 55, Building 4; ship and receive special nuclear material as needed to support LANL activities.	Activity performed as projected.	Activity performed as projected.
	Provide temporary storage of Security Category I and II materials removed in support of Technical Area 18 closure, pending shipment to the Nevada National Security Site and other DOE Complex locations.	Activity performed as projected.	Activity performed as projected.
	Store sealed sources collected under DOE's Offsite Source Recovery Program.	Activity performed as projected.	Activity performed as projected.
	Store mixed oxide fuel rods and fuel rods containing archive and scrap metals from mixed oxide fuel lead assembly fabrication.	Activity performed as projected.	Activity performed as projected.

* The actinide activities at the CMR Building and at Technical Area 55 are expected to total 400 kilograms per year. The future split between these two facilities was not known, so the facility-specific impacts at each facility were conservatively analyzed at this maximum amount. Waste projections that are not specific to the facility (but are related directly to the activities themselves) are only projected for the total of 400 kilograms per year.

Table A-30. Plutonium Facility Complex (Technical Area 55) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2015 Operations	2016 Operations
Radioactive Air Emissions				
Plutonium isotopes[b]	Ci/yr	1.95E-5	5.24E-09	1.59E-09
Tritium in Water Vapor	Ci/yr	7.50E+2	1.20E+00	8.30E-01
Tritium as a Gas	Ci/yr	2.50E+2	2.62E-01	4.60E-01
NPDES Discharge				
03A181	MGY	4.1	1.89	2.17
Wastes				
Chemical	kg/yr	8,618	7,806	14,634[c]
LLW	m^3/yr	757	343	398
MLLW	m^3/yr	15	24	28
TRU	m^3/yr	336[d]	29	43
Mixed TRU	m^3/yr	[d]	42	157

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m3/yr = cubic meters per year.

b. Projections for the SWEIS were reported as plutonium or plutonium-239, the primary material at Technical Area 55.

c. Chemical waste generation at the Plutonium Facility Complex exceeded 2008 SWEIS projections because of the disposal of cooling system descaling solution, which contributed to 18 percent (2,638 kilograms) of the total chemical waste generated at the Plutonium Facility. The disposal of used oil and ethylene glycol from the maintenance of equipment at RLUOB contributed to 9 percent (1,313 kilograms) and access control system maintenance at Technical Area 55 (the disposal of water and vegetable oil solution from vehicle access ram gates), which contributed to 13 percent (1,868 kilograms) of the chemical waste generated at the Plutonium Facility. An additional 1,445 kilograms of chemical waste was because of waste generated throughout LANL as unused/unspent products.

d. The 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Plant.

Table A-31. Operations at the Non-Key Facilities

Capability	Examples
Theory, Modeling, and High-Performance Computing	Modeling of atmospheric and oceanic currents. Theoretical research in areas such as plasma and beam physics, fluid dynamics, and superconducting materials.
Experimental Science and Engineering	Experiments in nuclear and particle physics, astrophysics, chemistry, and accelerator technology. Also includes laser and pulsed-power experiments (e.g., Atlas).
Advanced and Nuclear Materials Research and Development and Applications	Research and development into physical and chemical behavior in a variety of environments; development of measurement and evaluation technologies.
Waste Management	Management of municipal solid wastes. Sewage treatment. Recycling programs.
Infrastructure and Central Services	Human resources activities. Management of utilities (natural gas, water, electricity). Public interface.
Maintenance and Refurbishment	Painting and repair of buildings. Maintenance of roads and parking lots. Erecting and demolishing support structures.
Management of Environmental, Ecological, and Cultural Resources	Research into, assessment of, and management of plants, animals, historic properties, and environmental media (groundwater, air, surface waters).

Table A-32. Non-Key Facilities Operations Data

Parameter	Units[a]	2008 SWEIS	2015 Operations	2016 Operations
Radioactive Air Emissions[b]				
Tritium	Ci/y	9.1E+2	No emissions	No emissions
Plutonium	Ci/y	3.3E-6	No emissions	No emissions
Uranium	Ci/y	1.8E-4	No emissions	No emissions
NPDES Discharge				
Total Discharges	MGY	200.9	76.81	73.12
001	MGY	[c]	68.02[d]	63.93[d]
13S	MGY	[c]	[d]	[d]
03A160	MGY	28.5	0.32	0.25
03A199	MGY	[c]	8.47	8.94
Wastes				
Chemical	kg/yr	651,000	1,129,837[e]	4,507,929[f]
LLW	m^3/yr	1,529	121	2,597[g]
MLLW	m^3/yr	31	1	3
TRU	m^3/yr	23[h]	0	0
Mixed TRU	m^3/yr	[h]	0	0

a. Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m^3/yr = cubic meters per year.

b. Stack emissions from previously active facilities (Technical Areas 33 and 41); these stacks have been shut down. Does not include non-point sources.

c. The 2008 SWEIS did not calculate individual flow per outfall. Three outfalls in Sandia Canyon are projected to discharge 172.4 million gallons per year.

d. Discharge totals for Outfalls 001 and 13S have been combined. Outfall 001 includes discharge from the Technical Area 46 sanitary wastewater systems and Technical Area 03 Power Plant. New permit effective October 1, 2014, requires flow recording at Outfall 13S only if discharge is directed to Cañada del Buey.

e. The total chemical waste for 2015 exceeded 2008 SWEIS projections because of press filter cakes from Sanitary Effluent Reclamation Facility, this accounted for 71 percent (800,318 kilograms) of the total chemical waste generated.

f. The total chemical waste for 2016 exceeded 2008 SWEIS projections because of press filter cakes from Sanitary Effluent Reclamation Facility; this accounted for 21 percent (969,770 kilograms) of the total chemical waste generated. Sanitary Effluent Reclamation Facility processes sanitary wastewater effluent for the removal of unwanted constituents through a reverse osmosis process. A byproduct of the reverse osmosis process is reject water containing dissolved solids; this accounted for 77 percent (3,452,600 kilograms) of the total chemical waste from Non-Key Facilities.

g. The total LLW exceeded 2008 SWEIS projections for Non-Key Facilities because of the demolition of Technical Area 18 Casa 2 and 3, which accounted for 42 percent (1,088 cubic meters) of the total LLW from Non-Key Facilities.

h. The 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at the Waste Isolation Pilot Plant.

Appendix B of the SWEIS Yearbook–Calendar Years 2015 and 2016 Chemical Usage and Estimated Emission Data

This page intentionally left blank.

