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SWEIS Yearbook 2017

Front Cover photos: The Tranuranic Waste Facility, Technical Area 63, Building 144 (courtesy of Denise Gelston, Los Alamos National Laboratory, Technical Area 55 Radioactive Liquid Waste)

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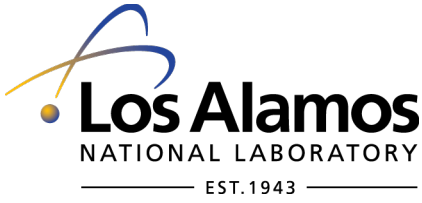
SWEIS Yearbook 2017

Comparison of 2017 Data with Projections of the 2008 Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory



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 year 2017. During 2017, LANL operations mostly fell within the 2008 SWEIS projections. Several facilities exceeded the 2008 SWEIS levels for waste generation quantities but all were infrequent, non-routine events that do not reflect day-to-day LANL operations. Chemical waste volumes in calendar year 2017 exceeded annual waste volumes for the Non-Key Facilities. This was the result of the disposition of press filter cakes and reverse osmosis reject water from the Sanitary Effluent Reclamation Facility (SERF). Gas, electricity, and water consumption remained within the 2008 SWEIS levels projected for utilities in calendar year 2017.

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.

Also 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 Notice of Intent to prepare a new SWEIS (DOE 2005a). The new SWEIS was issued in May 2008 (DOE 2008a). The 2008 SWEIS analyzed the potential environmental impacts of current and future operations at LANL. In September 2008, DOE/NNSA issued the first ROD for the 2008 SWEIS (DOE 2008b). DOE/NNSA chose to implement the No Action Alternative with the addition of some elements of the Expanded Operations Alternative. In July 2009, DOE/NNSA issued the second ROD for the 2008 SWEIS (DOE 2009a); 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 year 2017 to the 2008 SWEIS projections approved in the RODs. In calendar year 2017, Los Alamos National Security, LLC (LANS) was the management and operations contractor for the DOE/NNSA at LANL. In November 2018, a new management and operations contract became effective and Triad, LLC took over Los Alamos National Laboratory. Also in calendar year 2017, the DOE's Office of Environmental Management (DOE-EM) conducted legacy clean up work under a Bridge Contract with LANS. In December 2017, DOE announced the award of the new LANL legacy cleanup

contract to Newport News Nuclear BWXT-Los Alamos, LLC Alamos (N3B). N3B took over the legacy waste cleanup operations in April 2018.

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 year 2017 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 year 2017, 19 construction and modification projects were undertaken. Table 1 provides details.

Table 1. Calendar Year 2017 Construction and Modification Projects.

Key Facility	Construction/Modification Project
Plutonium Facility	Continued Projects: • The repurposing of existing laboratory space in the Plutonium Facility Building 04. • A combination facility (Technical Area 55, Building 432) was completed to support the Radiological Laboratory/Utility/Office Building (RLUOB) equipment installation project. • Installation of ventilated enclosures and tunnel access to enable efficient entry into the RLUOB began. • The Technical Area 55 Reinvestment Project construction continued.
Machine Shops	New Project in calendar year 2017: • New chiller upgrade for heat/treat operations located in Technical Area 03, Building 102.
High Explosives Processing	New Project in calendar year 2017: • Construction of the K-Site Control Building began at Technical Area 11.
	Continued Projects: • Technical Area 16, Building 307 modifications were completed in calendar year 2017. • Vertical blast wall installations were completed in calendar year 2017 at Technical Area 16, Building 260.
High Explosives Testing	New Projects for calendar year 2017: • Upgrades to the Eenie Firing Site were initiated in calendar year 2017.

	Continued Projects: • A new concrete pad and blast tube replacement were installed at the blast tube at Technical Area 36. • Construction of the new Dynamic Equation of State Facility was completed in May 2017 at Technical Area 40. • Building modification and upgrades to Technical Area 40, Building 5 were completed in April 2017. • Construction began on a new steel building at Technical Area 40, Building 15.
Tritium Facility	New Projects for calendar year 2017: • Building modifications and upgrades were completed in calendar year 2017.
Target Fabrication Facility	New Projects for calendar year 2017: • Upgrades were initiated to replace the heating, ventilation, air conditioning water cooling, and electrical systems in Technical Area 35, Building 213.
Radiochemistry Facility	New Projects for calendar year 2017: • Technical Area 48, Building 107 was brought online during calendar year 2017. • A permanent chiller and boiler were installed at Technical Area 48, Building 1.
Radioactive Liquid Waste Treatment Facility (RLWTF)	Continued Projects: • Construction of the new Low-level Radioactive Liquid Waste Facility continued in calendar year 2017.
Solid Radioactive and Chemical Waste Facilities	Continued Projects: • Construction was completed and operations began in calendar year 2017 at the new Transuranic (TRU) Waste Facility (TWF), Technical Area 63, Building 144.

During calendar year 2017, six construction and modification projects were undertaken in the Non-Key Facilities. Table 2 provides details.

Table 2. Non-Key Facilities Construction and Modification Projects

Project Title	Construction/Modification Project
Oppenheimer Collaboration Center	• Renovations on the first and second floors were completed in calendar year 2017. The basement floor design was complete, and construction began in calendar year 2018.
Upgrades to Fire Station One	• Construction was completed in calendar year 2017.
Technical Area 03 Substation	• Construction began in calendar year 2017.
Roof Assessment Management Program (RAMP)	• Construction began in calendar year 2017.
Supplemental Environmental Projects	• Construction began on the Mortandad Wetland Enhancement Supplemental Environmental Project (SEP) in calendar year 2017.

	• Construction began in calendar year 2017 for Phase 1 of the Low Impact Development project at Technical Area 3, Main Gate Pond. Phase 2 of the project is projected to begin in calendar year 2018.

In calendar year 2017, 69 capabilities were active and 15 capabilities were inactive at LANL's Key Facilities. Table 3 provides details.

Table 3. Key Facility Inactive Capabilities

Key Facility	Inactive Capabilities
Chemistry and Metallurgy Research Building (CMR) Key Facility	• destructive and nondestructive analysis • nonproliferation training • actinide research and development, and fabrication and processing
Tritium Facilities	• high-pressure gas fills and processing • diffusion and membrane purification • metallurgical and material research • hydrogen isotopic separation
High Explosives Testing Facility	• high explosives pulsed power experiments
Los Alamos Neutron Science Center (LANSCE)	• material test station • subatomic physics research • high-power microwaves and advanced accelerators
Solid Radioactive and Chemical Waste Facilities (SRCW)	• waste retrieval • waste disposal • decontamination operations
Plutonium Complex	• fabrication of ceramic-based reactor fuels

During calendar year 2017, all Key Facility operation levels were within the 2008 SWEIS.

In calendar year 2017, 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. Table 4 provides details.

Table 4. Calendar Year 2017 Waste Exceedances

Waste Type	Key Facility
Chemical Waste	• Sigma Complex – due to the disposal of beryllium contaminated waste. • High Explosives Processing Facilities – due to non-routine maintenance and construction activities and the disposal of propylene glycol/water mixture from maintenance activities. • High Explosives Testing Facilities – due to the removal of polychlorinated biphenyl contaminated soil and the removal of asphalt from Technical Area 40. • Target Fabrication Facility – due to the disposal of acid used to clean the heat exchanger. • RLWTF – due to the cleanup of an accidental diesel spill.

	• LANSCE – due to the disposal of waste generated from an office fire in Technical Area 53, Building 31. • SRCW 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 liquid, water from the maintenance of an access control system gate at Technical Area 55, and the disposal of unused/unspent products.
Low Level Waste (LLW)	• RLWTF – due to disposal of a wastewater by-product of the treatment process of radioactive liquid waste evaporator bottom at Technical Area 50. • SRCW – due to disposal of ongoing construction, demolition, and maintenance activities.
Mixed Low-Level Radioactive Waste (MLLW)	• LANSCE – due to the waste generated from the removal of the Lujan Flight path. • SRCW Facilities – due to the consolidating and repackaging of waste. • Plutonium Facility – due to the disposal of lead contaminated materials from housekeeping and maintenance operations.
TRU/Mixed TRU	• SRCW Facilities – due to the repackaging efforts.

In calendar year 2017, the Non-Key Facilities exceeded chemical waste volumes projected in the 2008 SWEIS due to the disposal of press filter cakes and reverse osmosis reject water from the SERF. In addition, LLW volumes exceeded the 2008 SWEIS projections due to the disposal of waste generated from the demolition of Technical Area 18, Casa 2 and 3.

Site-Wide Operations Data and Affected Resources

This Yearbook evaluates the effects of LANL operations during calendar year 2017 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 2017 totaled approximately 253 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 2017, maximum offsite dose to the maximally exposed individual was 0.47 millirem well below the 8.2 millirem per year projected in the SWEIS.

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

[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 LANSCE were much higher in those years due to 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.

In response to DOE Executive Order 13693, the Laboratory reported its greenhouse gas emissions from stationary combustion sources to the U.S. Environmental Protection Agency for calendar year 2017. These stationary combustion sources emitted approximately 42,558.5 metric tons of carbon dioxide equivalents in calendar year 2017.

Since 1999, the total number of permitted outfalls was reduced from 55 to 11 regulated under the National Pollutant Discharge Elimination System (NPDES) (LANL permit number NM0028355). In calendar year 2017, eight outfalls flowed totaling an estimated 104.8 million gallons, well under the 2008 SWEIS projected volume of 279.5 million gallons per year.

During calendar year 2017, groundwater monitoring, groundwater investigations, and installation of monitoring wells were performed pursuant to the 2016 New Mexico Environment Department Compliance Order on Consent (Consent Order) (NMED 2016a). Additionally, in 2017, DOE prepared a Supplement Analysis to the 2015 Environmental Assessment for the Chromium Plume Control Interim Measure and Plume Center Characterization (DOE 2017a). The proposal included drilling additional extraction wells and installing associated infrastructure to improve the effectiveness of the current system to control chromium plume migration. DOE determined the environmental impacts of the proposed actions were bounded by analysis presented in the 2015 Environmental Assessment. In 2017, three chromium infrastructure wells were installed (CrEX-2, CrEX-4 and CrIN-6) in Mortandad Canyon. DOE-EM completed installation of one new regional aquifer well (R-68) in Technical Area 09.

In calendar year 2017, 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 reverse osmosis reject water from the SERF. Waste quantities at specific Key Facilities that exceeded the 2008 SWEIS levels were infrequent, non-routine events. The 2008 SWEIS combined TRU and mixed TRU waste into one waste category since they are both managed for disposal at the Waste Isolation Pilot Plant (WIPP). In calendar year 2017, one shipment containing TRU and mixed TRU waste was transported to WIPP.

In calendar year 2017, DOE/NNSA removed approximately 10 structures at LANL, which eliminated 25,925 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 2017 was 274.8 million gallons. The 2008 SWEIS projection for water consumption was 459.8 million gallons. Improvements to the SERF operations have led to increased use of recycled effluent in cooling towers in calendar year 2017. In calendar year 2017, energy consumption was 466,220 megawatt-hours. The 2008 SWEIS projection for energy consumption was 651,000 megawatt-hours. Gas consumption for calendar year 2017 was 847 thousand decatherms. The 2008 SWEIS projection for gas consumption was 1.20 million decatherms.

Radiological exposures to LANL workers were within the levels projected in the 2008 SWEIS. The total effective dose equivalent for the LANL workforce in calendar year 2017 was 158.5 person-rem, much lower than the 280 person-rem workforce dose projected in the 2008 SWEIS. There were 101 recordable cases of occupation injury and illness in calendar year 2017, which represents a 24.4 percent decrease from 2016 In addition, approximately 20 cases resulted in

days away, restricted, or transferred duties in calendar year 2017, representing a 28.6 percent decrease from 2016. Both of these rates were well below 2008 SWEIS projections.

In the 2008 SWEIS No Action Alternative, the 2005 levels of employment at the Laboratory were projected to remain steady at 13,504. At the end of calendar year 2017, there were 11,782 employees.

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. In calendar year 2017, LANL continued annual surveys under the Threatened and Endangered Species Habitat Management Plan (LANL 2017a). 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. To date, the proposed expansion has not been necessary, so no cultural resources have been affected. DOE completed the required consultation with the State Historic Preservation Office for the demolition of four historic buildings in fiscal year 2017. In calendar year 2017, no tracts were conveyed or transferred as part of the EIS for Land Conveyance and Transfer (DOE 1999a). In 2017, LANL cultural resource staff members worked with the National Park Service on various park building assessments and repairs. This work was done in compliance with the 2014 National Defense Authorization Act providing legislation for the creation of the Manhattan Project National Historical Park (Park), as discussed in Section 3.9.

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ACKNOWLEDGMENTS

Marjorie Wright, Environmental Stewardship Group, served as the document manager for the 2017 SWEIS Yearbook. Renee Robinson, James Jackson, David Holtkamp, and Karen Musgrave also from the Environmental Stewardship Group, served as the chief contributors. Katharine Coggeshall, Communications Arts and Services, Renee Robinson and Brendi Heath (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.

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ACRONYMS AND ABBREVIATIONS

ALARA	as low as reasonably achievable
AOC	area of concern
BSL	Biosafety Level
CMR	Chemical and Metallurgy Research (Building)
CMRR	CMR Replacement
CMRR NF	Chemistry and Metallurgy Research Replacement Nuclear Facility
Consent Order	NMED Compliance Order on Consent
CRMP	Cultural Resources Management Plan
CY	Calendar Year
DART	Days away, Restricted, or Transferred
DARHT	Dual-Axis Radiographic Hydrodynamic Test (Facility)
DD&D	decontamination, decommissioning, and demolition
DNA	deoxyribonucleic acid
DOE	US Department of Energy
DOE-EM	DOE's Office of Environmental Management
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
GCS	Grade Control Structure
GHG	Greenhouse Gas Emissions
HWA	Hazardous Waste Act
HEPA	High-Efficiency Particulate Air (Filter)
IVML	In Vivo Measurements Laboratories
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
LANSCE	Los Alamos Neutron Science Center
LED	light-emitting diode
LID	Low Impact Development
Linac	Linear Accelerator
LLW	low-level radioactive waste
Metropolis Center	Nicholas C. Metropolis Center
MeV	million electron volts
MLLW	mixed low-level radioactive waste

MVA	megavolt amperes
N3B	Newport News Nuclear BWXT-Los Alamos, LLC Alamos
NEPA	National Environmental Policy Act
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
NPDES	National Pollutant Discharge Elimination System
OSRP	Off-Site Source Recovery Program
Park	Manhattan Project National Historic Park
PCB	polychlorinated biphenyl
PICT	Program in Interactive Cultural Technology
pRAD	Proton Radiography Facility
RAMP	Roof Assessment Management Program
RCRA	Resource Conservation and Recovery Act
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
SEP	Supplemental Environmental Project
SERF	Sanitary Effluent Reclamation Facility
SPEIS	Supplemental Programmatic Environmental Impact Statement (Complex Transformation)
SRCW	Solid Radioactive and Chemical Waste Facilities
SWEIS	Site-Wide Environmental Impact Statement
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TRC	Total Recordable Case
TRP	Technical Area 55 Reinvestment Project
TRU	Transuranic
TWF	Transuranic Waste Facility
UNM	University of New Mexico
WETF	Weapons Engineering Tritium Facility
WIPP	Waste Isolation Pilot Plant

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 1999b). DOE issued its Record of Decision (ROD) for this SWEIS in September 1999 (DOE 1999c), which identified the decisions DOE made on future levels of operation at LANL.