Key Facility	Toxic Air Pollutants*	CAS Number	2015 Usage	2015 Estimated Air Emissions	2016 Usage	2016 Estimated Air Emissions
Bioscience Facilities	1,4-Dioxane	123-91-1	0	0	2.58	0.90
	Acetic Acid	64-19-7	1.05	0.37	2.65	0.93
	Acetic Anhydride	108-24-7	0.65	0.23	0	0
	Acetone	67-64-1	28.44	9.95	63.20	22.12
	Acetonitrile	75-05-8	47.14	16.50	100.57	35.20
	Acrylamide	79-06-1	0.56	0.20	0	0
	Ammonium Chloride (Fume)	12125-02-9	2.88	1.01	0	0
	Bromoform	75-25-2	0.10	0.04	0	0
	Chlorine	7782-50-5	0	0	3.17	1.11
	Chlorobenzene	108-90-7	1.11	0.39	0	0
	Chloroform	67-66-3	2.41	0.84	0	0
	Dibutyl Phosphate	107-66-4	0	0	0.27	0.09
	Diethyl Phthalate	84-66-2	0	0	10.00	3.50
	Divinyl Benzene	1321-74-0	0	0	0.92	0.32
	Ethanol	64-17-5	126.91	44.42	80.69	28.24
	Ethyl Acetate	141-78-6	18.91	6.62	172.86	60.50
	Ethyl Ether	60-29-7	2.80	0.98	16.80	5.88
	Formamide	75-12-7	0.57	0.20	0	0
	Formic Acid	64-18-6	3.10	1.08	0	0
	Furfural	98-01-1	0.58	0.20	0	0
	Hexane (other isomers) or n-Hexane	110-54-3	34.34	12.02	63.39	22.19
	Hydrogen Bromide	10035-10-6	0.15	0.05	0	0
	Hydrogen Chloride	7647-01-0	6.77	2.37	0.46	0.16
	Hydrogen Peroxide	7722-84-1	0.14	0.05	1.27	0.44
	Isopropyl Alcohol	67-63-0	4.71	1.65	11.89	4.16
	Magnesium Oxide Fume	1309-48-4	0	0	3.28	1.14

Key Facility	Toxic Air Pollutants*	CAS Number	2015 Usage	2015 Estimated Air Emissions	2016 Usage	2016 Estimated Air Emissions
Bioscience Facilities (cont.)	Methyl Alcohol	67-56-1	9.89	3.46	25.36	8.86
	Methyl Iodide	74-88-4	0.50	0.18	0	0
	Methyl Chloride	74-87-3	0	0	3.60	1.26
	Methylene Chloride	75-09-2	21.23	7.43	212.26	74.29
	n,n-Dimenthyl Acetamide	127.19-5	0	0	0.94	0.33
	n,n-Dimethylformamide	68-12-2	9.01	3.15	0	0
	o-Phenylenediamine	95-54-5	0.05	0.02	0	0
	Phenol	108-95-2	0.03	0.01	0	0
	Phosphoric Acid	7664-38-2	0	0	0.92	0.32
	Phosphorous Trichloride	7719-12-2	0	0	4.00	1.40
	Propane	74-98-6	0	0	97.49	0
	Silica, Quartz	14808-60-7	3.00	1.05	0	0
	Tetrahydrofuran	109-99-9	1.78	0.62	3.56	1.24
	Toluene	108-88-3	3.47	1.21	13.87	4.85
	Triethylamine	121-44-8	0	0	2.00	0.70
	Xylene (o-,m-,p-Isomers)	1330-20-7	0.43	0.15	0	0
	Zinc Chloride Fume	7646-85-7	0	0	0.29	0.10
CMR Building	Acetone	67-64-1	9.48	3.32	9.48	3.32
	Acetylene	74-86-2	58.97	0	0	0
	Ammonium Chloride (Fume)	12125-02-9	0.75	0.26	0.75	0.26
	Ethanol	64-17-5	0	0	3.16	1.11
	Hexane (other isomers)	110-54-3	0	0	0.33	0.12
	Hydrogen Chloride	7647-01-0	13.06	4.57	25.52	8.93
	Hydrogen Fluoride	7664-39-3			0.49	0.17
	n-Heptane	142-82-5	0	0	1.37	0.48

Key Facility	Toxic Air Pollutants*	CAS Number	2015 Usage	2015 Estimated Air Emissions	2016 Usage	2016 Estimated Air Emissions
CMR Building (cont.)	Nitric Acid	7697-37-2	15.26	5.34	21.36	7.48
	Toluene	108-88-3	0	0	0.87	0.30
	Uranium (natural) Sol.&Unsol.Comp. as U	7440-61-1	6.65	2.33	0	0
	Xylene (o-,m-,p-Isomers)	1330-20-7	1.72	0.60	1.72	0.60
High Explosives Processing Facilities	1,4-Dioxane	123-91-1	0	0	2.07	0.72
	2-Butoxyethanol Acetate	112-07-2	0.47	0.16	0	0
	2-Methoxyethanol (EGME)	109-86-4	0	0	0.96	0.34
	Acetic Anhydride	108-24-7	1.08	0.38	0	0
	Acetone	67-64-1	174.57	61.10	403.20	141.12
	Acetonitrile	75-05-8	43.21	15.12	25.14	8.80
	Acetylene	74-86-2	277.16	0	16.44	0
	Acrylic Acid	79-10-7	0.50	0.18	0	0
	Amitrole	61-82-5	1.00	0.35	0	0
	Ammonia	7664-41-7	18.22	6.38	4.73	1.66
	Benzene	71-43-2	0	0	59.60	20.86
	Carbon Disulfide	75-15-0	0.13	0.04	0	0
	Di-sec, Octyl Phthalate	117-81-7	0.93	0.32	0	0
	Epichlorohydrin	106-89-8	0.12	0.04	0	0
	Ethanol	64-17-5	209.15	73.20	302.69	105.94
	Ethyl Acetate	141-78-6	189.07	66.17	0	0
	Ethyl Benzene	100-41-4	1.32	0.46	0	0
	Ethyl Ether	60-29-7	9.10	3.19	35.00	12.25
	Ethylene Dichloride	107-06-2	0	0	5.56	1.95
	Hydrazine	302-01-2	0.10	0.04	0	0
	Hydrogen Chloride	7647-01-0	2.97	1.04	11.87	4.15
	Hydrogen Peroxide	7722-84-1	1.41	0.49	4.22	1.48

Key Facility	Toxic Air Pollutants*	CAS Number	2015 Usage	2015 Estimated Air Emissions	2016 Usage	2016 Estimated Air Emissions
High Explosives Processing Facilities (cont.)	Iron Oxide Fume, as Fe	1309-37-1	0	0	1.00	0.35
	Isopropyl Alcohol	67-63-0	41.63	14.57	3.53	1.24
	Malononitrile	109-77-3	0	0	1.00	0.35
	Methyl Alcohol	67-56-1	36.40	12.74	20.58	7.20
	Methyl Ethyl Ketone (MEK)	78-93-3	0	0	0.81	0.28
	Methylene Bisphenyl Isocyanate (MDI)	101-68-8	0.50	0.18	0	0
	Methylene Chloride	75-09-2	13.82	4.84	42.45	14.86
	n,n-Dimethylformamide	68-12-2	0	0	4.74	1.66
	n-Heptane	142-82-5	0.65	0.23	0	0
	Nitric Acid	7697-37-2	37.39	13.09	21.36	7.48
	Phosphorus Oxychloride	10025-87-3	0	0	0.25	0.09
	Phosphorus Pentachloride	10026-13-8	0.25	0.09	2.00	0.70
	Potassium Hydroxide	1310-58-3	5.50	1.93	0	0
	Propane	74-98-6	188.21	0	514.03	0
	Propyl Alcohol	71-23-8	0	0	8.05	2.82
	Sulfur Hexafluoride	2551-62-4	70.12	24.54	0	0
	Sulfuric Acid	7664-93-9	32.23	11.28	18.40	6.44
	Tantalum Metal	7440-25-7	0.25	0.09	0	0
	Tetrahydrofuran	109-99-9	7.11	2.49	30.23	10.58
	Thionyl Chloride	7719-09-7	0.82	0.29	0	0
	Toluene	108-88-3	14.74	5.16	173.38	60.68
	Triethylamine	121-44-8	0	0	2.18	0.76
	Tungsten as W insoluble Compounds	7440-33-7	0	0	45.36	0.45
	Vanadium, Respirable Dust & Fume	1314-62-1	0.25	0.09	0	0