In August 2005, DOE/National Nuclear Security Administration (NNSA) issued a Notice of Intent to prepare a new SWEIS (DOE 2005a). The new SWEIS was issued in May 2008 (DOE 2008a). 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 2008b).

Concurrently, DOE/NNSA analyzed actions described in the Final Complex Transformation Supplemental Programmatic Environmental Impact Statement (Complex Transformation SPEIS) (DOE 2008c). DOE/NNSA did not make any decisions regarding nuclear weapons production at LANL, prior to the completion of the Complex Transformation SPEIS. 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 its first ROD for the 2008 SWEIS. (DOE 2008b).

The second ROD for the 2008 SWEIS was issued in June 2009 (DOE 2009a). In this ROD, DOE/NNSA continued to select the No Action Alternative from the 2008 SWEIS but decided to implement additional elements of the Expanded Operations Alternative specifying operational changes.

Since the issuance of the SWEIS, DOE/NNSA has prepared five supplement analyses to the 2008 SWEIS and one amended ROD. These supplement analyses and amended ROD are summarized in Table 1-1.

Table 1-1. 2008 SWEIS Supplement Analyses.

Reference Number	Issue Date	Summary
DOE/EIS-0380-SA-01	October 2009	DOE/NNSA prepared a supplement analysis (DOE 2009b) 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 was bounded by the 2008 SWEIS transportation analysis.
DOE/EIS-0380-SA-02	April 2011	DOE/NNSA prepared a supplement analysis (DOE 2011a) to assess activities of the Offsite Source Recovery Project to recover and manage high-activity beta/gamma sealed sources from Uruguay and other locations.
DOE/EIS-0380, 76 FR 131	July 2011	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.
DOE/EIS-0380-SA-03	May 2016	DOE/NNSA prepared a supplement analysis to the 2008 SWEIS for the proposal to implement facility 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/EIS-0380-SA-04	October 2016	DOE/NNSA prepared a 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 (WIPP). DOE/NNSA determined there would be no substantial changes and the proposed actions were bounded by the analyses presented in the 2008 SWEIS (DOE 2016b)
DOE/EIS-0380-SA-05	April 2018	In 2017, DOE/NNSA initiated preparation of a fifth supplement analysis to review changes in operations at the Laboratory since the issuance of the 2008 SWEIS (2008 through 2017) and evaluate the continued adequacy of the 2008 SWEIS for the future of LANL operations (2018 through 2022). This supplement analysis indicated that the environmental impacts for the periods from 2008 through 2017 and those projected for 2018 through 2022 have not substantially changed from those projected for the projects and operations selected in the SWEIS RODS and were bounded by the analyses presented in the 2008 SWEIS (DOE 2008a).

1.2 2008 SWEIS Yearbook

The DOE/NNSA and LANL have implemented a program where annual comparisons would be made between 2008 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 2008 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.

Each Yearbook 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 during the calendar year (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, (1) number of workers, (2) radiation doses, (3) workplace incidents, (4) utility requirements, (5) air emissions, (6) liquid effluents, and (7) 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.
- *Summary and conclusion.* Chapter 4 summarizes calendar year data for LANL in terms of overall facility constructions and modifications, facility operations and operations data, and environmental parameters. These data 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[2] at the time the SWEIS was issued and all facility changes in hazard category through the calendar year.

[2] DOE-STD-1027-92 DOE, U.S. Department of Energy (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 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.

Data for comparison come from a variety of sources, including facility records, operations reports, facility personnel, and the Annual Site Environmental Report.[3] The focus on operations, rather than on programs, missions, or funding sources, is consistent with the approach of the 2008 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 Laboratory 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 Year 2017 SWEIS Yearbook

This Yearbook represents data collected for calendar year 2017 as compared with the 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.

DOE's Office of Environmental Management (DOE-EM) is responsible for legacy waste cleanup operations at LANL. The legacy waste generation was projected in the 2008 SWEIS through fiscal year 2016. To ensure that DOE-EM annual waste generation meets the 2008 SWEIS projections, the annual waste generation total will be added to the cumulative total (calendar year 2008 through calendar 2017) and then compared to the projected total for DOE -EM operation data. The Key Facilities and Non-Key Facilities waste volumes will continue to be compared to the projected estimates identified in Table 5-39 of the 2008 SWEIS. In addition, beginning in the 2017 SWEIS Yearbook, the number of waste shipments and disposal locations will be tracked in Section 3.3 Solid Radioactive and Chemical Wastes. The legacy waste cleanup work at LANL was transitioned to a bridge contract under DOE-EM in October 2015. In December 2017, DOE announced the award of the new LANL legacy cleanup contract to Newport News Nuclear BWXT-Los Alamos, LLC Alamos (N3B). N3B took over the legacy waste cleanup operations in April 2018.

1.4 NEPA Documents Prepared in 2017

In calendar year 2017, DOE prepared a supplement analysis (DOE 2017a) to the 2015 Final Environmental Assessment for Chromium Plume Control Interim Measure and Plume Center Characterization (DOE 2015a). The proposal included drilling additional extraction wells and installing associated infrastructure to improve the effectiveness of the current system to control chromium plume migration. In the supplement analysis, DOE-EM determined the environmental impacts of the proposed actions were bounded by analysis presented in the 2015 Environmental Assessment.

[3] 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."

DOE/NNSA issued nine categorical exclusions for projects in 2017:

- *Los Alamos National Laboratory Domestic and Foreign Sealed Source Recovery Project (DOE 2017b).*
- *115 kV Transmission Line (Norton Line) Grant of Easement for Right-of Way Contract Renewal (DOE 2017c).*
- *Los Alamos County Landfill Cap Repair Project (DOE 2017d).*
- *Los Alamos County Department of Public Utilities Proposed New Easement for the Construction and Operation of a Switchgear Substation and Underground Duct Bank including Electric Lines and Related Utility Appurtenances (DOE 2017e).*
- *Mortandad Wetland Enhancement Supplemental Environmental Project (DOE 2017f)*.
- *Succeeding (New) Lease for the Los Alamos Transit Mix Plant (DOE 2017g).*
- *Los Alamos Canyon Reservoir Waterline Replacement Project (DOE 2017h).*
- *Uranium Machining Consolidation at Technical Area 3, Building 66 (DOE 2017i).*
- *Upper Cañon de Valle Watershed Enhancement Project (DOE 2017j).*

2.0 FACILITIES AND OPERATIONS

LANL operations are conducted within numerous facilities located in 49 designated 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. In 2017, LANL managed 904 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 number includes approximately 770 permanent buildings and 134 temporary structures (i.e., trailers and transportable buildings). In calendar year 2017, LANS also leased approximately 43 buildings and trailers 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 1999b) developed the Key Facility concept, and is 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 site 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 are critical to meeting mission objectives and (1) house operations that have potential to cause significant environmental impacts, (2) are of most interest or concern to the public (based on comments in the 1999 and 2008 SWEIS public hearings), or (3) might be subject to change because of DOE/NNSA programmatic decisions.

The definition of each Key Facility hinges upon operations[4], capabilities, and location and 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.

In 2008, Pajarito Site (Technical Area 18), one of the Key Facilities identified in the 1999 SWEIS, 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 2017b). For the purpose of the 2008–2017 SWEIS Yearbooks, Pajarito Site has been removed as a Key Facility. In addition, the 2008 SWEIS recognized the Nicholas C. Metropolis Center (Metropolis Center), also known as the Strategic Computing Complex, as a new Key Facility because of the amount of electricity and water it uses.

4 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), subatomic investigations (e.g., using the LANSCE linear accelerator), and 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.

This chapter discusses each of the 15 Key Facilities from three aspects: (1) significant facility construction and modifications, (2) types and levels of operations, and (3) environmental effects of operations that have occurred during calendar year 2017. 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 year 2017 are summarized in previous Yearbooks.

Since the issuance of the 2008 SWEIS, DOE/NNSA and LANL have published three lists identifying nuclear facilities at LANL (LANL 2017b). 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 (TWF) at Technical Area 63 was added as a Hazard Category 2 facility (LANL 2017b).

Chapter 2 also discusses Non-Key Facilities, which include buildings and structures not part of a Key Facility and make up the balance of LANL facilities. The Non-Key Facilities represent a significant fraction of LANL, comprising approximately half of LANL land and all or the majority of 30 of the 49 technical areas, including Technical Area 00.The Non-Key Facilities include important buildings and operations such as, (1) the Nonproliferation and International Security Center; (2) the National Security Sciences Building, (3) the main administration building; and (4) 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, and Figure 2-2 illustrates locations of the technical areas and the Key Facilities.

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	14, 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 (SRCW) Facilities	50, 54, and 63	949
Plutonium Facility Complex	55	93
Subtotal, Key Facilities	19 of 49 Technical Areas	11,840
All Non-Key Facilities	30 of 49 Technical Areas	14,218
Total: LANL		**26,058**

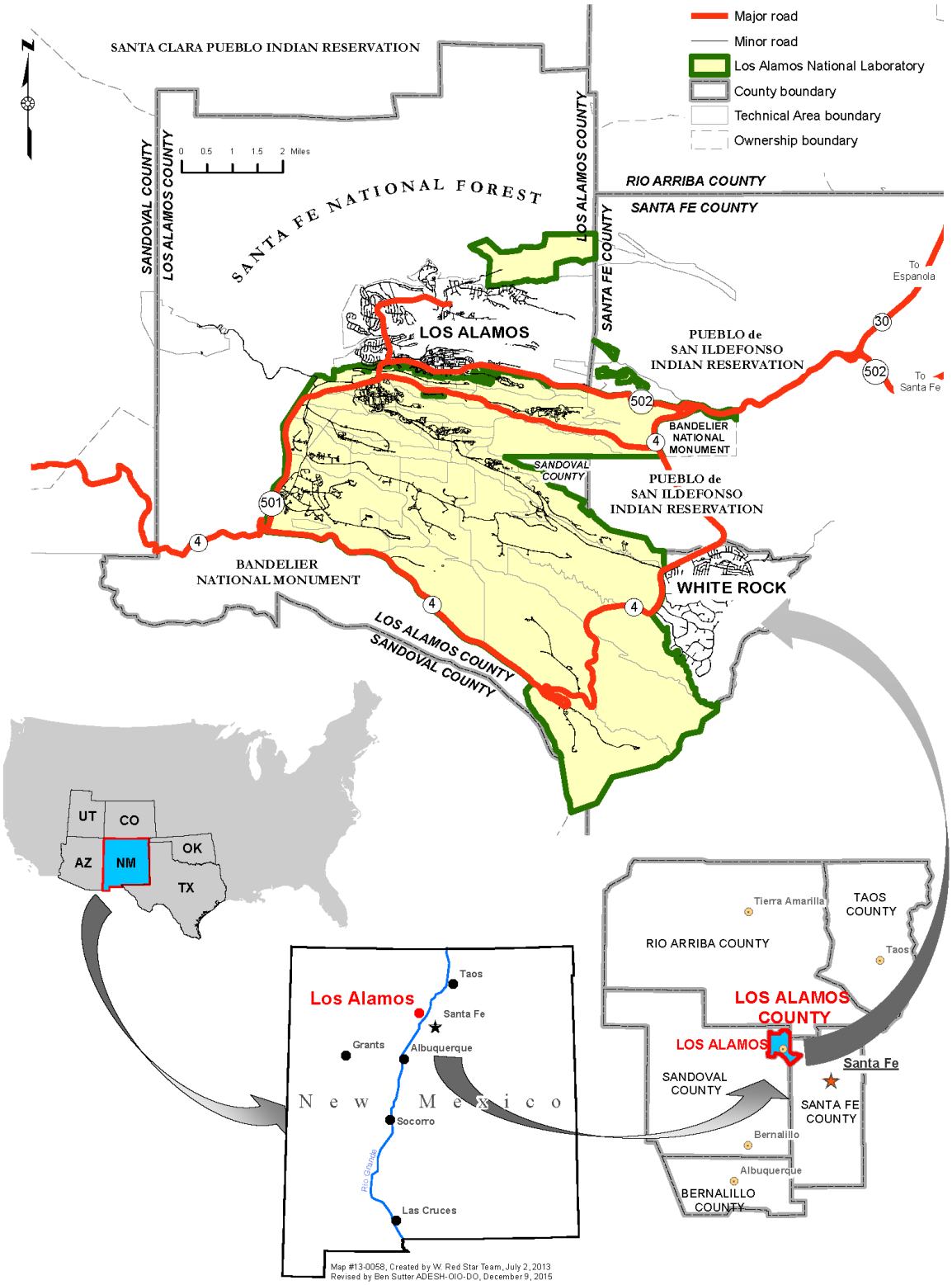

Figure 2-1. Location of LANL.

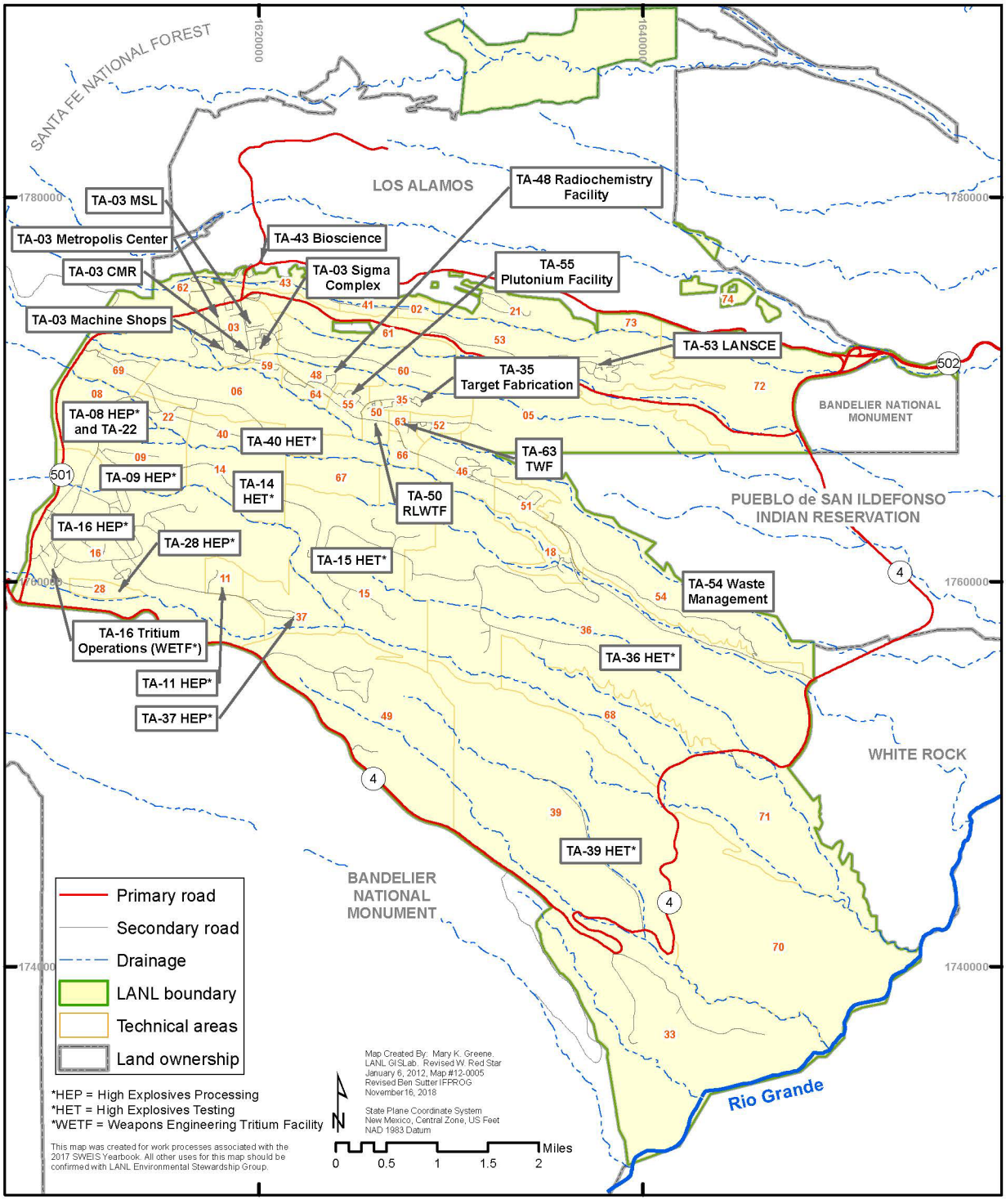

Figure 2-2. Location of Technical Areas and Key Facilities.

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 the following: (1) analytical chemistry, (2) plutonium metallurgy, (3) uranium chemistry, and (4) engineering design and drafting activities. When 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 1999b).

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 2017*
Technical Area 03, Building 29	CMR	2	2

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

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 Environmental Impact Statement (EIS) for the CMRR Project (DOE 2003). It evaluated the potential for environmental impacts resulting from activities associated with consolidating and relocating the mission-critical CMR Building capabilities at LANL and the replacement of the CMR Building. In its ROD issued in February 2004, DOE/NNSA decided to replace the CMR Building with a new Hazard Category 2 Nuclear Facility (CMRR NF) at Technical Area 55 and to completely vacate and demolish the CMR Building (DOE 2004a). Since the issuance of the 2004 ROD, several changes have occurred that required further NEPA analysis. Table 2-3 discusses the history of National Environmental Policy Act (NEPA) for CMRR. On February 13, 2012, DOE/NNSA deferred the CMRR NF, and on August 21, 2014, Deputy Secretary of Energy Daniel Poneman approved the cancellation of the CMRR NF.

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

Table 2-3. CMR NEPA.

Reference Number	Issue Date	Summary	Decision
DOE/EIS-0350-SA-01	January 2005	A supplement analysis (DOE 2005b) to the CMRR EIS was written to determine if the environmental impacts of proposed changes to the location of the CMRR NF 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.
DOE/EIS-0350-S1	August 2011	DOE/NNSA issued a Supplemental EIS for the CMRR NF to evaluate the potential environmental impacts from revised alternatives for constructing and operating the CMRR NF and from ancillary projects that had been proposed since publication of the CMRR EIS (DOE 2011c)	DOE/NNSA selected the Modified CMRR NF Alternative described in the Supplemental EIS to proceed with the design and construction of the CMRR NF at LANL(DOE 2011d).
DOE/EIS-0350-SA-2	January 2015	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 RLUOB or the Plutonium Facility.	In January 2015, DOE/NNSA determined that the proposal to relocate capabilities did not represent a substantial change in environmental impacts as described in the CMRR EIS (DOE 2015b).

In 2003, modifications to Wing 9 in the CMR Building were started in support of the Confinement Vessel Disposition Project to provide for the disposition of large vessels previously used to contain experimental explosive shots involving various actinides (DOE 2004b). The project was placed on hold in 2004 and not restarted until 2009. In 2010, installation of the confinement vessel disposition enclosure and glovebox began and vessel processing began in 2014. Since 2014, six vessels have been processed, two of the six were processed in calendar year 2017.

In calendar year 2017, construction activities continued for relocating analytical chemistry and materials characterization capabilities out of the CMR Building. The repurposing of existing laboratory space also continued in the Plutonium Facility Building 4. 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, installation of the enclosures, the craft fabrication/staging area at the combination facility (Technical Area 55, Building 432), and tunnel access to enable efficient entry and egress for crews.

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 year 2017, 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 three principal buildings: the Sigma Building (Technical Area 03, Building 66), the Beryllium Technology Facility (Technical Area 03, Building 141), and the Forming Building (Technical Area 03, Building 159; previously referred to as the Thorium Storage Building), as well as several support and storage facilities. 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 4,000-square-foot addition was proposed to be added on the northeast corner of the main Sigma building (Technical Area 03, Building 66). In 2017, DOE/NNSA issued a categorical exclusion for the uranium machining consolidation within the new addition proposed for the Sigma building. Uranium machining operations from the Machine Shops at Technical Area 03, Building 102 would be relocated to the Sigma building to improve the efficiency of machining operations that support hydrodynamic tests and other mission critical programs (DOE 2017i). Initial construction efforts began in calendar year 2018.

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 year 2017 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 were below levels projected in the 2008 SWEIS, with one exception. In calendar year 2017, chemical waste generation at the Sigma Complex exceeded 2008 SWEIS projections because of the disposal of beryllium contaminated waste, which accounted for approximately 79 percent (19,481.8 kilograms) of chemical waste generated.

2.3 Machine Shops (Technical Area 03)

The Machine Shops Key Facility consists of two buildings, the Nonhazardous and Hazardous Materials Machine Shop (Technical Area 03, Building 39) and the Radiological Hazardous Materials Machine Shop (Technical Area 03, Building 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. 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.

In calendar year 2017, the following facility modification was made to Technical Area 03, Building 102 machine shop.

- A new chiller was installed for heat treat operations located in Technical Area 03, Building 102 (heat treat room 125), which will result in more efficient heat treat operations.

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 year 2017 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 Complex (Technical Area 03)

The Materials Science Laboratory Complex comprises several buildings in Technical Area 03 (Building 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 five major types of experimentation: (1) materials processing, (2) mechanical behavior in extreme environments, (3) advanced materials development, (4) materials characterization, and (5) applied energy research.

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.[5] In calendar year 2017, 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.

[5] 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)

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

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 at Technical Area 03, Building 2327. It is the home of the Trinity Supercomputer (one of the 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[6] 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.

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.

In 2015, preparation and planning for the Exascale Class Computer Cooling Equipment Project commenced. The project will expand the water cooling capability of the Metropolis Center by 4,800 tons. 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

[6] 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, or 2 to the 40th power flops.

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 a NEPA determination for this project (DOE 2016c). 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 groundwater and 73 million gallons (276 million liters) per year of reclaimed water from the Sanitary Effluent Reclamation Facility (SERF). 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. In 2017, design for the Exascale Class Computer Cooling Equipment Project continued.

2.5.2 Operations at the Metropolis Center

The 2008 SWEIS identified one capability at the Metropolis Center. This capability was active in calendar year 2017 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.[7] The Metropolis Center water consumption is currently metered. Water usage is monitored daily and reported monthly. In calendar year 2017, the Metropolis Center used approximately 10.5 megawatts of electricity, 11 million gallons (22.7 million liters) of groundwater, and 32.9 million gallons (124 million liters) of reclaimed water from the SERF. Operations data

[7] 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 2016c).

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 Area Buildings and include: (1) production and assembly facilities, (2) analytical and synthesis laboratories, (3) test facilities, (4) explosives storage magazines, (5) units for treating hazardous explosive waste by open burning, and (6) a facility for treatment of explosive-contaminated wastewaters. Activities consist primarily of manufacture and assembly of detonators for nuclear weapons, 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 09, 11, and 16. Technical Area 08 houses nondestructive testing, including radiography and ultrasonic activities.

Operations within the High Explosives Processing Facilities are performed by personnel in multiple directorates, divisions, and groups. 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 the High Explosives Processing Facilities.

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.
- Removal or demolition of vacated structures that are no longer needed.

The Technical Area 16 Engineering Complex project was cancelled. Construction and modifications to Technical Area 16 buildings were initiated or completed in calendar year 2017 including:

- 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. This work was completed in May 2017.
- 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 (LANL 2015a). Blast wall installation was completed in May 2017.

- Construction of the K-Site Control Building at Technical Area 11 began in calendar year 2017. The Control Building will be used to monitor safety and mechanical testing operations at Technical Area 11, Building 30. Construction was completed in July 2017.

No structures were demolished or removed during calendar year 2017.

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 year 2017 and all were below operational levels projected in the 2008 SWEIS (Table A-11). 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 (37,500 kilograms) of explosives and 2,910 pounds (1,320 kilograms) of mock explosives. In calendar year 2017, less than 12,000 pounds (5,443 kilograms) of high explosives and less than 1,000 pounds (453.5 kilograms) of mock explosives material were used in the fabrication of test components for internal and external customers. In calendar year 2017, materials tested at Technical Area 09 resulted in 518 shots expended within the High Explosives Testing Key Facility and 779 pounds (353.3 kilograms) of explosives. Materials testing at Technical Area 22 expended less than 4 pounds (1.8 kilograms) of pentaerythritol tetranitrate-based detonators.

In calendar year 2017, high explosives processing and high explosives laboratory operations generated approximately 13,953 gallons (52,818 liters) of explosive-contaminated water, 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 1,693 pounds (768 kilograms) of water-saturated high explosives and 2,560 pounds (1,161 kilograms) of high explosives-contaminated scrap metal treated annually. No explosives-contaminated solvents were treated. Approximately 4,140 gallons (15,671 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 year 2017, 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. One detonator lot typically takes a year-and-a-half from start to finish to complete. No major product lines were manufactured in calendar year 2017, but work was on-going.

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 one exception. In calendar year 2017, chemical waste generation at the

High Explosives Processing Facility exceeded 2008 SWEIS projections due to the disposal of non-routine maintenance and construction activities, which accounted for 73 percent (39,900 kilograms) of the chemical waste generated at the facility, 28 percent (16,915 kilograms) from the disposal of propylene glycol/water mixture used for weapons facilities maintenance operations, and 9 percent (5,292 kilograms) from Technical Area 09, Building 45 maintenance and construction activities. 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 within this Key Facility 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 year 2017. Several modifications and upgrades to existing facilities were initiated or completed in calendar year 2017.

- In calendar year 2017, the installation of a double-walled replacement tank at Technical Area 15, Building 313, was completed. This project is still pending approval from the New Mexico Environment Department (NMED).
- In calendar year 2017, various upgrades to the Eenie Firing Site, Technical Area 36, Building 3, were initiated. Construction activities include upgrading communication and power installations, relocating siren and light equipment, and regrading and paving the surrounding area of the firing point to maintain the facility for high explosives operations. The upgrades are projected to be completed in calendar year 2018.
- A new concrete pad and blast tube replacement were installed at the blast tube at Technical Area 36, Lower Slobbovia Firing Site.
- In 2017, construction of a new steel building at Technical Area 40, Building 15 continued. The purpose of the upgrade is to create a new indoor firing facility to allow for year-round mission capability. The project continued in 2018.
- In calendar year 2015, DOE/NNSA proposed the construction of the new Dynamic Equation of State Facility. Construction of this facility began in calendar year 2017 and was completed in May 2017.

- Building modifications and upgrades to Technical Area 40, Building 5 began in calendar year 2016 and were completed in April 2017. Upgrades and modifications included the following: (1) the installation of new Armag®[8] units, (2) a new exhaust fan, (3) new electrical outlets to power the Armag® units, (4) a new inlet for storm drainage, and (5) the removal of the existing exterior steel blast shields.

2.7.2 Operations at the High Explosives Testing Facilities

The 2008 SWEIS identified six capabilities at this Key Facility. No high explosives pulsed power experiments were conducted. All six of the capabilities were active in calendar year 2017 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 2017, 365 pounds (165 kilograms) of depleted uranium was expended. The quantity of expended depleted uranium includes the quantity of depleted uranium expended during material sanitization.

Five hydrotests were performed at the DARHT Facility in calendar year 2017. Intermediate-scale dynamic experiments containing beryllium using single-walled steel containment vessels continued at the Eenie Firing Site Technical Area 36, Building 3, 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 2017 due to the removal of polychlorinated biphenyl (PCB) contaminated soil, which accounted for 68 percent (338,312 kilograms) of the chemical waste generated and to the removal of asphalt from Technical Area 40, which accounted for 15 percent (72,575 kilograms) of chemical waste generated at the High Explosives Testing Facilities. Table A-14 provides operations data details.

2.8 Tritium Facility (Technical Area 16)

The Weapons Engineering Tritium Facility (WETF) in Technical Area 16 is the principal building in this Key Facility. 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 8024. 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 8024 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, are included as part of the Plutonium Complex Facility.

[8] Armag® Corporation manufactures secure, modular storage vaults used for high explosives storage.

WETF is listed as a Hazard Category 2 Nuclear Facility (Table 2-4). In calendar year 2017, the tritium inventory at WETF was greater than 30 grams.

Table 2-4. WETF Buildings with Nuclear Hazard Classification

Building	Description	2008 SWEIS	LANL 2017*
Technical Area 16, Building 205	WETF	2	2
Technical Area 16, Building 450	WETF	2	2

∗ List of LANL nuclear facilities (LANL 2017b).

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.

The DD&D of Technical Area 21 tritium facilities was completed in 2010. In calendar year 2017, WETF completed the following facility upgrades and building modifications:

- pressure safety system upgrades,
- mercury trap installation, and
- liquid nitrogen tank replacement.

2.8.2 Operations at the Tritium Facilities

The 2008 SWEIS identified eight capabilities for this Key Facility.[9] Four of the eight capabilities were active in calendar year 2017. All capabilities were below operational levels projected in the 2008 SWEIS (Table A-15). No gas processing operations were conducted in calendar year 2017. Five flanged tritium waste containers (containing 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 be required to meet offsite disposal requirements. DOE/NNSA is considering offsite disposal at the Nevada National Security Site and/or at a commercial facility. It is anticipated that actions to prepare for offsite disposal will begin in calendar year 2019.

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 three-story, 70,000-square-foot building with laboratory and office space and a penthouse floor with mechanical systems. The Target Fabrication Facility houses activities related to weapons production, precision machining, target assembly and target characterization (metrology), polymer foam materials, computer tomography, and laser fusion research. This Key Facility is categorized as a moderate-hazard, non-nuclear facility. The Target Fabrication Facility has laboratories and machine shops

9 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.

(fabrication is specialized to provide precision machining, polymer science, physical and chemical vapor deposition, target assembly, and specialized 3-D printing). Machining is micro-machining using a diamond turning process.

2.9.1 Construction and Modifications at the Target Fabrication Facility

The 2008 SWEIS projected no major facility modifications to this Key Facility. The following modifications and upgrades to the facility were initiated or completed in calendar year 2017.

- An engineering study and design was conducted to include the conversion and replacement of air-cooled chillers and building-wide pneumatic controls. This involved replacing previously failed equipment (fans, dampers, chilled water, hot water systems, and cooling tower control valves).
- Upgrades were initiated to replace the heating, ventilation, air conditioning water cooling, and electrical systems in Technical Area 35, Building 213. .