Key Facility	Toxic Air Pollutants*	CAS Number	2015 Usage	2015 Estimated Air Emissions	2016 Usage	2016 Estimated Air Emissions
High Explosives Testing Facilities	Acetone	67-64-1	6.32	2.21	1.18	0.41
	Beryllium	7440-41-7	0.23	0.08	0	0
	Copper	7440-50-8	892.01	8.92	0	0
	Ethanol	64-17-5	18.77	6.57	81.30	28.45
	Isopropyl Alcohol	67-63-0	18.01	6.30	1.53	0.54
	Nitric Acid	7697-37-2	0	0	3.05	1.07
	Nitromethane	75-52-5	0	0	1054.59	369.11
	Propane	74-98-6	206.96	0	0	0
	Sulfur Hexafluoride	2551-62-4	1096.10	383.64	935.99	327.60
	Tungsten as W insoluble Compounds	7440-33-7	4394.92	43.95	0	0
	Uranium (natural) Sol.&Unsol.Comp. as U	7440-61-1	2.38	0.83	0	0
LANSCE	Acetone	67-64-1	157.07	54.97	4.74	1.66
	Acetylene	74-86-2	158.70	0	10.85	0
	Chlorodifluoromethane	75-45-6	0	0	34.33	12.02
	Ethanol	64-17-5	25.36	8.88	3.16	1.11
	Hydrogen Peroxide	7722-84-1	11.25	3.94	0	0
	Isobutane	75-28-5	48.46	16.96	146.06	51.12
	Isopropyl Alcohol	67-63-0	42.42	14.85	53.41	18.70
	Methyl Alcohol	67-56-1	3.17	1.11	0	0
	Nitric Acid	7697-37-2	3.82	1.34	0	0
	Propane	74-98-6	505.01	0	316.83	0
	Sulfur Hexafluoride	2551-62-4	405.96	142.09	102.06	35.72
	Sulfuric Acid	7664-93-9	73.60	25.76	0	0
	Toluene	108-88-3	0.90	0.31	0	0
	Tungsten as W insoluble Compounds	7440-33-7	1.00	0.01	0	0
	Acetic Acid	64-19-7	0	0	0.52	0.18

Key Facility	Toxic Air Pollutants*	CAS Number	2015 Usage	2015 Estimated Air Emissions	2016 Usage	2016 Estimated Air Emissions
Material Science Laboratory	Acetone	67-64-1	34.76	12.16	26.07	9.12
	Acetonitrile	75-05-8	0	0	3.14	1.10
	Ammonium Chloride (Fume)	12125-02-9	0.03	0.01	0	0
	Aniline & Homologues	62-53-3	0	0	3.07	1.07
	Benzene	71-43-2	0	0	0.88	0.31
	Cyclohexane	110-82-7	0.78	0.27	0	0
	Diethanolamine	111-42-2	0	0	0.50	0.18
	Ethanol	64-17-5	15.62	5.47	2.37	0.83
	Ethyl Acetate	141-78-6	3.60	1.26	0.90	0.32
	Ethyl Ether	60-29-7	6.30	2.21	11.20	3.92
	Ethylene Diamine	107-15-3	0	0	1.80	0.63
	Hexane (other isomers)* or n-Hexane	110-54-3	1.32	0.46	7.26	2.54
	Hydrogen Bromide	10035-10-6	0	0	0.75	0.26
	Hydrogen Chloride	7647-01-0	12.46	4.36	10.68	3.74
	Hydrogen Peroxide	7722-84-1	9.85	3.45	11.25	3.94
	Iodine	7553-56-2	0	0	0.50	0.18
	Iron Pentacarbonyl, as Fe	13463-40-6	0	0	0.25	0.09
	Isopropyl Alcohol	67-63-0	28.28	9.90	8.25	2.89
	Methyl Alcohol	67-56-1	3.17	1.11	2.37	0.83
	Methyl Cyclohexane	108-87-2	0.08	0.03	0	0
	Methyl Ethyl Ketone (MEK)	78-93-3	0	0	0.40	0.14
	Methylamine	74-89-5	1.08	0.38	1.13	0.39
	Methylene Chloride	75-09-2	37.81	13.23	21.23	7.43
	n,n-Dimethylformamide	68-12-2	1.90	0.66	0.95	0.33
	n-Butyl Alcohol	71-36-3	0.81	0.28	0	0

Key Facility	Toxic Air Pollutants*	CAS Number	2015 Usage	2015 Estimated Air Emissions	2016 Usage	2016 Estimated Air Emissions
Material Science Laboratory (cont.)	n-Butylamine	109-73-9	0.18	0.06	0	0
	Nitric Acid	7697-37-2	3.82	1.34	0	0
	Potassium Hydroxide	1310-58-3	0	0	1.50	0.53
	Propyl Alcohol	71-23-8	3.22	1.13	0	0
	Silica, Quartz	14808-60-7	0.50	0.18	0	0
	Silver (metal dust & soluble comp., as Ag)	7440-22-4	0.32	0.11	0	0
	Sulfur Hexafluoride	2551-62-4	81.19	28.42	0	0
	Sulfuric Acid	7664-93-9	9.20	3.22	27.64	9.67
	Tetrahydrofuran	109-99-9	5.34	1.87	20.01	7.00
	Tin numerous forms	7440-31-5	0.10	0	0	0
	Toluene	108-88-3	10.40	3.64	27.74	9.71
	Trichlorothylene	79-01-6	0	0	1.46	0.51
	Triethylamine	121-44-8	0	0	0.36	0.13
	Trimethyl Phosphite	121-45-9	0.03	0.01	0	0
	Xylene (o-,m-,p-Isomers)	1330-20-7	2.58	0.90	68.89	24.11
Plutonium Facility Complex	Acetonitrile	75-05-8	0.08	0.03	0	0
	Acetylene	74-86-2	39.51	0	37.15	0
	Chloroform	67-66-3	0.74	0.26	0	0
	Ethanol	64-17-5	0	0	32.09	11.23
	Hydrogen Chloride	7647-01-0	18.99	6.65	23.14	8.10
	Hydrogen Fluoride, as F	7664-39-3	1.00	0.35	7.90	2.76
	Hydrogen Peroxide	7722-84-1	5.77	2.02	27.53	9.64
	Methyl 2-Cyanoacrylate	137-05-3	0.65	0.23	0.62	0.22
	Methylene Chloride	75-09-2	0.63	0.22	0	0
	n,n-Dimethylformamide	68-12-2	0	0	11.38	3.98
	Nitric Acid	7697-37-2	7.63	2.67	16.02	5.61