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 year 2017 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 purposes in calendar year 2017 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, with one exception. In calendar year 2017, chemical waste generation at the Target Fabrication Facility exceeded the 2008 SWEIS projections due to the cleaning of the heat exchanger, which requires the use of acid; this accounted for 81 percent of the total chemical waste generated (3,556.2 kilograms). Table A-18 provides operations data details.

2.10 Bioscience Facilities (Technical Areas 43, 03, 35, and 46)

Bioscience Facilities include the main Health Research Laboratory (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 (BSL) -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. DOE/NNSA cancelled the project.

In calendar year 2017, DOE/NNSA issued a categorical exclusion for a new modular biosafety level 2 facility. This would be a replacement facility for Bioscience operations that are currently conducted at Technical Area 43, Building 1. The former location of the Press Building (Technical Area 03, Building 35) is being evaluated for installation (DOE 2017k).

During calendar year 2004, construction was finalized on the BSL-3 facility. The BSL-3 facility is a windowless, single-story 3,202-square-foot stand-alone biocontainment facility located in Technical Area 03, Building 1076. 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 BSL-3 facility (DOE 2005c). A draft EIS was in final review prior to release for public comment. Currently, the EIS is expected to be rescinded by the DOE/NNSA, and the facility would be utilized for BSL-2 operations. 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 year 2017 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 bases.

This Key Facility has BSL-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. BSL-2 work is expanding as part of LANL's growing Chemical and Biological Nonproliferation Program.

The Radiation Protection Services Group's In Vivo Measurements Laboratories (IVML) program maintains equipment and facilities for the direct (in vivo) monitoring of personnel for intakes of radioactive materials in Technical Area 43, Building 1 and is a capability within this Key Facility. The IVML program is part of the overall LANL Radiation Protection and Internal Dosimetry Programs at LANL. The TA-43 IVML facility is located in the subbasement of Building 1 and includes two 20-centimeter-thick pre-World War II steel counting chambers (SB-14 and SB-16), associated detection equipment, change rooms, support space (offices, storage, etc.), and a

dedicated ventilation system with high-efficiency particulate air (HEPA) filters. The ventilation system provides filtered outdoor air for the counting chambers to minimize background from naturally occurring radon and thoron decay products. Sealed radioactive sources used for instrument calibrations and quality control measurements are maintained in the IVML facility. The IVML program is accredited by the DOE Laboratory Accreditation Program for Radiobioassay in accordance with the requirements in 10 CFR 835.403. In April 2015, the IVML program was modified to focus operations on in vivo measurements for fission and activation products deposited in the whole-body. Routine in vivo measurements for uranium and transuranic radionuclides deposited in the lungs were discontinued. 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 2017, the SB-16 system was the primary system in use, with SB-14 maintained as a backup. The radiation detectors used by IVML require cooling to approximately –190 °C for proper operation. For the SB-16 detectors, this is accomplished using electromechanical coolers, while SB-14 utilizes liquid nitrogen. The SB-14 lung detector array was taken out of service and LN2 fills discontinued in February 2017 due to the failure of one of the detectors in the array and the LN2 supply system. The system was maintained for whole-body counting into August 2017 when the system was shut down and the use of liquid nitrogen was discontinued. The SB-16 system remained operational for all of 2017. In calendar year 2017, a total of 227 workers were counted at the TA-43 IVML facility along with associated quality assurance and instrument calibration measurements.

2.10.3 Operations Data for the Bioscience Facilities

In calendar year 2017, 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, dealing primarily with radiological and chemical analyses of samples. Technical Area 48 contains six major research buildings: 1, 17, 28, 45, 107, and 8.

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 year 2017.

- Technical Area 48, Building 107 was brought online during 2017.
- The temporary chiller for Technical Area 48, Building 1 was removed and a permanent one installed during 2017.
- Boiler replacement occurred at Technical Area 48, Building 1 during 2017.

2.11.2 Operations at the Radiochemistry Facility

The 2008 SWEIS identified 10 capabilities at the Radiochemistry Facility.[10] All 10 capabilities were active in calendar year 2017 (Table A-21).

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: (1) the RLWTF Building (Technical Area 50, Building 1), (2) the influent storage building for low-level radioactive liquid wastes (Technical Area 50, Building 2), (3) the influent storage building for TRU radioactive liquid waste (Technical 50, Building 66), (4) a 100,000-gallon (380,000-liter) influent tank for LLW (Technical Area 50, Building 90), (5) a facility for the storage of secondary liquid wastes (Technical Area 50, Building 248), and (6) the Waste Mitigation and Risk Management Facility (Technical Area 50, Building 250). Building 250 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 2-5). 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 2-5. RLWTF Buildings with Nuclear Hazard Classification

Technical Area 50 Building	Description	2008 SWEIS	LANL 2017*
1	RLWTF Building	3	3
2	Influent Storage Building for LLW	3	3
66	Influent Storage Building for TRU	3	3
90	Holding Tank for LLW	3	3
248	Evaporator Storage Tanks	3	3

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

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.

The following construction and modifications took place during calendar year 2017.

- Construction of a replacement Low-Level Radioactive Liquid Waste Facility began in calendar year 2015 and continued during calendar year 2017. The design of the replacement of the TRU Liquid Waste Facility was completed during calendar year 2017, but construction has not begun.

[10] 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.

- Solar evaporation tanks were installed at Technical Area 52 calendar year 2012, but have yet to be used. Startup awaits NMED approval of a permit application submitted in August 2012.

2.12.2 Operations at the RLWTF

The 2008 SWEIS identified two capabilities at this Key Facility. Both capabilities were active in calendar year 2017 and were below operational levels projected in the 2008 SWEIS (Table A-22).

2.12.3 Operations Data for the RLWTF

The primary measurement of activity for this Key Facility is the volume of radioactive liquid waste processed through the main treatment plant. In calendar year 2017, the RLWTF received 3.95 million liters of influent; two percent of this was delivered by truck (15 tankers). A total of 3.4 million liters of treated water were discharged to the environment via the effluent evaporator. No treated water was discharged to Mortandad Canyon. There was no TRU radioactive liquid waste activity during calendar year 2017. No waste transfers were received from Technical Area 55; no treatment or solidification occurred.

Operations data levels at the RLWTF remained below levels projected in the 2008 SWEIS, with two exceptions. In 2017, chemical waste generated at RLWTF exceeded 2008 SWEIS projections due to the clean-up of an accidental diesel spill that accounted for 94 percent (kilograms) of the chemical waste. In 2017, LLW generation exceeded 2008 SWEIS projections due to a wastewater byproduct of the treatment process of radioactive liquid waste evaporator bottoms at Technical Area 50, which accounted for approximately 94 percent (608 cubic meters) of the LLW generated at RLWTF.

2.13 Los Alamos Neutron Science Center (Technical Area 53)

LANSCE lies entirely within Technical Area 53. This Key Facility has more than 400 structures, including one of the largest buildings at LANL. Building 3, which houses the linear accelerator (linac), is 315,000 square feet. Activities consist of the following: (1) neutron science and nuclear physics research, (2) proton radiography, (3) the development of accelerators and diagnostic instruments, and (4) 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: (1) the Manuel Lujan Neutron Scattering Center, (2) the Weapons Neutron Research Facility, (3) the Isotope Production Facility, (4) Experimental Area B (known as the Ultracold Neutron Facility), and 5) Experimental Area C (the Proton Radiography Facility).

Experimental Area A, formerly used for nuclear physics experiments using pi mesons,[11] 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 365 is currently being used for modern LANSCE linac injector and radio frequency system development. 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 2015b) and the LANSCE Accelerator Safety (LANL 2015c).

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

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).

In 2017, cleanup activities at the Proton Radiography Facility (pRad) (Technical Area 53, Building 596) began to remediate contaminated soil around the facility. Further modifications and updates to the pRad facility are anticipated for 2018.

2.13.2 Operations at LANSCE

The 2008 SWEIS identified eight capabilities at this Key Facility. Six of the eight capabilities were active in calendar year 2017 and all six fell below operational levels projected in the 2008 SWEIS (Table A-25).

During calendar year 2017, 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.

2.13.3 Operations Data for LANSCE

Operations data levels at LANSCE remained below levels projected in the 2008 SWEIS, with two exceptions. In 2017, chemical waste generation exceeded the 2008 SWEIS projections due to the general cleanup from an office fire at Technical Area 53, Building 31; this contributed to 40 percent (10,269 kilograms) of chemical waste generated. In 2017, MLLW exceeded 2008 SWEIS projections due to the waste generated from the removal of the Lujan Flight Path. Table A-27 provides operations data details.

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

SRCW Facilities are located at Technical Areas 50 and 54. Activities at this Key Facility are related to the management (e.g. 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 SRCW 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 following: (1) the waste generating process, (2) quantity, (3) chemical and physical characteristics of the waste, (4) regulatory status of the waste, (5) applicable treatment and disposal standards, and (6) the final disposition of the waste. These data are ultimately used to assess operational efficiency, help ensure environmental protection, and demonstrate regulatory compliance.

The 2008 SWEIS recognized structures at the SRCW Facility as having Hazard Category 2 Nuclear Classification (Table 2-6). (Area G was recognized as a whole, and then individual buildings and structures were also recognized.)

Table 2-6. Solid Waste Buildings with Nuclear Hazard Classification

Building	Description	2008 SWEIS	LANL 2017[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
54-2	TRU Storage Building	N/A	2
54-8	MLLW/LLW Storage Building	2	2
54-33	TRU Drum Preparation	2	2
54-38	Radioassay and Nondestructive Testing Facility	2	2
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	3
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 2017b)
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; 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 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 TWF.

Construction was completed and startup authorization and critical decision-4 was received on September 28, 2017. The TWF achieved Leadership in Energy and Environmental Design gold certification. The TWF is designed to store up to 1,240 drums for a period of no longer than one year, which is 260 drums less than projected in the 2008 SWEIS (1,500 drums per year). 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 2016 Consent Order (DOE 2008a).

On February 14, 2014, an airborne radiological release occurred underground at the WIPP involving improperly treated TRU wastes generated by LANL (DOE 2015c). Because of this event, wastes destined for transportation to WIPP have been stored onsite. In addition to the suspension of waste shipments to WIPP, two LANL facilities (Waste Compaction Reduction and Repackaging Facility and Radioassay and Nondestructive Testing Facility) involved in the processing and packaging of waste suspended operations.

In calendar year 2016, DOE/NNSA prepared two supplement analyses to the 2008 SWEIS to determine if an additional NEPA analysis was required to conduct remediation studies these included: (1) proposed treatment, (2) repackage, (3) onsite transport, (4) short-term storage, and (5) final disposition 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 2016b). The final treatment on the TRU waste drums containing remediated nitrate salts was completed in 2017, and TRU waste shipments to WIPP resumed.

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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 year 2017 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. In 2017, the new TRU Waste Facility began operations. Table A-27 represents both legacy waste operations and the new TRU Waste Facility operations.

2.14.3 Operations Data for the Solid Radioactive and Chemical Waste Facilities (SRCW)

The 2008 SWEIS waste projections were exceeded for all waste types at the SRCW Facilities in calendar year 2017. Chemical waste generation exceeded the 2008 SWEIS projections due to the disposal of Area L sump water collected from rain and snow events, which contributed to 55 percent (9,797 kilograms) of chemical waste. LLW generation exceeded 2008 SWEIS projections in calendar year 2017 due to the disposal of construction, demolition and maintenance debris at the SRCW. This contributed to 41 percent (111 cubic meters) of the LLW waste generated at SRCW Facilities. MLLW generation exceeded 2008 SWEIS projections due to the consolidating and repackaging MLLW generated at the SRCW Facilities that contributed to 24 percent (42 cubic meters) of the total MLLW generated. TRU and MTRU waste generation exceeded the 2008 SWEIS due to the repackaging efforts made at the facility, which contributed to 77 percent (82 cubic meters) of the total TRU and mixed TRU waste generation at SRCW Facilities. 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, Technical Area 55, Building 4, is categorized as a Hazard Category 2 Nuclear Facility. In addition, Technical Area 55 includes two low-hazard chemical facilities (Technical Area 55, Building 3 and Technical Area 55, Building 5) and one low-hazard energy source facility (Technical Area 55, Building 7). The DOE/NNSA listing of LANL nuclear facilities for 2017 (LANL 2017b) retained Building 4 as a Hazard Category 2 Nuclear Facility (Table 2-7).

Table 2-7. Plutonium Facility Complex Buildings with Nuclear Hazard Classification

Building	Description	2008 SWEIS	LANL 2017*
Plutonium Facility (55-4)	Plutonium Processing	2	2

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

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 separate line items (TRP I, TRP II, and TRP III). Each line item was split into subprojects. During calendar year 2017, TRP II activities continued. TRP III planning stage, which included ventilation system replacement in Building 41, continued in 2017.

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 year 2017.

The following construction and modification projects were initiated and continued in calendar year 2017.

- DD&D and upgrades of equipment were initiated 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 4 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 2016a). Project planning and construction activities continued through calendar year 2017.
- As discussed in Section 2.1.1, construction activities began in Technical Area 55, Building 4 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 year 2017. For all six active capabilities, activity levels were below those projected by the 2008 SWEIS.

In 2017, DOE/NNSA proposed the use of mobile-loading operations of TRU and mixed-TRU waste at Technical Area 55. This new activity would occur at the Resource Conservation and Recovery Act (RCRA) permitted outdoor storage pad and the High Efficiency Neutron Center pad at Technical Area 55. These areas would be used as a staging area for containers prior to the shipment to WIPP. DOE/NNSA determined that the proposal to prepare and load TRU waste containers at Technical Area 55 for disposal at WIPP was within the boundaries of activities previously analyzed in the 2008 SWEIS.

During 2017, LANL was directed to prepare Critical Decision-0 package to initiate design for the dilute and dispose alternative in the "2015 Surplus Plutonium Disposition Supplemental Environmental Impact Statement" (DOE 2015d). DOE also initiated a data call inquiry to assist in the preparation of a new NEPA analysis or supplemental environmental impact statement for this program.

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 two exceptions. In calendar year 2017, chemical waste generation at the Plutonium Facility Complex exceeded 2008 SWEIS projections due to (1) the disposal of cooling system descaling solution, which contributed to 15 percent (2,638 kilograms) of the total amount of chemical waste generated, (2) the disposal of used oil and ethylene glycol from the maintenance equipment at RLUOB, which contributed to seven percent (1,313 kilograms), (3) the disposal of a water from the maintenance of an access control system gate at Technical Area 55 which contributed to 11 percent (1,868 kilograms) of the chemical waste generated, and (4) the disposal of unused/unspent products which contributed to eight percent (1,445 kilograms) at the Plutonium Facility Complex. In 2017, MLLW exceeded 2008 SWEIS projections due to the disposal of lead contaminated materials from routine housekeeping and maintenance operations this contributed to 98 percent (71 cubic meters) of the total MLLW generated at the Plutonium Facility Complex. Table A-29 provides operations data details.

2.15.4 Off-Site Source Recovery Program

The Off-Site Source Recovery Program (OSRP) 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[12] (42 USC);
- or are DOE-owned.

The OSRP, 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 03, Building 30 warehouse and transported by truck to Technical Areas 54, 55, or other approved LANL or subcontracted facilities for storage.

NEPA coverage for OSRP 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 OSRP 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 OSRP, including the recovery, storage, and disposition of high-activity beta/gamma sealed sources. This program includes the recovery of sealed sources 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.

In September 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.

In January 2017, the NNSA NEPA Compliance Officer removed the requirement for the preparation of yearly categorical exclusions for domestic and foreign sealed source recovery efforts by OSRP. Coverage remains provided by "Categorical Exclusions Applicable to Specific Agency Actions: CX B2.6 Recovery of radioactive sealed sources" (DOE 2017l).

Of the planned countries slated for source repatriation in calendar year 2017, the OSRP recovered sources from Brazil, Japan, Nicaragua, and the Philippines.

In calendar year 2017, the OSRP recovered 55 radiological sources from Brazil, 1 source from Japan, 39 sources from Nicaragua, 73 sources from the Philippines, and 2,441 from United States-domestic locations.

[12] 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.

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 14,218 of LANL's 26,058 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 2-8. A complete description of these projects can be found in previous Yearbooks.

Table 2-8. 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
Technical Area 49 Training Facility Expansion	2016
Technical Area 72 Armory Cleaning Facility	2016
Unmanned Aerial Systems User Facility	2016

New projects that were still under construction or were completed in calendar year 2017 are discussed in the following paragraphs.

2.16.1.1 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. Work on the first and second floors has been completed. The basement floor design is complete and construction is expected to begin in calendar year 2018.

2.16.1.2 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 from old insulation, and re-insulation of piping.

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

2.16.1.3 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 03 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 2016d).

2.16.1.4 Roof Asset Management Program

Description: The Roof Asset Management Program (RAMP) is the DOE/NNSA's effort initiated in October 2005 to replace existing roofing systems that have reached the end of their life. This innovative and unique process manages roofing repairs and replacements at six sites, as a single portfolio, under one contract.

Key program attributes include:

- Emphasis on strategic, proactive repairs to extend roof life.
- Use of sustainable construction materials and methods, and reduction in energy usage.
- Regular reviews of program performance, opportunities for improvement, discussion of new directions, and sharing of lessons learned.
- Protects essential equipment and personnel that are housed within the structures across the Laboratory from outside element infiltration.

Prior to the program, roofing concerns were often addressed only when critical operations were interrupted by roof leaks. This reactive approach to roof leaks often resulted in premature replacement of the roof, the use of a limited number of roofing contractors, and a higher cost of roof replacements.

Status: 349 facilities have been re-roofed since 2004. Fiscal year 2017 saw 24 facilities re-roofed within the Weapons Facilities Operations, Technical Area 55, and LANSCE.

2.16.1.5 Supplemental Environmental Projects (SEP)

Description: In 2014, the state of New Mexico's Hazardous Waste Bureau issued compliance orders for New Mexico Hazardous Waste Act (HWA) violations. One of the orders stemmed from the improper treatment of TRU waste shipped from LANL to WIPP. A settlement agreement (NMED 2016b) between DOE/NNSA and the NMED signed in 2016 included five projects, which DOE/NNSA intends to implement by 2019.

1) Roads – Improve transportation routes at LANL used for the transportation of TRU waste to WIPP.
2) Triennial Review – Conduct an independent, external triennial review of environmental regulatory compliance and operations.

3) Watershed Enhancement – Design and install engineering structures in and around LANL to slow storm water flow and decrease sediment load to improve water quality in the area.
4) Surface Water Sampling – Conduct increased sampling and improve monitoring capabilities for storm water runoff in and around LANL with the results of sampling and monitoring shared with the public and the NMED.
5) Potable Water Line Replacement – Replace aging potable water lines and install metering equipment for LANL potable water systems. These improvements would reduce potable water losses, minimize reportable spills, and enhance water conservation.

Status: In calendar year 2017, the SEP were in the design phase with the exception of the following Watershed Enhancement Projects:

- In May 2017, DOE/NNSA issued a categorical exclusion for the Mortandad Wetland Enhancement project (DOE 2017f). The project is located in Technical Areas 03 and 59 in upper Mortandad Canyon, directly south of Technical Area 03, Building 1076. This project would repair erosional damage to the wetland and prevent or reduce future erosion and increase wetland area and improve wildlife habitat. Construction began in calendar year 2017.
- In September 2017, DOE/NNSA issued a categorical exclusion for the Upper Cañon de Valle Wetland Enhancement project. The project is located in Technical Area 16 in an old borrow pit adjacent to West Jemez Road and extending east-southeast to Crossroads Road. This project would slow storm water runoff thereby allowing for additional infiltration and to reduce peak storm water flow downstream (DOE 2017j). Construction began in calendar year 2018.
- In September 2017, the Institutional Low Impact Development (LID) Master Plan was developed in order to implement a number of projects to slow storm water flow and decrease sediment loads to improve water quality and allow surface water management at the watershed scale (LANL 2017c). Construction began at the Main Gate LID in November 2017.

2.16.2 Operations at the Non-Key Facilities

The Non-Key Facilities occupy more than half of LANL's 26,058 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 year 2017, no new capabilities were added to the Non-Key Facilities and none of the seven existing capabilities was deleted.

2.16.3 Operations Data for the Non-Key Facilities

Operations data levels at the Non-Key Facilities were below levels projected in the 2008 SWEIS, with two exceptions. Chemical waste generated in calendar year 2017 exceeded annual volumes projected in the 2008 SWEIS. This was due to the disposition of press filter cakes and reverse osmosis reject water from the SERF. 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 accounted for about 81 percent of the total chemical waste generated at Non-Key Facilities. The volume of LLW waste exceed 2008 SWEIS projections due to waste generated from the demolition of Technical Area 18, Casa 2 and 3.[13] This accounted for about 44 percent of the total LLW generated at Non-Key Facilities.

In calendar year 2017, the Non-Key Facilities generated about 83 percent of the total LANL chemical waste volume, about 51 percent of the total LLW volume, and .08 percent of the total MLLW and none of the total TRU waste volumes.

In calendar year 2017, the combined flows of the Technical Area 46 Sanitary Wastewater System and the Technical Area 03 Power Plant account for about 84 percent of the total water discharges from Non-Key Facilities and about 59 percent of all water discharged by LANL. Section 3.2 provides more details.

2.17 Environmental Cleanup

The legacy waste cleanup work at LANL was transitioned to a bridge contract under DOE-EM in October 2015. In December 2017, DOE announced the award of the new LANL legacy cleanup contract to N3B. N3B took over the legacy waste cleanup operations in April 2018.

A significant amount of waste is generated during characterization and remediation activities; therefore, DOE-EM 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's legacy cleanup contractors 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 HWA (NMSA1978, § 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

[13] The 2008 SWEIS analyzed the demolition of Technical Area 18 in Appendix H.1 Technical Area 18 Closure, including remaining operations, relocation, and structure Decontamination, Decommissioning, and Demolition Impacts Assessment.

were potentially subject to the new Consent Order requirements. Of these, 166 sites had been removed from Module VIII by NMED and were not regulated by the Consent Order. In addition, 25 AOCs previously approved for no further action by NMED and 541 sites approved for no further action by the Environmental Protection Act (EPA) 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 the 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 2017, NMED issued 242 Certificates of Completion without Controls and 77 Certificates of Completion with Controls. Of the 319 Certificates of Completion issued, two overlap former EPA or NMED approvals for no further action and two overlap NMED removals from Module VIII of LANL's Hazardous Waste Facility Permit; thus, only 315 are subtracted. This administrative action reduced the total number of corrective action sites remaining in the investigation process at LANL to 1,107.

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 RCRA 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. One of these new SWMUs was split again in 2017 to create one additional new SWMU. Combined, these administrative actions reduced the total number of corrective action sites remaining in the investigation process at LANL to 1,100.

In Appendix A of the Consent Order, 135 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 complete. 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

DOE-EM developed and/or revised one annual monitoring plan, three work plans, six progress/status report, three monitoring reports, two investigation reports, and one supplemental investigation report, which were submitted to NMED in calendar year 2017. 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 completion reports as well as the annual update to the Interim Facility-Wide Groundwater Monitoring Plan.

Table 2-10 provides summaries of the site, aggregate area, and canyon investigations conducted and/or reported in calendar year 2017. In addition, the 2017 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 2017 at 79 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 2017, the second sampling event was conducted during October 2017. 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 potential threats to groundwater and whether corrective actions may be required.

Table 2-9. Summary of Site, Aggregate Area, and Canyon Investigations Conducted and/or Reported on in

Document/Activity	Technical Area(s)	Number of Sites Investigated	Number of Samples Collected	Number of Sites where Cleanup Conducted	Number of Sites where Extent Defined/ Not Defined	Conclusions/Recommendations
2016 Sandia Wetland Performance Report (LANL 2016b)	03	Monitoring conducted at wetland in Sandia Canyon	75 samples collected in 2016	n/a[a]	n/a	The monitoring performed during the performance period indicates that the Sandia wetland is stable and expanding following installation of the grade control structure (GCS) in December 2013. Year-over-year comparison of analytical results indicates the wetland is discharging lower concentrations of contaminants of concern in storm water. Even with declining effluent volumes entering the wetlands, wetland sediments remain highly reducing, and no detrimental temporal trends in chemistry have been noted. Water levels remain sufficiently high to sustain and promote expansion of obligate wetland vegetation.

Document/Activity	Technical Area(s)	Number of Sites Investigated	Number of Samples Collected	Number of Sites where Cleanup Conducted	Number of Sites where Extent Defined/ Not Defined	Conclusions/Recommendations
2016 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project (LANL 2017d).	multiple	Monitoring conducted at 13 gage stations located throughout the watershed.	24 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 ~500 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. In DP Canyon, the GCS and associated floodplains facilitated a significant reduction in the suspended sediment being transported downstream. In Pueblo Canyon, the wetland, willows, drop structure, and GCS facilitated a substantial reduction in peak discharge and suspended sediment. In Los Alamos Canyon, the low-head weir and associated sediment detention basins facilitated a reduction in the peak discharge during all of the runoff events and a significant reduction in the volume of suspended sediment being transported downstream. Based on the correlations between concentrations of metals, radioisotopes, and PCBs in unfiltered storm water and suspended sediments presented in the "2015 Monitoring Report for Los Alamos/Pueblo Watershed," the Laboratory discontinued monitoring certain constituents at 11 Los Alamos and Pueblo watershed gaging stations. The Laboratory continued monitoring dissolved metals and unfiltered total recoverable selenium, unfiltered mercury, total recoverable aluminum, unfiltered silver, total PCBs, and certain unfiltered radionuclides.

Document/Activity	Technical Area(s)	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 Lower Sandia Canyon Aggregate Area (LANL 2017e).	53, 72	17	331 samples collected from 1995 through 2010	0	13/4	The Laboratory recommended no further investigation or remediation activities are warranted for 13 sites, all of which are appropriate for corrective action complete without controls. Additional sampling is needed to define the extent of contamination at 4 sites. No sites are recommended for remediation. A Phase II investigation work plan will be developed based on the conclusions and recommendations presented in this supplemental investigation report.
2017 Biennial Asphalt Monitoring and Removal Report for Area of Concern C-00-041, Guaje/Barranca/Rendija Canyons Aggregate Area (LANL 2017f).	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. The quantity of asphalt removed in 2017 was nearly equivalent to the quantity removed in 2015, and approximately 25 percent of the amount removed in 2009. Based on these trends, DOE–EM recommended reevaluating the need to continue the biennial inspection and removal activities.

Document/Activity	Technical Area(s)	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 Report for Corrective Measures Implementation and Deep Groundwater Investigations for Consolidated Unit 16-021(c)-99 (LANL 2017g).	16	1	Best management practices inspected (five significant rain events recorded between October 2016 and September 2017); 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. Quarterly monitoring of tracers 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) continued. Cross-well tracer transport has not been detected yet. The conceptual site model was refined through geochemical studies; reviews of geologic, bioremediation, and natural attenuation studies; and improvements to groundwater flow and transport models. Concentrations of barium and RDX in springs and stream flow were found to remain relatively stable regardless of discharge. No evidence of biodegradation of RDX in the regional aquifer was found, but data suggest RDX is degraded in the alluvial system. Evaluation of geochemical data identified different groundwater types indicating different recharge sources, different subsurface flow paths, and contamination sources.

Document/Activity	Technical Area(s)	Number of Sites Investigated	Number of Samples Collected	Number of Sites where Cleanup Conducted	Number of Sites where Extent Defined/ Not Defined	Conclusions/Recommendations
Fiscal Year 2016 Fieldwork Completion Status Report for Town Site Solid Waste Management Units 01-001(g), 01-006(b), 01-007(a), 01-007(b), and Area of Concern 01-003(b) in the Upper Los Alamos Canyon Aggregate Area (LANL 2017h) .	01	2	90 samples collected in 2015 and 2016	0	1/1	Investigation and remediation activities for SWMUs 01-006(b), 01-007 (a), 01-007(b), and AOC 01-003(b1) were reported in "Investigation Report for the Former Los Alamos Inn Property Sites within the Upper Los Alamos Canyon Aggregate Area, Revision 1." Nature and extent of contamination has been defined at SWMU 01-001 (g) and no further corrective actions are anticipated. Data from AOC 01-003 (b2) will be evaluated further to determine whether arsenic is from pressure treated wood used for landscaping or is site-related.
Investigation Report for the Former Los Alamos Inn Property Sites within the Upper Los Alamos Canyon Aggregate Area, Revision 1 (LANL 2017i).	01	10	288 samples collected from 2008 through 2016	3	10/0	Characterization sampling was performed at 10 sites. A total of 89 cubic yards of plutonium-239/240-contaminated soil was removed from SWMUs 01-006(b), 01-007 (a), and 01-007(b). Nature and extent of contamination has been defined at all sites and these sites are appropriate for corrective action complete without controls.

Document/Activity	Technical Area(s)	Number of Sites Investigated	Number of Samples Collected	Number of Sites where Cleanup Conducted	Number of Sites where Extent Defined/ Not Defined	Conclusions/Recommendations
Fiscal Year 2017 Fieldwork Completion Status Report for Middle Los Alamos Canyon Aggregate Area (LANL 2017j)	02	3	365	0	1/2	Characterization sampling was performed at three sites. Nature and extent of contamination has been defined at SWMU 02-011(d) and no further corrective actions are anticipated. Nature and extent have not been defined at SWMUs 02-005 and 02-011(a) (ii). Bioassay studies for plants and earthworms conducted using soil from Technical Areas 02 and TA-26 and small mammal trapping studies will be reported in the Phase II investigation report for Middle Los Alamos Canyon Aggregate Area.

a. n/a = Not applicable.
b. Both progress reports summarized together.

There were 16 volatile organic compounds and tritium detected in pore gas at Material Disposal Area C during the first sampling event and 29 volatile organic compounds and tritium detected in pore gas during the second sampling event. The screening evaluation of the 2017 data identified three volatile organic compounds with vapor concentrations above their respective Tier I screening values based on protection of groundwater: 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 four 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 2017 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 LANL Nuclear Facilities list during 2017 (Table 2-11). Additionally, there were no changes to the hazard categories of any nuclear environmental sites.

Table 2-10. Environmental Sites with Nuclear Hazard Classification

Site	Description	2008 SWEIS	LANL 2017*
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 2017b).

3.0 SITE-WIDE 2017 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 2017 totaled approximately 253 curies, about 0.7 percent of the annual projected radiological air emissions of 34,000 curies 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 82 curies in calendar year 2017.