Key Facility	Toxic Air Pollutants*	CAS Number	2015 Usage	2015 Estimated Air Emissions	2016 Usage	2016 Estimated Air Emissions
Plutonium Facility Complex (cont.)	Paraffin Wax Fume	8002-74-2	21.77	7.62	0	0
	Propane	74-98-6	39.34	0	24.37	0
	Sulfuric Acid	7664-93-9	1.84	0.64	0	0
	Trichloroacetic Acid	76-03-9	0.10	0.04	0	0
RLWTF	Acetylene	74-86-2	19.46	0	0	0
	Ammonium Chloride (Fume)	12125-02-9	0	0	0.50	0.18
	Hydrogen Chloride	7647-01-0	106.83	37.39	142.44	49.85
	Hydrogen Peroxide	7722-84-1	0	0	4.22	1.48
	Propane	74-98-6	302.25	0	0	0
	Sulfuric Acid	7664-93-9	3374.78	1181.17	1532.35	536.32
	Tin numerous forms	7440-31-5	0	0	0.91	0.01
Radiochemistry Facility	1,4-Dioxane	123-91-1	3.31	1.16	0.41	0.14
	2-Methoxyethanol (EGME)	109-86-4	0.96	0.34	0	0
	Acetic Acid	64-19-7	6.30	2.20	224.21	78.48
	Acetone	67-64-1	154.43	54.05	148.11	51.84
	Acetonitrile	75-05-8	3.30	1.15	0.79	0.27
	Aluminum numerous forms	7429-90-5	0.10	0	0	0
	Ammonia	7664-41-7	0.54	0.19	0	0
	Ammonium Chloride (Fume)	12125-02-9	0.50	0.18	0	0
	Antimony and Compounds, as Sb	7440-36-0	0.05	0.02	0	0
	Benzene	71-43-2	1.80	0.63	1.84	0.64
	Benzenethiol or Phenyl Mercaptan	108-98-5	0.11	0.04	0	0
	Benzyl Chloride	100-44-7	0.25	0.09	0.28	0.10

Key Facility	Toxic Air Pollutants*	CAS Number	2015 Usage	2015 Estimated Air Emissions	2016 Usage	2016 Estimated Air Emissions
Radiochemistry Facility (cont.)	Beryllium	7440-41-7	0.23	0.08	0.23	0.08
	Bromoform	75-25-2	0.07	0.03	0	0
	Cadmium, el.&compounds, as Cd	7440-43-9	3.24	1.13	66.94	23.43
	Carbon Disulfide	75-15-0	0.03	0.01	1.26	0.44
	Chlorine	7782-50-5	0	0	2.27	0.79
	Chloroform	67-66-3	0	0	1.48	0.52
	Copper	7440-50-8	0.03	0	0	0
	Cyclohexane	110-82-7	0.78	0.27	0	0
	Ethanol	64-17-5	4.34	1.52	233.68	81.79
	Ethyl Acetate	141-78-6	10.80	3.78	0	0
	Ethyl Ether	60-29-7	233.80	81.83	11.97	4.19
	Ethylene Dichloride	107-06-2	0.62	0.22	0	0
	Formic Acid	64-18-6	1.22	0.43	2.44	0.85
	Hexane (other isomers)* or n-Hexane	110-54-3	29.71	10.40	13.87	4.85
	Hydrogen Bromide	10035-10-6	0.90	0.32	11.03	3.86
	Hydrogen Chloride	7647-01-0	440.14	154.05	457.33	160.06
	Hydrogen Fluoride, as F	7664-39-3	0.49	0.17	7.65	2.68
	Hydrogen Peroxide	7722-84-1	48.53	16.99	34.11	11.94
	Iodine	7553-56-2	9.86	3.45	0	0
	Iron Oxide Fume, as Fe	1309-37-1	0.25	0.09	0	0
	Isopropyl Alcohol	67-63-0	12.57	4.40	19.64	6.87
	Isopropyl Ether	108-20-3	2.17	0.76	0	0
	Magnesium Oxide Fume	1309-48-4	67.76	23.72	0	0
	Manganese Dust & Compounds or Fume	7439-96-5	0.25	0.09	0	0
	Mercury numerous forms	7439-97-6	0	0	0.90	0.01

Key Facility	Toxic Air Pollutants*	CAS Number	2015 Usage	2015 Estimated Air Emissions	2016 Usage	2016 Estimated Air Emissions
Radiochemistry Facility (cont.)	Methyl Alcohol	67-56-1	26.91	9.42	21.37	7.48
	Methyl Formate	107-31-3	1.00	0.35	0	0
	Methylene Chloride	75-09-2	0.80	0.28	2.65	0.93
	Molybdenum	7439-98-7	2.55	0.89	1.28	0.44
	Naphtalene	91-20-3	0.50	0.18	0	0
	n-Heptane	142-82-5	0.68	0.24	1.37	0.48
	Nitric Acid	7697-37-2	1674.08	585.93	1555.16	544.31
	Oxalic Acid	144-62-7	0.10	0.04	0	0
	Pentane (all isomers)	109-66-0	4.38	1.53	5.01	1.75
	Phenol	108-95-2	0.10	0.04	0	0
	Phosphoric Acid	7664-38-2	6.42	2.25	12.84	4.49
	Phosphorus Pentachloride	10026-13-8	0.25	0.09	0	0
	Potassium Hydroxide	1310-58-3	1.86	0.65	1.45	0.51
	Propane	74-98-6	1138.30	0	527.72	0
	Pyridine	110-86-1	0.93	0.33	3.91	1.37
	Sulfuric Acid	7664-93-9	0.05	0.02	14.50	5.07
	Tellurium & Compounds, as Te	13494-80-9	0	0	0.88	0.31
	tert-Butyl Alcohol	75-65-0	0.79	0.28	0	0
	Tetrahydrofuran	109-99-9	21.96	7.69	19.00	6.65
	Toluene	108-88-3	29.04	10.16	6.94	2.43
	Triethylamine	121-44-8	0.73	0.25	0	0
	Uranium (natural) Sol.&Unsol.Comp. as U	7440-61-1	0	0	2.38	0.83
	Xylene (o-,m-,p-Isomers)	1330-20-7	2.58	0.90	0.86	0.30
	Yttrium	7440-65-5	0	0	1.01	0.35
	Zinc Chloride Fume	7646-85-7	0	0	1.00	0.35

Key Facility	Toxic Air Pollutants*	CAS Number	2015 Usage	2015 Estimated Air Emissions	2016 Usage	2016 Estimated Air Emissions
Radiochemistry Facility (cont.)	Zirconium Compounds, as Zr	7440-67-7	0	0	0.81	0.01
Shops	Acetone	67-64-1	15.80	5.53	0	0
	Acetylene	74-86-2	0	0	23.67	0
	Ethanol	64-17-5	0	0	1076.43	376.75
	Hydrogen Chloride	7647-01-0	0	0	2.97	1.04
	Propane	74-98-6	121.86	0	121.86	0
Sigma Complex	Acetic Acid	64-19-7	0	0	2.62	0.92
	Acetone	67-64-1	6.77	2.37	161.14	56.40
	Acetylene	74-86-2	9.20	0	0.33	0
	Aluminum numerous forms	7429-90-5	1.50	0.02	0	0
	Boron Oxide	1303-86-2	0.50	0.18	0	0
	Carbon Disulfide	75-15-0	0.63	0.22	0	0
	Cyanamide	420-04-2	1.00	0.35	0	0
	Diethylene Triamine	111-40-0	0.96	0.34	0	0
	Ethanol	64-17-5	0	0	68.89	24.11
	Ethylene Dichloride	107-06-2	0	0	3.71	1.30
	Furfuryl Alcohol	98-00-0	5.65	1.98	0	0
	Hydrogen Chloride	7647-01-0	6.80	2.38	0	0
	Isopropyl Alcohol	67-63-0	118.27	41.39	61.16	21.40
	Magnesium Oxide Fume	1309-48-4	5.00	1.75	0	0
	Methyl Alcohol	67-56-1	6.33	2.22	3.17	1.11
	Methyl Chloride	74-87-3	0	0	1.80	0.63
	n-Butyl Alcohol	71-36-3	8.10	2.83	8.10	2.83
	Nitric Acid	7697-37-2	0.92	0.32	662.13	231.75
	Phosphorus Trichloride	7719-12-2	0	0	4.71	1.65
	Potassium Hydroxide	1310-58-3	0	0	50.00	17.50