The total point source emissions from LANSCE were approximately 170 curies in calendar year 2017.

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 2017, diffuse emissions were approximately 145 curies.

Maximum offsite dose to the maximally exposed individual was 0.47 millirem in 2017. The EPA 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 (LANL 2018a).

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 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 year 2017 emissions for all four categories (carbon monoxide, nitrogen oxides, sulfur oxides, and particulate matter) were within the 2008 SWEIS projection.

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

Pollutants	2008 SWEIS (tons/year)	Calendar Year (CY) 2017 Operations (tons/year)
Carbon monoxide	58.0	8.8
Nitrogen oxides	201.0	16.0
Particulate matter	11.0	2.1
Sulfur oxides	0.98	0.38

* Emissions included on the annual Emissions Inventory Report do not include small boilers.

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 2017 (LANL 2017k). In calendar year 2017, more than half of the criteria pollutants (nitrogen oxides and carbon monoxide) originated from the Technical Area 03 Power Plant.

In February 2017, 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 year 2017 actual emissions from all sources included in the permit. Emissions from small boilers and heaters 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 year 2017. 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 2017k).

Table 3-2. 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)	2017 Emissions (tons/year)
Carbon monoxide	58.0	225	23.0
Nitrogen oxides	201.0	245	30.9
Particulate matter	11.0	120	3.5
Sulfur oxides	0.98	150	0.32

* 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 year 2017, 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	2017
Hazardous air pollutants	24	5.2
Volatile organic compounds	200	10.3

Greenhouse Gas Emissions (GHG). LANL reports its annual GHG from stationary combustion sources to the EPA 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 2017, these stationary combustion sources emitted 42,558.5 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]	2017 Emissions
Methane	metric tons/year	–	0.81
Nitrous oxide	metric tons/year	–	0.082
Carbon dioxide	metric tons/year	–	42,513.8
Total Emissions	metric tons carbon dioxide equivalents/year	–	42,558.5

a. LANL Greenhouse Gas Emissions Electronically Submitted to the Environmental Protection Agency (LANL 2018b).
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, 2017, through December 31, 2017, 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 2017 totaling approximately 104.8 million gallons. This is approximately 3.5 million gallons less than in calendar year 2016 and 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 year 2017 are provided in 2017 Annual Site Environmental Reports (LANL 2018c). Calendar year 2017 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 2017	Discharge 2008 SWEIS	Discharge 2017
Guaje	0	0	0	0
Los Alamos	5	1	45.6	27.77
Mortandad	5	4	44.3	3.72
Pajarito	0	0	0	0
Pueblo	0	0	0	0
Sandia	6[a]	5	187.3	73.30
Water[b]	5	1	2.26	0
Totals	21	11	279.5	104.79

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 year 2017, the bulk of the discharges came from Non-Key Facilities. Key Facilities accounted for approximately 31.8 million gallons of the total in calendar year 2017. LANSCE discharged approximately 28.3 million gallons in calendar year 2017, about 5.1 million gallons more than calendar year 2016, accounting for about 89 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 CY 2017	Discharge 2008 SWEIS	Discharge CY 2017
Plutonium Complex	1	1	4.1	3.0
Tritium Facility	2	None	17.4	0
CMR Building	1	None	1.9	0
Sigma Complex	2	1	5.8	0.48[a]
High Explosives Processing	3	1	0.06	0
High Explosives Testing	2	None	2.2	0
LANSCE	4	2	29.5[b]	28.3
Metropolis Center	1	1	17.7[c]	0[d]
Biosciences	None	None	0	0
Radiochemistry Facility	None	None	0	0
RLWTF	1	1	4.0	0
Pajarito Site	None	None	0	0
Materials Science Laboratory	None	None	0	0
Target Fabrication Facility	None	None	0	0
Machine Shops	None	None	0	0
Solid Radioactive and Chemical Waste Facilities	None	None	0	0
Subtotal, Key Facilities	17	7	82.66[e]	31.79
Non-Key Facilities	4	4	200.9	72.96[g.]
Totals	21[f]	11	283.5[e]	104.79

a. Estimated discharge from unidentified low-volume discharge that began August 13, 2014, and continued through the end of calendar year 2017.
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.
g. Discharges to Outfall 03A160 (NHMFL) have been directed to the SWWS beginning on May 3, 2018.

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 wastewater in calendar year 2017.

As previously stated, discharges from the Non-Key Facilities made up the majority of the total calendar year 2017 discharge from LANL. The total for calendar year 2017, 72.96 million gallons, was about 127.94 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 84 percent of the total discharge from Non-Key Facilities and about 59 percent of all water discharged by LANL in calendar year 2017.

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 external subcontractors 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 following: a) project activities and potential pollutants, b) site conditions, c) best management practices (sediment and erosion control measures), and d) 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.

LANS performed 554 storm water inspections. Oversight staff for two federalized construction projects at the Laboratory performed 52 storm water inspections. LANS inspectors found 94.9 percent of the inspection items to be in compliance, and the federalized project inspectors found 96.1 percent of inspections to be in compliance.

Multi-Sector General Permit. The National Pollutant Discharge Elimination System Multi-Sector General Permit for Storm Water Discharges Associated with Industrial Activities (Multi-Sector General Permit) regulates storm water discharges from specific industrial activities and their associated facilities. Industrial activities conducted at the Laboratory covered under the Multi-Sector General Permit includes: 1) metal and ceramic fabrication, 2) wood product fabrication, 3) hazardous waste treatment and storage, 4) vehicle and equipment maintenance, 5) recycling activities, 6) electricity generation, 7) warehousing activities, and 8) asphalt manufacturing.

The Multi-Sector General Permit requires the implementation of control measures, development of storm water pollution prevention plans, and monitoring of storm water discharges from 14 permitted sites. Compliance with the requirements is achieved by:

- developing and implementing facility-specific storm water pollution prevention plans,
- implementing corrective actions identified during inspections,
- monitoring storm water run-off at facility samplers for benchmark parameters, impaired water constituents, and effluent limitations, and
- visually inspecting storm water run-off to assess color; odor; floating, settled, or suspended solids; foam; oil sheen; and other indicators of storm water pollution.

Storm water monitoring, as required by the Multi-Sector General Permit, occurs from April 1 through November 30 of each year. Under the current permit, the benchmark values for some pollutants are the same as New Mexico water quality standards. As such, some pollutant limits are significantly more stringent now than under the previous permit, and exceedances of permit limits occur more frequently. Some of these permit limit exceedances may be caused by natural background conditions. If an exceedance occurs, it triggers corrective action, which includes evaluation of potential sources and either follow-up action or documentation of why no action is required. All of the identified corrective actions associated with exceedances in 2017 have been completed. A benchmark exceedance does not trigger a corrective action if it is determined that the exceedance is solely attributable to natural background sources. A study to identify naturally occurring background concentrations in storm water run-off from these sites is pending.

In 2017, the following tasks were completed:

- Completed 118 inspections of storm water controls at the 14 permitted sites and one annual inspection at each of 34 sites having no-exposure status and at one inactive site.
- Collected 199 samples at 14 permitted sites.
- Completed 533 sampling equipment inspections.
- Conducted 86 visual inspections at 24 monitored discharge points and 432 visual inspections at 46 substantially identical discharge points.
- Converted one permitted site to no-exposure status.
- Completed 254 corrective actions including:
    - 75 corrective actions to mitigate exceedances.
    - Installation of one additional control measure at one permitted site.
    - Maintenance, repair, or replacement of 50 control measures at nine permitted and three no-exposure sites.
    - 78 actions to remedy control measures inadequate to meet non-numeric effluent Limits.
    - 48 corrective actions to address unauthorized releases (spills) or discharges Correction of two storm water pollution prevention plan non-conformances.
- Discontinued monitoring of 25 pollutants at eight permitted sites by meeting permit-defined criteria:
    - Quarterly benchmarks: Discontinued monitoring of 16 pollutants at four permitted sites due to the average of four results not exceeding the benchmark.
    - Impaired waters pollutants: Nine pollutants at seven permitted sites were not expected to be present and were not detected.

NPDES Individual Permit for Storm Water Discharges from SWMUs/AOCs. The Individual Permit authorizes discharges of storm water from certain SWMUs and AOCs (sites) at the Laboratory. The EPA issued the original permit in 2010 and has been administratively continued until a new permit is issued. 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 sites to determine the effectiveness of the controls. When target action levels are exceeded, which are based on New Mexico water quality standards, 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 2017, the following tasks were completed:

- Published the 2016 update to the Site Discharge Pollution Prevention Plan. It identifies pollutant sources, describes the control measures, and describes the monitoring at all regulated sites.
- Completed 1,331 inspections of storm water controls at the 250 site monitoring areas.
- Completed 1,237 sampling equipment inspections.
- Conducted storm water monitoring at 159 site monitoring areas.
- Collected post-certification storm water samples at two site monitoring areas and completed the monitoring at those sites.
- Collected corrective action enhanced control confirmation samples at nine site monitoring areas.
- Installed 64 additional control measures at 32 site monitoring areas.
- Installed eight replacement baseline controls at seven site monitoring areas.
- Installed two enhanced controls at two site monitoring areas.
- Received certification of completion of corrective action for 10 site monitoring areas or sites.
- Documented one site monitoring area completed with results less than target action levels.
- Held two public meetings as required by Individual Permit.
- Completed website updates and public notifications.

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

LANL is required to manage a wide variety of waste types including solids, liquids, semi-solids, and contained gases due to the complex array of facilities and operations that generate such wastes. These waste streams are regulated as solid, hazardous, LLW, TRU, or wastewater by 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. Each new project includes a Waste Generation Plan to ensure that wastes are managed appropriately through temporary storage to permanent storage and final disposal. The creation of this plan ensures that LANL projects meet 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: 1) information on waste generating processes, 2) waste quantities, 3) chemical and physical characteristics of the waste, 4) regulatory status of the waste, 5) applicable treatment and disposal standards, and 6) final disposition of the waste. These data are ultimately used to assess operational efficiency, ensure environmental protection, and demonstrate regulatory compliance.

Although there is a variety of waste types, the 2008 SWEIS categorizes wastes as chemical, LLW, MLLW, or TRU. Mixed TRU waste is combined with TRU waste, since they both are managed for disposal at the WIPP. Table 3-7 summarizes the waste types and total generation for LANL in calendar year 2017.

Table 3-7. LANL Waste Types and Generation for Calendar Year 2017

Waste Type	Units	LANL Waste Generators			Total CY
		Key Facility Total	Non-Key Facility	EM	
Chemical	10^3 kilograms per year[a]	653.58	3,430.00	27.43	4,110.40
LLW	cubic meters per year[b]	2,490.75	2,720.39	113.173	5,324.31
MLLW	cubic meters per year[b]	245.05	0.2	0	245.26
TRU[c]	cubic meters per year[b]	243.89	0	0	243.89
Mixed TRU[c]	cubic meters per year[b]	n/a	n/a	n/a	n/a

a. The 2008 SWEIS lists chemical waste projections in kilograms per year. Waste numbers are recorded here as 10^3 kilograms per year for readability.
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 because they are both managed for disposal at the Waste Isolation Pilot Plant.

Radioactive and chemical waste generation at LANL is a result of LANL operation (i.e. research, production, maintenance, and construction) and DOE-EM legacy waste cleanup operations. Legacy waste cleanup operations include the DD&D of site and facilities formerly involved in weapons research and development and those that require remediation under the 2016 Consent Order.

The 2008 SWEIS identifies waste generators belonging to one of three categories: Key Facilities, Non-Key Facilities, and Environmental Management. Normal LANL operations generate radioactive and chemical waste from Key Facilities and Non-Key Facilities. DOE-EM legacy waste cleanup operations generate radioactive and chemical waste, which is categorized as Environmental Management.

The 2008 SWEIS projected radioactive and chemical waste volumes for Key Facilities and Non-Key Facilities as identified in Chapter 5 (page 5-139), Table 5-39 Radioactive and Chemical Waste Projections from Routine Operations. 2008 SWEIS projections for Environmental Management legacy waste generation projections are identified in Appendix I (I-185), Table I-70 Removal Option Annual Waste Generation Rates. Comparisons of the 2017 annual waste totals to the 2008 SWEIS projects are discussed in the following sections.

Projections for waste generation documented in the 2008 SWEIS are identified for each of the three categories through fiscal year 2016. The annual total of Key Facilities and Non-Key Facilities waste generation will continue to be compared to the projected estimates identified in Table 5-39 of the 2008 SWEIS.

Previously, the Environmental Management annual waste generation total was compared to the fiscal year projection identified in Table I-70; however, there are no fiscal year projections beyond 2016. To ensure Environmental Management annual waste generation meets the 2008 SWEIS ROD projections, the annual waste generation total will be added to the cumulative total and then compared to the projected total for Environmental Management operations.

Most of the waste generated at Key Facilities, Non-Key Facilities, or from Environmental Management operations is transported offsite for treatment and disposal. The majority of waste generated during a calendar year will be transported to another facility within that same year; however, some transported waste shipments are for waste generated in the previous year. The 2008 SWEIS projected minor amounts of low-level waste would be disposed onsite. The majority is transported offsite for treatment and disposal.

TRU and mixed TRU wastes are characterized, certified, and placed in drums or boxes, which are then prepared for transport to WIPP for long-term disposal. Following the February 2014 release at the WIPP facility, legacy TRU and mixed TRU shipments were suspended. In 2017, WIPP reopened and shipments to the facility resumed.

The total number of radiological shipments bounded by the 2008 SWEIS is 122,445 over a 10-year projection. As stated in the 2018 Supplement Analysis to the 2008 SWEIS, waste generation is expected to remain within the 2008 SWEIS ROD projections, the projected offsite shipments from the 2008 SWEIS continue through 2022. The projected number of shipments is derived from the sum maximum radiological shipments as stated under the Expanded Operations Alternative, as found in Table K-5. From the time that the 2008 SWEIS was published through 2017, the total number of radiological shipments was 27,553, approximately 25 percent of the projected total.

The 10-year maximum projection for chemical (hazardous) waste shipments is 4,749 (Table K-5, page K-24), which represents the total shipments for chemical (hazardous) waste from LANL. Since the issuance of the 2008 SWEIS through 2017, the total number of chemical (hazardous) waste shipments is 1,200, approximately 25 percent of the projected total.

In calendar year 2017, there were a total of 203 radiological waste shipments offsite to permitted treatment, disposal, or storage facilities. There were a total of 155 chemical waste shipments offsite to permitted treatment, disposal, or storage facilities.

3.3.1 Chemical Waste

The 2008 SWEIS defined chemical wastes as hazardous waste (designated RCRA 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, the 2018 Supplement Analysis of the 2008 SWEIS projects that waste generation will continue and current generation projections will continue through 2022. 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 consist 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 RCRA. (Note: Hazardous wastes are regulated pursuant to Subtitle C of RCRA) DD&D waste volumes generated for calendar year 2017 are tracked in Section 3.11.2 of this Yearbook.

In calendar year 2017, the total volume of chemical waste generated at Key Facilities and Non-Key Facilities was above the annual volume projected in the 2008 SWEIS (Table 3-8). Chemical waste generated at the Non-Key Facilities for calendar year 2017 exceeded 2008 SWEIS projections due to the press filter cakes and reverse osmosis reject water from the SERF. Chemical waste generated at the Key Facilities exceeded the 2008 SWEIS projections due to non-routine maintenance, upgrade, and cleanup activities. Table 3-8 summarizes chemical waste generation at Key Facilities and Non-Key Facilities during calendar year 2017.

Table 3-8. Chemical Waste Quantities from Key Facilities and Non-Key Facilities for Calendar Year 2017

Waste Generator	2008 SWEIS*	CY 2017*
Key Facilities	596	653.58
Non-Key Facilities	650	3,429.93

* 10^3 kilograms per year.

In calendar year 2017, the total volume of chemical waste generated from DOE-EM operations contributed 0.06 percent to the estimated chemical waste projected in the 2008 SWEIS for Environmental Management operations. At the conclusion of 2017, chemical waste from Environmental Management operations was 7,433 x 10^3 kilograms, approximately 18 percent of the total estimated chemical waste projected in the 2008 SWEIS for Environmental Management operations. Table 3-9 summarizes chemical waste generation in relation to Environmental Management operations.

Table 3-9. Chemical Waste Quantities from EM Operations for Calendar Year 2017

Waste Generator	2008 SWEIS Projection Total[a]	Cumulative Total (2007 - 2016)[a]	2017 Cumulative Total[a]	Percentage of Total Projected Waste Generation by EM[e]
EM	41,209.78[b,c]	7,405.49[d]	7,432.92	18

a. 10^3 kilograms.
b. Used conversion 1,100 kilograms per 1 cubic meter. The 1,100 kilograms was derived from adding all of the Environmental Management chemical waste for calendar year 2008.
c. Projected total waste generation from Implementation of the Consent Order, Removal Option, 2008 SWEIS (Table I-70).
d. The total sum of the chemical waste generated from Environmental Management operations from calendar year 2007 through calendar year 2016.
e. The 2017 cumulative total divided by the 2008 SWEIS projection, total multiplied by 100

In calendar year 2017, 155 shipments of chemical waste were shipped offsite to permitted treatment and disposal facilities. Treatment and disposal facilities varied, but the majority of chemical waste was shipped to the Waste Management – New Mexico facility and Liquid Environmental Solutions (Table 3-10).

Table 3-10. Chemical Waste Shipped Offsite during Calendar Year 2017

Offsite Treatment and Disposal Facility	2017 Trucks from LANL
ACTenviro	1
Keers	2
Mesa	3
Veolia	5
Waste Management – New Mexico	68
Clean Harbors- Arizona	1
Clean Harbor – Colorado	3
Liquid Environmental Solutions	68
LR-Texas	2
Stericycle	1
Evoqua Water Technologies	1
TOTAL	**155**

3.3.2 Low-Level Radioactive Wastes (LLW)

In calendar year 2017, Non-Key Facilities LLW volumes exceeded volumes projected in the 2008 SWEIS; however, waste generation was below the projected volume for Key Facilities (Table 3-11). The LLW exceeded the 2008 SWEIS for Non-Key Facilities due to the demolition of Technical Area 18, Casa 2 and 3 (581 cubic meters) and the demolition waste from the Technical Area 03, Building 35 (former Press Building) (1,743 cubic meters). Table 3-11 summarizes LLW generation during calendar year 2017.

Table 3-11. LLW Quantities from Key Facilities and Non-Key Facilities for Calendar Year 2017

Waste Generator	2008 SWEIS[a]	2017[a]
Key Facilities	7,646	2,490.75
Non-Key Facilities	1,529	2,720.39[b]

a. cubic meters per year.
b. LLW exceeded the 2008 SWEIS projections due to the demolition of previous Key Facilities in Technical Area 18 and 03.

In calendar year 2017, 113.7 cubic meters of LLW was generated from Environmental Management operations (Table 3-7). At the conclusion of 2017 the cumulated LLW volumes from Environmental Management operations is 65,499.91 cubic meters, which is approximately 8 percent of the total estimated LLW projected in the 2008 SWEIS for Environmental Management operations. Table 3-12 summarizes LLW generation for Environmental Management operations.

Table 3-12. LLW Waste Quantities from EM Operations for Calendar Year 2017

Waste Generator	2008 SWEIS Projection Total[a]	Cumulative Total (2007 - 2016)[a]	2017 Cumulative Total[a]	Percentage of Total Projected Waste Generation by EM[d]
EM	1,061,200[b]	65,386.21[c]	65,499.91	8

a. cubic meters.
b. Projected total waste generation from Implementation of the Consent Order, Removal Option, 2008 SWEIS (Table I-70).
c. The total sum of the LLW generated from Environmental Management operations from 2007 through 2016.
d. The 2017 cumulative total divided by the 2008 SWEIS projection and total multiplied by 100

In calendar year 2017, 191 shipments of LLW were transported offsite to permitted treatment and disposal facilities. Treatment and disposal facilities varied, but the majority of LLW was shipped to the Waste Control Specialists facility (Table 3-13). The total number of LLW shipments bounded by the 2008 SWEIS is 10,775 over a 10-year projection. The projected number of shipments is derived from the sum maximum LLW and remote handled LLW shipments as stated under the Expanded Operations Alternative, as found in Table K-5 (page K-24). From the time the 2008 SWEIS was issued through 2017, the total number of LLW shipments was 8,956, approximately 83 percent of the projected total.

Table 3-13. Low Level Waste Offsite Shipments during Calendar Year 2017

Offsite Treatment and Disposal Facility	Total Shipments from LANL during 2017
Energy Solutions	33
Nevada National Security Site	24
Omegatech	13
Perma-Fix Environmental Services - Washington	23
Perma-Fix Environmental Services - Florida	1
Unitech	1
Waste Control Specialists	96
TOTAL	**191**

3.3.3 Mixed Low-Level Radioactive Wastes

In calendar year 2017, MLLW generation at Non-Key Facilities were below the volumes projected in the 2008 SWEIS; however, MLLW volumes exceeded the projected volumes for Key Facilities (Table 3-14). The Key Facilities that exceeded their projected volumes for MLLW include the Plutonium Facility Complex, LANSCE, and the SRCW Facilities. The exceedances were due to DD&D and permitted process change activities. Table 3-14 summarizes MLLW generation during calendar year 2017.

Table 3-14. MLLW Quantities from Key Facilities and Non-Key Facilities for Calendar Year 2017

Waste Generator	2008 SWEIS*	2017*
Key Facilities	68	245.05
Non-Key Facilities	31	0.2

* cubic meters per year.

In calendar year 2017, no MLLW was generated from Environmental Management operations (Table 3-7). At the conclusion of 2017, the cumulated MLLW waste volumes generated from Environmental Management operations is 64.3 cubic meters, which is approximately 0.04 percent of the total estimated MLLW projected in the 2008 SWEIS for Environmental Management operations. Table 3-15 summarizes MLLW generation for Environmental Management operations.

Table 3-15. MLLW Waste Quantities from EM Operations Calendar Year 2017

Waste Generator	2008 SWEIS Projections Total[a]	Cumulative Total (2007 - 2016)[a]	2017 Cumulative Total[a]	Percentage of Total Projected Waste Generation by EM[d]
EM	136197.80[b]	64.3[c]	64.3	0.04

a. cubic meters.
b. Projected total waste generation from Implementation of the Consent Order, Removal Option, 2008 SWEIS (Table I-70).

c. The total sum of the MLLW generated from Environmental Management operations from 2007 through 2016.
d. The 2017 cumulative total divided by the 2008 SWEIS projections total and multiplied by 100.

In calendar year 2017, 11 shipments of MLLW were transported offsite to permitted treatment and disposal facilities. Treatment and disposal facilities varied, but the majority of MLLW was shipped to the EnergySolutions (Table 3-16). The total number of MLLW shipments bounded by the 2008 SWEIS is 9,019 over a 10-year projection. The projected number of shipments is derived from the sum maximum MLLW shipments as stated under the Expanded Operations Alternative, as found in Table K-5 (page K-24). From the time the 2008 SWEIS was issued through 2017, the total number of MLLW shipments was 4,584, approximately 51 percent of the projected total.

Table 3-16. Mixed Low Level Waste Offsite Shipments during Calendar Year 2017

Offsite Treatment and Disposal Facility	Total Shipments from LANL
EnergySolutions	7
Perma-Fix Environmental Services - Washington	2
Perma-Fix Environmental Services - Florida	1
Waste Control Specialists	1
TOTAL	11

3.3.4 TRU and Mixed TRU Waste

The 2008 SWEIS combines TRU and mixed TRU waste into one waste category because they are both managed for disposal at WIPP. Therefore, TRU and mixed TRU waste generation are analyzed together in this Yearbook. TRU and mixed TRU generation in calendar year 2017 for Key Facilities and Non-Key Facilities was below the 2008 SWEIS projections (Table 3-17). No TRU or mixed TRU waste was generated from Non-Key Facilities (Table 3.7). Key Facilities accounted for 100 percent of the total TRU and mixed TRU waste volumes generated. Table 3-17 summarizes the TRU and mixed TRU generation during calendar year 2017.

Table 3-17. TRU and Mixed TRU Quantities from Key Facilities and Non-Key Facilities for Calendar Year 2017

Waste Generator	2008 SWEIS[a]	TRU and Mixed TRU[a]	2017 Mixed TRU[a]	2017 TRU[a]
Key Facilities	413[b]	243.47	173.25	70.22
Non-Key Facilities	23[b]	0.00	0.00	0.00

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

In calendar year 2017, no TRU or mixed TRU waste was generated from Environmental Management operations (Table 3-7). At the end of calendar year 2017 the cumulated TRU and mixed TRU waste volumes from Environmental Management operations was 38 cubic meters, which is approximately 0.2 percent of the total estimated TRU or mixed TRU projected in the 2008 SWEIS for Environmental Management operations. Table 3-18 summarized TRU and mixed TRU generation for Environmental Management operations.

Table 3-18. TRU and Mixed TRU Waste Quantities from EM Operations for Calendar Year 2017

Waste Generator	2008 SWEIS Projection Total[a]	Cumulative Total (2007 - 2016)[a]	2017 Cumulative Total[a]	Percentage of Total Projected Waste Generation by EM[d]
EM	16858.43[b]	38[c]	38	0.2

a. cubic meters.
b. Projected total waste generation from Implementation of the Consent Order, Removal Option, 2008 SWEIS (Table I-70).
c. The total sum of the TRU and mixed TRU waste generated from Environmental Management operations from 2007 through 2016.
d. The 2017 cumulative total divided by the 2008 SWEIS projection total and multiplied by 100.

As noted in previous Yearbooks, WIPP was not accepting TRU and mixed TRU waste because of the February 2014 radiological release in the facility. Since that time, LANL has been temporarily storing legacy and newly generated TRU and mixed TRU waste at LANL permitted facilities. In January 2017, WIPP began accepting TRU and mixed TRU waste. During 2017, LANL made 1 shipment of TRU and mixed TRU waste was transported to WIPP. Under the Expanded Operations Alternative, as stated in Table K-5 (page K-24) in the 2008 SWEIS, the 10-year maximum projection for TRU waste (including mixed TRU waste) is 5,044 shipments. From 2008 through the end of 2017, a total of 1,114 shipments of TRU and mixed TRU waste from LANL have been completed.

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 Norton Transmission line import capacity of 116 megavolt amperes (MVA).

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 Los Alamos Power Pool under contractual arrangement. The steam turbines at the Co-generation Complex are out of service. There are plans to replace the existing central steam plant with a Combined Heat and Power plant that uses the existing Combustion Gas Turbine as the primary heat source. 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 MVA is expected to be exceeded by summer 2027 by the combined demand loads of LANL and Los Alamos County. The reconductoring of the Norton Line is being discussed to increase the import capacity from 116 to 143 MVA, 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 13.8-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 approved 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 3-19 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 3-19. Electricity Peak Coincidental Demand in Calendar Year 2017[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]
2017	41,823	23,387	7,586	72,796	16,567	89,613

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.
f. LANSCE electrical meters were off-line due to damage sustained May 2015. The consumption value provided includes estimated usage for January and February of 2017 and no coincidental was included for these months. Actual usage metering began March 2017.

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 and will increase the generation capacity to 45 megawatts.

Table 3-20 shows energy consumption for calendar year 2017. LANL's energy consumption remains below projections in the 2008 SWEIS.

Table 3-20. Energy Consumption in Calendar Year 2017[a]

Category	LANL Base	LANSCE	Metropolis Center	LANL Total	County Total	Pool Total
2008 SWEIS	356,000	208,000[b]	131,400[c]	651,400[d]	150,000	801,400[e]
CY 2017	235,127	137,515[f]	93,578	466,220	121,233	589,643

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 were off-line due to damage sustained May 2015. The consumption value provided includes estimated usage for January and February of 2017 and no coincidental was included for these months. Actual usage metering began March 2017.

Energy Efficiency. As in previous years, LANL invested in a number of energy reduction initiatives in calendar year 2017. Investments include: (1) building automation system upgrades; (2) monitoring via energy analytics software; (3) heating, (4) ventilation, and air conditioning recommissioning; (5) smart labs program, and (6) light-emitting diode (LED) lighting upgrades.

Based on DOE/NNSA sustainability goals, Laboratory has worked toward an energy intensity-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 include 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 GHG goals.

3.4.2 Water

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.

The Laboratory has worked to install water meters on high user Laboratory facilities and has a supervisory control and data acquisition/equipment surveillance system on the water distribution to keep track of water tank levels and usage. The Laboratory continues to maintain the distribution system by replacing portions of the system in need of repair that are identified during leak detection surveys.

Elements of the Expanded Operations Alternative in the 2008 SWEIS were approved in the two RODs. Two of the elements approved under the Expanded Operations Alternative were expansion of the capabilities and operational levels at the Metropolis Center to support additional processors and material disposal area remediation. 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 SERF 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 10.7 million gallons in calendar year 2017. The SERF provided over 32.9 million gallons of makeup water.

Table 3-22 shows water consumption for calendar year 2017. Under the 2008 SWEIS RODs, water use at LANL was projected to be 459.9 million gallons from the No Action Alternative plus elements of the Expanded Operations Alternative. LANL consumed approximately 274 million gallons of water in calendar year 2017. Total use by LANL in 2017 was about 187 million gallons less than the 2008 SWEIS projection of 459.8 million gallons.

Table 3-21. Water Consumption (million gallons) in Calendar Year 2017

Category	LANL Total	Metropolis Center	LANSCE	Los Alamos County	Total
2008 SWEIS	459.8[a]	51	119	1,241	1,621
2017	274.8	10.7	60.7	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 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 3-23 presents LANL's calendar year 2017 gas usage. Approximately 90 percent of the gas used by LANL in 2017 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 year 2017 was less than projected in the 2008 SWEIS.

Table 3-22. Gas Consumption (decatherms[a]) at LANL in Calendar Year 2017

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
2017	847,023	52,605	794,418	241,507[c]

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 2017) and that used for heat (216,900 klb)

3.5 Worker Safety

The LANL Institutional 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. In 2017, DOE assessed the Laboratory Voluntary Protection Program. 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 28.6 percent in calendar year 2017 compared with calendar year 2016 with respect to the Days Away, Restricted or Transferred (DART) rate and a decrease of 24.4 percent in the Total Recordable Case (TRC) rate.

Table 3-24 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.