Key Facility	Toxic Air Pollutants*	CAS Number	2015 Usage	2015 Estimated Air Emissions	2016 Usage	2016 Estimated Air Emissions
Sigma Complex (cont.)	Propane	74-98-6	115.26	0	401.03	0
	Tantalum Metal	7440-25-7	45.46	15.91	77.50	27.13
	Toluene	108-88-3	13.87	4.85	0	0
	Xylene (o-,m-,p-Isomers)	1330-20-7	0	0	6.52	2.28
Solid Radioactive and Chemical Waste Facilities	Propane	74-98-6	699.34	0	955.02	0
Target Fabrication Facility	Acetone	67-64-1	1.58	0.55	14.22	4.98
	Acetonitrile	75-05-8	3.14	1.10	0	0
	Acetylene	74-86-2	4.27	0	0	0
	Benzene	71-43-2	2.63	0.92	2.63	0.92
	Carbon Black	1333-86-4	31.03	10.86	0	0
	Carbon Tetrachloride	56-23-5	0.80	0.28	0	0
	Chlorine	7782-50-5	13.90	4.87	2.27	0.79
	Divinyl Benzene	1321-74-0	0.92	0.32	1.15	0.40
	Ethanol	64-17-5	16.97	5.94	449.99	157.50
	Ethyl Acetate	141-78-6	0	0	61.22	21.43
	Ethyl Ether	60-29-7	25.20	8.82	0	0
	Hexane (other isomers)* or n-Hexane	110-54-3	0	0	10.56	3.70
	Hydrogen Chloride	7647-01-0	0.59	0.21	0	0
	Hydrogen Fluoride, as F	7664-39-3	0	0	2.99	1.05
	Indium & compounds, as In	7440-74-6	0.03	0.01	0	0
	Isopropyl Alcohol	67-63-0	29.06	10.17	62.06	21.72
	Magnesium Oxide Fume	1309-48-4	0.30	0.11	0	0
	Methyl Alcohol	67-56-1	32.20	11.27	12.66	4.43

Key Facility	Toxic Air Pollutants*	CAS Number	2015 Usage	2015 Estimated Air Emissions	2016 Usage	2016 Estimated Air Emissions
Target Fabrication Facility (cont.)	Methyl Ethyl Ketone (MEK)	78-93-3	0	0	3.22	1.13
	Methyl Methacrylate	80-62-6	0.94	0.33	0	0
	Methylene Chloride	75-09-2	13.27	4.64	26.53	9.28
	n-Amyl Acetate	628-63-7	0.22	0.08	0	0
	Propylene Dichloride	78-87-5	0	0	4.62	1.62
	Propylene Oxide	75-56-9	0.90	0.32	0	0
	Pyridine	110-86-1	0.56	0.20	0	0
	Sulfuric Acid	7664-93-9	0	0	0.37	0.13
	Tetrahydrofuran	109-99-9	7.11	2.49	28.45	9.96
	Toluene	108-88-3	3.47	1.21	0	0
	Triphenylphosphate	115-86-6	1.00	0.35	0	0
	Zinc Chloride Fume	7646-85-7	0.50	0.18	0	0
Tritium	Acetone	67-64-1	17.38	6.08	0	0
	Acetylene	74-86-2	17.36	0	0	0
	Ethanol	64-17-5	50.52	17.68	11.95	4.18
	Isopropyl Alcohol	67-63-0	6.28	2.20	0	0
	Propane	74-98-6	0	0	11.08	0

* All toxic air pollutants are measured at kilograms per year.

This page intentionally left blank.

Appendix C of the SWEIS Yearbook–
Calendar Years 2015 and 2016
Nuclear Facilities List

This page intentionally left blank.

Los Alamos NATIONAL LABORATORY EST. 1943

List of Los Alamos National Laboratory Nuclear Facilities

LIST–SBD-503-R0.1

Prepared by:

Gregory D. Smith
Safety Basis Division

Signature: [signature] Date: 6/1/17

Approver:

James L. Tingey
Safety Basis Division Leader

Signature: [signature] Date: 6/1/17

☒ Unclassified ☐ UCNI ☐ Classified ☐ OUO	Derivative Classifier Name: SHAWNA EISELE SB-PF Signature: [signature]	Date: 6/1/17

Revision Log

Document Number	Revision	Date	Description of Change
LIST-SBD-503	0.1	June 2017	Correction of TWF FOD
	0	May 2017	Addition of Transuranic Waste Facility (TWF) as a Hazard Category 2 facility per OPS:55JR-707231. Document reformatted to current Safety Basis Division standards and new number issued; revision number set back to zero to coincide with new document number issuance.
LANL Nuclear Facility List (No Document Number)	12	December 2010	Removed MDA-C per COR-SO-6.30.2010-264748; Removed TA-53 Resin Tank per COR-SO-2.8.2010-232928; Removed EF Site per COR-SO-9.15.2010-282846; added TA-50-0248 to Table 2
	11	September 2009	Removed MDA B per SBT:2SBLJ-56803; Removed WWTP per 2009 SBT:25BLJ-49261; Removed Pratt Canyon per SBT:25BLJ-49261.Added EF Firing Site per AD-NHHO:09-93; editorial changes (e.g., removed SB-40 1 since the old EWMO-document numbering system is no longer utilized by the Safety Basis Division).
	10	January 2008	Re-categorized RLWTF per memo SBT:CMK-002, Removed SST Pad per 5485.3/SBT:JF-39193
	9	September 2007	Removed TA-18 due to facility downgrade per FRT:5RA-001; Removed DVRS per EO:2JEO-007 dated 4/2/2007; Removed TA-10 due to SBT:5KK-003; updated WCRRF due to ABD-WFM-005, R. 0; updated NES to be referenced to NES-ABD-0101, R.1.0
	8	January 2007	Removed LANSCE 1L Target, Lujan Center, and component storage facilities due to PCM-06-016; Removed TA-55, PF-185 per SBT:5485.3:5SS-06-003; Removed TWISP per SABT:5485.3:CMK:103105; Updated RDL to be the current FODs relative to 5485.1 SABT:8JF-001; Updated general editorial elements (e.g., PS-SBO to SB,

Revision Log

Document Number	Revision	Date	Description of Change
			summary of Table 1, deletion of "Performance Surety", etc.)
	7	October 2005	Removed TSFF per the successful OFO V&V per SABM: Steele: Approval of 2nd LANL Submittal Request for TSFF Downgrade; dated 8/1/2005
	6	June 2005	Removed TA-8-23 from nuclear facility per SABM/STEELE 040805, "Approval of request to Recategorize the TA-8-23 nuclear facility to a less than High Hazard Radiological Facility" dated 4/8/2005. Updated TA55 PF-185 as a Hazard Category 2 nuclear facility per SABM:STEEL, "TA-55-PF185 OSRP SB Approval" dated 5/17/2005. Updated TA55 PF-355 as a Hazard Category 2 nuclear facility per SER for SST Facility, dated 5/25/2005. Updated various RDLs, editorial changes, etc. Tables columns listing the DOE CSO, and the LANL FMU were deleted upon consultation between SBO and SABT. Table rows re-ordered for easier reading.
	5	August 2004	Updated TA-50 RLWTF as Hazard Category 2 nuclear facility, Added DVRS as a temporary Hazard Category 2 nuclear facility. Downgraded TSFF to a Hazard Category 3 nuclear facility from a Hazard Category 2. The organization of the nuclear facility list was modified to identify only the document that categorizes the facility. Other safety basis documents related to a facility would be identified in the Authorization Agreements. The purpose of this was to reduce redundancy and conflicts between the Nuclear Facility List and Authorization Agreements.
	4	February 2004	Update safety basis documentation for Transportation, TA-18 LACEF, TA-8-23

Revision Log

Document Number	Revision	Date	Description of Change
			Radiography, TA-21 TSTA, and TA-50 RLWTF. Added 11 Environmental Sites that were categorized as Hazard Category 2 and Hazard Category 3 Nuclear Facilities. TA-21 TSTA, TA-48-1 Radiochemistry, and TA-50 RAMROD were downgraded to Radiological Facilities and removed from this list. The facility contacts were changed from the Facility Manager and Facility Operations to Responsible Division Leader and Facility Management Unit.
	3	July 2002	Semi-annual update.
	2	December 2001	Corrected CSOs, referenced DOE approval memo for 10 CFR 830 compliant facilities, new acronym list, and safety basis documentation update since last revision.
	1	June 2001	Updated nuclear facility list and modified format.
	0	April 2000	Original Issue

Changes in Nuclear Facility Status

Date	Description
March 1997	Omega West Reactor, TA-2-1, downgraded from Hazard Category 2 reactor facility to a radiological facility. Omega West Reactor removed from the nuclear facilities list.
September 1998	Safety Analysis Report approved accepting the Radioactive Materials, Research, Operations, and Demonstration Facility (RAMROD), TA-50-37, as a Hazard Category 2 nuclear facility. RAMROD added to the nuclear facilities list.
September 1998	TA-35 Buildings 2 and 27 downgraded from a Hazard Category 2 nuclear facility to a Hazard Category 3 nuclear facility.
September 1998	Basis of Interim Operations (BIO) approved accepting the Los Alamos Neutron Science Center (LANSCE) A-6 Isotope Production and Materials Irradiation and 1L Manuel Lujan Neutron Scattering Center Target Facilities as Hazard Category 3 nuclear facilities.
October 1998	TA-8 Radiography Facility Buildings 24 and 70 downgraded from Hazard Category 2 nuclear facilities to radiological facilities.
November 1998	Health Physics Calibration Facility (TA-3 SM-40, SM-65 and SM-130) downgraded from a Hazard Category 2 nuclear facility to a radiological facility. SM-40 and SM-65 had been Hazard Category 2 nuclear facilities while SM-130 had been a Hazard Category 3 nuclear facility. Health Physics Calibration Facility removed from the nuclear facilities list.
December 1998	Radioactive Liquid Waste Treatment Facility (RLWTF) downgraded from a Hazard Category 2 nuclear facility to a Hazard Category 3 nuclear facility.
January 1999	Pion Scattering Experiment of the TA-53 Nuclear Activities at Los Alamos Neutron Science Center (LANSCE) removed from the nuclear facilities list.
February 2000	Building TA-50-190, Liquid Waste Tank, of the Waste Characterization Reduction and Repackaging Facility (WCRRF) removed from the nuclear facilities list.
March 2000	DOE SER clarifies segmentation of the Waste Characterization Reduction and Repackaging Facility (WCRRF) as: 1) Building TA-50-69 designated as a Hazard Category 3 nuclear facility, 2) an outside operational area designated as a Hazard Category 2 nuclear facility, and 3) the Nondestructive Assay (NDA) Mobile Facilities located outside TA-50-69 and designated as a Hazard Category 2 nuclear facility.

Changes in Nuclear Facility Status

Date	Description
April 2000	Building TA-3-159 of the TA-3 SIGMA Complex downgraded from Hazard Category 3 nuclear facility to a radiological facility and removed from the nuclear facilities list.
April 2000	TA-35 Nonproliferation and International Security Facility Buildings 2 and 27 downgraded from Hazard Category 3 nuclear facilities to radiological facilities and removed from the nuclear facilities list.
March 2001	TA-3-66, Sigma Facility, downgraded and removed from this nuclear list.
May 2001	TA-16-411, Assembly Facility, downgraded and removed from this nuclear list.
May 2001	TA-8-22, Radiography Facility, downgraded and removed from this nuclear list.
June 2001	Site Wide Transportation added as a nuclear activity (included in 10 CFR 830 plan).
September 2001	TA-53 LANSCE, WNR Target 4 JCO approved as Hazard Category 3 nuclear activity.
October 2001	TA-53 LANSCE IL JCO in relation to changes in operational parameters of the coolant system with an expiration date of 1/31/02.
October 2001	TA-53 LANSCE Actinide BIO approved as Hazard Category 3 nuclear activity.
March 2002	TA-33-86, High Pressure Tritium Facility removed from nuclear facilities list.
April 2002	TA-53 LANSCE, DOE NNSA approves BIO for Storing Activated Components (A6, etc.) in Bldg 53-3 Sector M "Area A East" and added as Hazard Category 3 nuclear activity.
July 2002	TA-53 LANSCE, WNR Facility Target 4 downgraded to below Hazard Category 3 and removed from the nuclear facilities list.
January 2003	TA-50 Radioactive Materials, Research, Operations, and Demonstration (RAMROD) facility was downgraded to below Hazard Category 3 and removed from the nuclear facilities list.

Changes in Nuclear Facility Status

Date	Description
June 2003	TA-48-1, Radiochemistry and Hot Cell Facility was downgraded to below Hazard Category 3 and removed from the nuclear facilities list.
July 2003	TA-21 Tritium System Test Assembly (TSTA) facility was downgraded to below Hazard Category 3 and removed from the nuclear facilities list.
November 2003	TA-10 PRS 10-002(a)-00 (former liquid disposal complex) environmental site was categorized as a Hazard Category 3 nuclear facility
November 2003	TA-21 PRS 21-014 (Material Disposal Area A) environmental site was categorized as a Hazard Category 2 nuclear facility
November 2003	TA-21 PRS 21-015 (Material Disposal Area B) environmental site was categorized as a Hazard Category 3 nuclear facility
November 2003	TA-21 PRS 21-016(a)-99 (Material Disposal Area T) environmental site was categorized as a Hazard Category 2 nuclear facility
November 2003	TA-35 PRS 35-001 (Material Disposal Area W, Sodium Storage Tanks) environmental site was categorized as a Hazard Category 3 nuclear facility
November 2003	TA-35 PRS 35-003(a)-99 (Wastewater treatment plant (WWTP)) environmental site was categorized as a Hazard Category 3 nuclear facility
November 2003	TA-35 PRS 35-003(d)-00 (Wastewater treatment plant – Pratt Canyon) environmental site was categorized as a Hazard Category 3 nuclear facility
November 2003	TA-49 PRS 49-001(a)-00 (Material Disposal Area AB) environmental site was categorized as a Hazard Category 2 nuclear facility
November 2003	TA-50 PRS 50-009 (Material Disposal Area C) environmental site was categorized as a Hazard Category 2 nuclear facility
November 2003	TA-53 PRS 53-006(b)-99 (Underground tank with spent resins) environmental site was categorized as a Hazard Category 2 nuclear facility
November 2003	TA-54 PRS 54-004 (Material Disposal Area H) environmental site was categorized as a Hazard Category 3 nuclear facility
March 2004	TA-54-38, Radioassay and Nondestructive Testing (RANT) facility, is re-categorized as a Hazard Category 2 nuclear facility from Hazard Category 3.

Changes in Nuclear Facility Status

Date	Description
June 2004	TA-54-412 Decontamination and Volume Reduction Glovebox (DVRS) added to nuclear facility list. The facility will operate as a Hazard Category 2 not exceeding 5 months from the date the Los Alamos Site Office formally releases the facility for operations following readiness verification.
June 2004	DOE Safety Evaluation Report for the TSFF BIO establishes that TSFF is re-categorized as a Hazard Category 3 from Hazard Category 2.
July 2004	TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) was re-categorized as a Hazard Category 2 nuclear facility based on a DOE Memo dated March 20, 2002.
April 2005	Removed TA-8-23 from nuclear facility list per SABM/STEELE 040805, "Approval of request to Recategorize the TA-8-23 nuclear facility to a less than High Hazard Radiological Facility" dated 4/8/2005.
May 2005	Updated TA55 PF-185 as a Hazard Category 2 nuclear facility per SABM:STEEL, "TA-55-PF185 OSRP SB Approval" dated 5/17/2005.
May 2005	Updated TA55 PF-355 as a Hazard Category 2 nuclear facility per SER for SST Facility dated 5/25/2005.
October 2005	Removed TSFF from the nuclear facility list per SABM: Steele: Approval of 2nd LANL Submittal Request for TSFF Downgrade; dated 8/1/2005
January 2007	Removed TWISP from the nuclear facility list per "Authorization for Removal of TWISP Mission from the LANL Nuclear Facility List as a hazard Category 2 Activity; SABT:5485.3:CMK:103105; Removed TA-55 PF-185 from the List per "Authorization for Removal of TA-55-PF-185 from the nuclear facility list; SBT:5485.3:5SS-06-003; Remove LANSCE 1L Target, Lujan Center, and component storage facilities due to PCM-06-016 Titles of positions updated to reflect current operations model (RDL to FODs, SABM to SBT Leader)
September 2007	Removed TA-18 from the nuclear facility list per FRT:5RA-001, " Downgrade of TA 18 from a Hazard Category 2 nuclear facility to a Radiological Low Hazard Facility," dated 4/5/2007

Changes in Nuclear Facility Status

Date	Description
	Removed DVRS from the nuclear facility list per EO:2JEO-007, "Approval of Strategy for Future Operations at the Decontamination and Volume Reduction System (DVRS) Facility," dated 4/2/2007 Removed TA-10 per SBT:5KK-003, "Re-categorization of TA-10, Bayo Canyon Nuclear Environmental Site," dated 8/10/2007. Updated WCRRF due to ABD-WFM-005, R.0, Basis for Interim Operation for Waste Characterization, Reduction, and Repackaging Facility (WCRRF)," dated 4/23/2007. Updated NESs to be referenced "Documented Safety Analysis for Surveillance and Maintenance of Nuclear Environmental Sites at Los Alamos National Laboratory", NES-ABD-0101, R1.0, dated 6/26/07.
November 2008	TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) was approved to be re-categorized as a Hazard Category 3 nuclear facility per SBT:CMK-002. SST Pad removed as a nuclear facility per 5485.3/SBT:JF-39193, "Revocation of the Authorization Agreement for the Technical Area (TA)-55 Safe Secure Transport Facility, dated 1/16/08.
September 2009	Removed MDA B per SBT:25BLJ-56803 which approved final hazard categorization MDAB-ADB-I004 Removed WWTP per SBT:25LJ-49261 which approved final hazard categorization NES-ABD-0501 RI Removed Pratt Canyon per SBT:25BLJ-49261 which approves final hazard, categorization NES-ABD-0401 RI Added EF Firing Site per AD-NHHO:09-093
November 2010	Removed MDA-C per COR-SO-6.30.2010-264748 Removed TA-53 Resin Tank per COR-SO-2.8.2010-232928 Removed EF Site per COR-SO-9.15.2010-282846
December 2016	Added TWF Hazard Category 2 facility per OPS:55JR-707231

Table of Contents

List of Tables

Acronyms and Abbreviations

Acronym	Definition
BIO	Basis for Interim Operations
CFR	Code of Federal Regulations
CMR	Chemistry and Metallurgy Research (Facility)
CSO	cognizant secretarial officer
DOE	U.S. Department of Energy
DVRS	decontamination and volume reduction glovebox
EWM	Environmental Waste Management
FMU	facility management unit
FOD	Facility Operations Director
HC	hazard category
JCO	justification for continued operations
LACEF	Los Alamos Criticality Experiment Facility
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Science Center
LLW	low-level waste
MDA	material disposal area
NDA	nondestructive assay
NES	Nuclear Environmental Site
NHHO	Nuclear and High-Hazard Operations
NNSA	National Nuclear Security Administration
OSD	Operations Support Division
OSRP	Offsite Source Recovery Project
PRS	Potential Release Site
Pu	plutonium
RAMROD	Radioactive Material, Research, Operations, and Demonstration (Facility)
RANT	Radioactive Assay Nondestructive Testing (Facility)
RDL	Responsible Division Leader
RLWTF	Radioactive Liquid Waste Treatment Facility
SER	safety evaluation report
SM	South Mesa
SST	Safe-Secure Trailer

Acronym	Definition
TA	technical area
TSTA	Tritium System Test Assembly
TRU	transuranic
TWF	Transuranic Waste Facility
WCRRF	Waste Characterization, Reduction and Repackaging Facility
WETF	Weapons Engineering Tritium Facility
WFO	Weapons Facilities Operations
WWTP	Wastewater treatment plant

Foreword

1. This document was prepared by Safety Basis Division personnel at Los Alamos National Laboratory (LANL). This document provides a tabulation and summary information concerning hazard category 1, 2 and 3 nuclear facilities at LANL. Currently, there are no hazard category 1 facilities at LANL.

2. This nuclear facility list is updated as needed to reflect changes in facility status caused by inventory reductions, final hazard classifications, exemptions, facility consolidations, and other factors.

3. DOE-STD-1027-92 methodologies are the bases used for identifying nuclear facilities. Differences between this document and other documents that identify nuclear facilities may exist as this list only covers nuclear hazard category 2 and 3 facilities that must comply with the requirements stipulated in 10 CFR 830, Subpart B. Other documents might include facilities that have inventories below the nuclear hazard category 3 thresholds, such as radiological facilities.

List of Los Alamos National Laboratory Nuclear Facilities

1. Scope

Standard DOE-STD-1027-92, Change 1, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*, provides methodologies for the hazard categorization of DOE facilities based on facility material inventories and material-at-risk. This document lists Hazard Category 2 and 3 nuclear facilities because they must comply with requirements in Title10, *Code of Federal Regulations*, Part 830, Nuclear Safety Management, Subpart B, "Safety Basis Requirements." The Los Alamos National Laboratory (LANL) nuclear facilities that are below Hazard Category 3 (radiological facilities) have not been included on this list because they are exempt from the requirements in 10 CFR 830, Subpart B.

2. Purpose

This document provides a list of Hazard Category 2 (HC-2) and 3 (HC-3) nuclear facilities at LANL. The list will be revised, as appropriate, to reflect changes in facility status resulting from final hazard categorization, movement, relocation, or final disposal of radioactive inventories. The list shall be used as the basis for determining initial applicability of DOE nuclear facility requirements. The list now identifies the categorization of site wide transportation and environmental sites per the requirements of 10 CFR 830, Subpart B.

3. Applicability

This document is intended for use by the National Nuclear Security Administration (NNSA) and contractors with responsibilities for facility operation and/or oversight at LANL.

4. References

10 CFR 830. *Nuclear Safety Management*. Washington DC: Code of Federal Regulations, current version.

49 CFR 173. *Shippers-General Requirements for Shipments and Packagings*. Washington DC: Code of Federal Regulations, current version.

ANSI/HPS N43.6. *Sealed Radioactive Sources - Classification*. Englewood CO: Health Physics Society, 2007 Edition, Reaffirmed September 2013.

DOE O 420.2C. *Safety of Accelerator Facilities*. Washington DC: U.S. Department of Energy, July 21, 2011.

DOE-STD-1027-92. *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*. Change Notice 1. Washington DC: U.S. Department of Energy, September 1997.

5. Nuclear Facilities List

Table 1 identifies all HC-2 and HC-3 nuclear facilities at LANL. Facilities have been categorized based on criteria in DOE-STD-1027-92, Change 1. Site, zone or area, building number, name, and dominant hazard category identifies each facility. The dominant hazard category is determined by identifying the highest hazard category for multi-process facilities. Buildings, structures, and processes addressed by a common documented safety analysis have been designated as a single facility. DOE-STD-1027-92, Change 1, permits exclusion of sealed radioactive sources from a radioactive inventory of the facility if the sources were fabricated and tested in accordance with 49 CFR 173.469 or ANSI N43.6. In addition, material contained in U.S. Department of Transportation (DOT) Type B shipping containers may also be excluded from radioactive inventory. Facilities containing only material tested or stored in accordance with these standards do not appear in the list and tables that follow.

Table 1. Summary of LANL Nuclear Facilities

Hazard Category	Facility Name
2	Site Wide Transportation
2	TA-16 Weapons Engineering Tritium Facility (WETF)
2	TA-3 Chemistry and Metallurgy Research Facility (CMR)
2	TA-55 Plutonium Facility
3	TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF)
2	TA-50 Waste Characterization Reduction and Repackaging Facility (WCRRF)
2	TA-54 Waste Storage and Disposal Facility (Area G)
2	TA-54 Radioactive Assay Nondestructive Testing (RANT) Facility
2	TA-63 Transuranic Waste Facility (TWF)
2	TA-21 MDA A NES (General's Tanks)
2	TA-21 MDA T NES
3	TA-35 MDA W NES
2	TA-49 MDA AB NES
3	TA-54 MDA H NES

6. LANL Nuclear Facilities Summary Tables

Table 2 lists a brief description for each nuclear facility identified in Table 1. For all categorization basis information, go to the most current revision of the Safety Basis Document List for each facility. Safety Basis Document Lists are located at the following LANL web page.

http://int.lanl.gov/org/padops/adnhho/safety-basis/_subpages/safety-basis-document-list.shtml

Table 2. Nuclear Facility Categorization Information

TA	Bldg	Haz Cat	Facility Name	Description	FOD
Site Wide		2	Site Wide Transportation	Laboratory nuclear materials transportation	NHHO OSD
16	0205 0450	2	Weapons Engineering and Tritium Facility (WETF)	Perform research and development and to process tritium to meet the requirements of the present and future stockpile stewardship program	WFO
3	0029	2	Chemistry and Metallurgy Research Facility CMR	Actinide chemistry research and analysis	CMR
55	4	2	TA-55 Plutonium Facility	TA-55 PF-4 facility is a critical plutonium-processing facility in the DOE complex, and as such is essential to the continued assurance of the nuclear stockpile while performing its principle missions: • Conducting basic special nuclear material (SNM) research and technology development; • Processing a variety of plutonium-containing materials; • Building and dismantling nuclear weapon components; and • Preparing reactor fuels, heat sources, and other SNM devices.	TA-55
50	Multiple	3	TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF)	Collect, treat and store radioactive liquid waste (RLW) influent to meet discharge or disposal limits. Secondary operations consist of collecting, packaging, and disposing of radioactive sludge and residues.	TA-55

Table 2. Nuclear Facility Categorization Information

TA	Bldg	Haz Cat	Facility Name	Description	FOD
50	0069	2	TA-50 Waste Characterization Reduction and Repackaging Facility (WCRRF)	Waste characterization, reduction, and repackaging facility	EWM
	External	2		Drum staging activities outside TA-50-69	
54	Multiple	2	TA-54 Waste Storage and Disposal Facility (Area G)	Low-level waste (LLW) (including mixed waste) storage and disposal in domes, pits, shafts, and trenches. TRU waste storage in domes and shafts (does not include TWISP). TRU legacy waste in pits and shafts. Low-level disposal of asbestos in pits and shafts. Operations building; TRU waste storage.	EWM
54	0038	2	TA-54 Radioactive Assay Nondestructive Testing (RANT) Facility	TRUPACT-II and HalfPACT loading of drums for shipment to WIPP	EWM
21	21-014	2	TA-21 MDA A NES	An inactive Material Disposal Area containing two buried 50,000 gallon storage tanks (the "General's Tanks")	EWM
21	TA-21	2	TA-21 MDA T NES	An inactive Material Disposal Area consisting of four inactive absorption beds, a distribution box, a portion of the subsurface retrievable waste storage area, and disposal shafts.	EWM
5	35-001	3	TA-35 MDA W NES	An inactive Material Disposal Area consisting of two vertical shafts or "tanks" that were used for the disposal of sodium coolant used in LAMPRE-1 research reactor.	EWM
49	TA-49	2	TA-49 MDA AB NES	An underground, former explosive test site comprised of three distinct areas, each with a series of deep shafts used for subcritical testing.	EWM

Table 2. Nuclear Facility Categorization Information

TA	Bldg	Haz Cat	Facility Name	Description	FOD
54	54-004	3	TA-54 MDA H NES	An inactive Material Disposal Area located on Mesita del Buey containing nine shafts that were used for disposal of classified materials.	EWM
63	Multiple	2	TA-63 Transuranic Waste Facility	A facility for storage, characterization, and intra-site shipping of transuranic (TRU) waste.	EWM