Table 3-23. TRC and DART Rates at LANL

Rate	Total 2016 Cases	CY 2016	Total 2017 Cases	CY 2017	Percent Change
TRC	125	1.35	101	1.02	24.4% decrease
DART	26	.28	20	.20	28.6% decrease

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

3.5.2 Ionizing Radiation and Worker Exposures

Occupational radiation exposures for workers at LANL during calendar years 2016 and 2017 are summarized in Table 3-25. The collective total effective dose for the LANL workforce during calendar year 2017 was 158.5 person-rem, an increase of 66 percent from calendar year 2016. Data in Table 3-25 reflect that 22 fewer radiation workers received a measurable dose in calendar year 2016 but 65 percent more in calendar year 2017. With more workers and proportionally higher collective dose, the average non-zero dose per worker was essentially unchanged from 2016 to 2017. 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. Similarly, of the 158.5 person-rem collective total effective dose reported for calendar year 2017, 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	CY 2016	CY 2017
Collective total effective dose (external + internal)	person-rem	280	95.6	158.5
Number of workers with measurable dose	number	2,018	1,106	1,828
Average non-zero dose (external + internal radiation exposure)	millirem	139	86	87

The highest individual doses in calendar years 2016 and 2017 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 in 2016 and largely resumed Technical Area 55 operations in 2017. 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 year 2017, 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 3-26 summarizes the five highest individual dose data for calendar years 2016 and 2017 compared with 2008 when the LANL 2008 SWEIS was finalized.

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

CY 2008	CY 2016	CY 2017
2.106	1.293	1.637
1.198	1.293	1.613
1.132	1.281	1.609
1.096	1.170	1.604
0.952	0.989	1.577

Comparison with the 2008 SWEIS Baseline. The collective total effective dose for calendar years 2016 and 2017 was 34 and 57 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 Plutonium Facility operations accounted for the majority of occupational dose at LANL in 2017. Occupational dose was accrued from weapons manufacturing and related work, Pu-238 work, repackaging materials, and providing Radiological Control Technicians and other infrastructure support for radiological work and facility maintenance at Technical Area 55. The top 25 doses at LANL in 2017 were accrued at Technical Area 55. A primary contributor to dose in 2017 was work with Pu-238, producing general purpose heat sources for use individually and in radioisotope thermoelectric generators. Doses at Technical Area 55 are significantly higher for 2017 because most programmatic work was fully resumed following a stand down in 2013 and was operating at normal capacity.

In addition to Technical Area 55 operations, a significant portion of LANL dose was accrued by workers commensurate with programmatic and maintenance work at the Technical Area 53 LANSCE.

Also, a significant portion of LANL dose was accrued by workers performing retrieval, repackaging, and shipping of radioactive solid waste within LANL facilities and at waste facilities Technical Area 50 and Technical Area 54. This work included resumed operations directly handling solid waste. Internal doses were essentially unchanged from calendar year 2017 (0.1 rem). In calendar year 2017, internal dose consisted of low-level uranium and tritium intakes consistent with routine operations.

LANL extremity dose increased by 60 percent from calendar year 2016 to calendar year 2017. These increases correlate with increasing worker doses, reflecting relatively more hands-on work at Technical Area 55 as operations resumed in calendar year 2017. 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 2018 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 organizations 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 year 2017 represented the majority of the LANL collective total effective dose. Approximately 85 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 the management and operations contractor (LANS in 2017) 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 3-27, the total number of employees in calendar year 2017 was 12 percent lower than 2008 SWEIS projections. The 11,782 total employees at the end of calendar year 2017 shows an increase from the 10,739 employees reported in the calendar year 2016 (LANL 2018d).

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
CY 2017	11,025	480	No longer included	277	11,782

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 calendar year 2017 have been published.

The residential distribution of the LANL-affiliated workforce reflects the housing market dynamics of three counties. Approximately 76 percent of management and operations employees reside in Los Alamos, Santa Fe, and Rio Arriba counties (Table 3-28).

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
CY 2017	4,768	1,860	2,345	1,258	10,231	1,551	11,782

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 remains undeveloped as grasslands, shrublands, woodlands, and forests that serve as security and safety buffer zones, and lands for future programmatic 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. LANL is surrounded by: the lands of other federal agencies (National Park Service, U.S. Forest Service, and the Bureau of Land Management); the Pueblos of San Ildefonso and Santa Clara; and Los Alamos County which includes public and private properties. Developed lands are found mostly on mesa tops. The highest concentration of facilities and workers are located at Technical Area 03, Technical Area 53, and along the Pajarito Corridor in Technical Areas 35, 46, 48, 50, 55 and 66. Future development will likely take place in these areas as sites are redeveloped and repurposed to accommodate new missions.

On December 19, 2014, the Manhattan Project National Historical Park (Park) legislation was signed by President Obama directing the DOE and the Department of Interior to develop a Memorandum of Understanding by December 2015 and complete a Park Management Plan.

2008 SWEIS Analysis

The 2008 SWEIS noted that LANL occupied about 40 square miles (25,600 acres) spread across 49 Technical Areas. 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 (e.g. trailers, transportables, and transportainers), and 897 miscellaneous structures (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. 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 DD&D'd.

The latest Ten Year Site Plan states that LANL occupied 25,314 Acres. Facilities comprised about 7.9 million gross square feet of space. There were a total of 981 permanent buildings and trailers. Leased space in Los Alamos and White Rock accounted for 435,000 gross square feet (LANL 2016c)

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 3,090 acres (4.8 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 990 acres of land have been conveyed to Los Alamos County and the Los Alamos School District. These actions were analyzed in the "Environmental Impact Statement for the Conveyance and Transfer of Certain Land Tracts Administered by the Department of Energy and Located at Los Alamos National Laboratory, Los Alamos and Santa Fe Counties, New Mexico." Ten original tracts, identified in SWEIS for conveyance or transfer were later subdivided into 32 tracts (DOE 1999a). Twenty tracts have been conveyed to the County of Los Alamos, three tracts were conveyed to the Los Alamos County School District, and three tracts have been transferred to the Bureau of Indian Affairs. Table 3-29 provides location and size information on the land tracts remaining to be conveyed. The remaining tracts total 1,284 acres (2 square miles) and all would be conveyed to Los Alamos County.

Table 3-28. Remaining Tracts Analyzed for Potential Conveyance

Land Tract	Approximate Acreage	Location
Technical Area 21/A-16	220	Accessed by DP Road, these were subdivided into smaller tracts in order to prepare for conveyance to County. Tracts A-16-b and A-15-2 are likely to be conveyed in FY18-19, while tracts east of the access gate (A-16-c, A-16-d and the remainder of the former Technical Area 21) are contingent upon further actions by DOE EM.
Rendija Canyon/A-14a, c, d	890	North of and below Los Alamos town site's Barranca Mesa residential subdivision. Deed restrictions require resolution prior to conveyance.
A-18-2	24	Located in Bayo Canyon. Likely to be conveyed to Los Alamos County in FY18-19 for recreational use.
C-2 and C-4	150	Highway 501 (White Rock "Y" and NM 4 south to East Jemez Road). Contingent on DOE supplemental environmental projects scheduling, these two tracts comprise the White Rock "Y" and NM 4 between the "Y" and East Jemez Road.

In calendar year 2017, no tracts were conveyed or transferred.

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 2016 Consent Order in calendar year 2017 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-EM 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 year 2017, DOE prepared a Supplement Analysis to the 2015 Environmental Assessment for Chromium Plume Control Interim Measure and Plume Center Characterization (DOE 2017a). The proposal included drilling additional extraction wells and installing associated infrastructure to improve the effectiveness of the current system to control chromium plume migration. DOE-EM determined the environmental impacts of the proposed actions were bounded by analysis presented in the 2015 Environmental Assessment.

In calendar 2017, equipment and additional infrastructure was installed in Mortandad Canyon to prepare for the implementation of the chromium plume control interim measures. Three chromium infrastructure wells (CrEX-2, CrEX-4, and CrIN-6) were installed.

Groundwater monitoring, groundwater investigations, and installation of monitoring wells were performed pursuant to the 2016 Consent Order. In calendar year 2017, DOE-EM completed installation of one new regional aquifer well (R68) in Technical Area 09 (Figure 3-1).

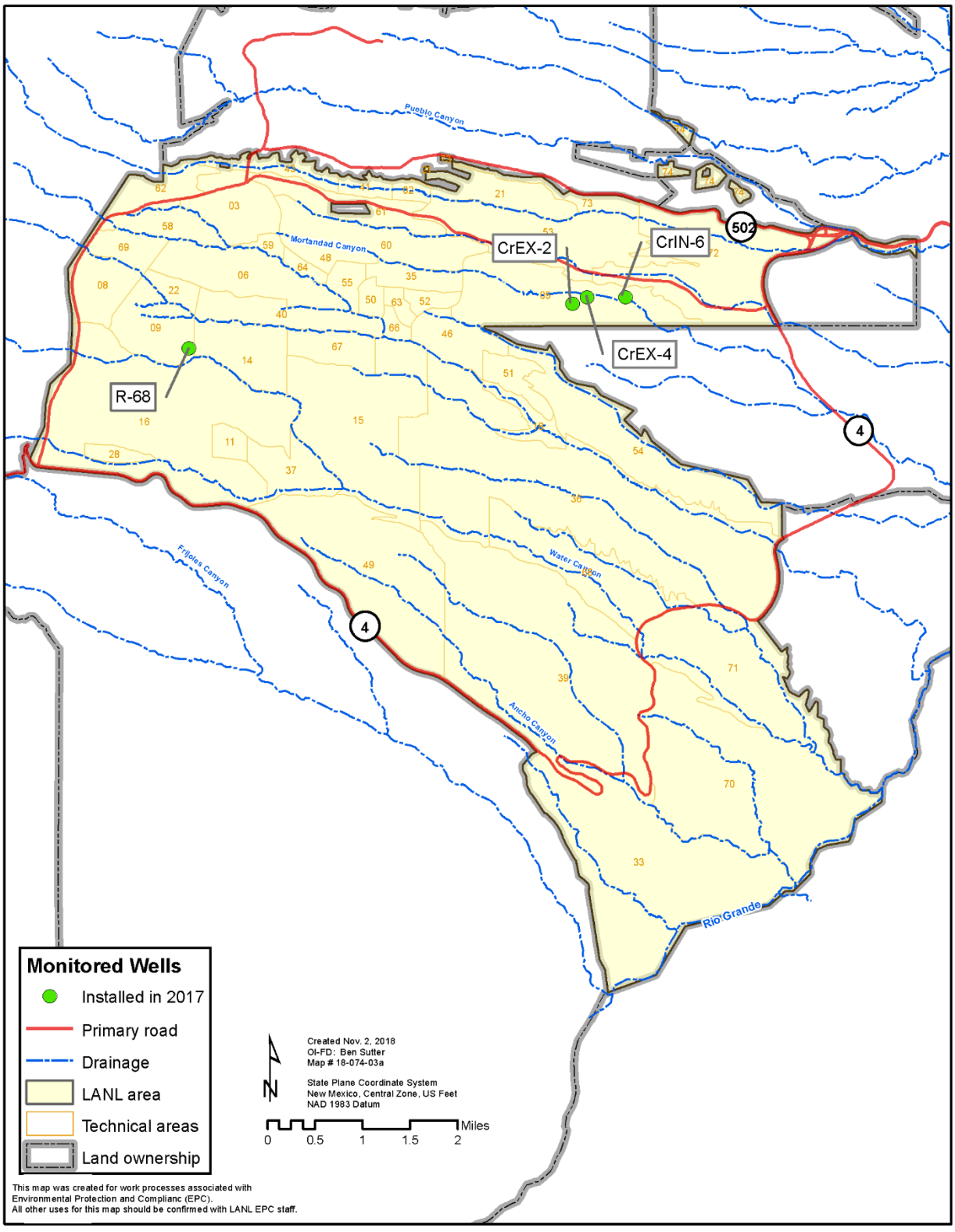

Figure 3-1. Location of wells installed in Calendar Year 2017

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 3-30). 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[14] 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 and 2017[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 NRHP sites	Percentage of total site eligibility
2008	0	23,130	1,727[b]	1,625[b]	94
2017	34[c]	23,193	1,745[b]	1,642[b]	94

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 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.

c. There were 34 new acres surveyed during fiscal year 2017 and additional linear errors in the surveyed area spatial database were also corrected, bringing the total number of surveyed acres to 23,193. One tract of land was conveyed during fiscal year 2017.

To date, cultural resource staff at LANL have not identified Spanish Colonial or Mexican period sites. In 2004, the historic periods (Historic Pueblo, United States Territorial, Undetermined Athabascan, and Statehood) were combined into one site affiliation code, Early 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 Field Office,

[14] 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.

the State Historic Preservation Office, and the Advisory Council on Historic Preservation (LANL 2017l). Additionally, LANL 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. Only those buildings still standing are included in the total count of 573 (Table 3-31). 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 and potentially eligible 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
2017	573	467	371	202	79.4	220

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.

DOE continues to evaluate buildings and structures from the Early Cold War, and the late Cold War periods (1943–1990) for eligibility in the National Register of Historic Places.

There are 146 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 3-32 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
2017	2	4

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.

In 2017, cultural resources staff at LANL evaluated more than 1,100 proposed actions, and conducted 10 field surveys to identify archaeological sites and historic buildings. DOE/NNSA sent seventeen survey reports in fiscal year 2017 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). Culturally affiliated tribes are notified of possible impacts to traditional and sacred places. During fiscal year 2017, one archaeological site eligibility report was sent to the Governor of the Pueblo de San Ildefonso. 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). No discoveries of human remains occurred in fiscal year 2017. 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 2017.

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. The nine year study on Nake'muu indicated that displacement rates are significantly correlated with annual snowfall (freeze/thaw patterns), but not with annual rainfall or explosive tests at the DARHT Facility. The site is revisited annually to record changes and remove vegetation that may impact the standing walls. Representatives from the Pueblo de San Ildefonso visited Nake'muu in 2008, 2009, and 2010. In recent years, the Pueblo de San Ildefonso have not requested visits to Nake'muu. No pueblo site visits were conducted in 2017.

Land Conveyance and Transfer. The Laboratory continued a multiyear program in support of the Land Conveyance and Transfer Project, which included excavation of 39 archaeological sites, with more than 200,000 artifacts and 2,000 samples recovered (LANL 2008). In 2017, DOE and cultural resources staff from LANL 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/NNSA are housed. In 2017, three fences surrounding sensitive cultural areas on previously conveyed tracts were monitored.

Manhattan Project National Historical Park. The 2014 National Defense Authorization Act signed by President Obama provided legislation for the creation of the 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 in 2015 (DOE 2015e). 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 were identified as contributing to the Park. Located in eight separate areas, these 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.

In 2017, cultural resources staff worked with National Park Service staff on various assessment and repair projects at park and park-eligible properties under an Interagency Agreement for preservation assistance between the National Park Service and the DOE/NNSA. Repair work was carried out at Technical Area 22's Quonset Hut and at V-Site. A historic railroad gate at the Technical Area 8 Gun Site was restored using new lumber and original hardware. Several tours of Manhattan Project properties were provided. Also in 2017, a new exhibit about the park, entitled "Manhattan on the Mesa: Manhattan Project Park Properties at Los Alamos" was installed at the Bradbury Science Museum to facilitate enhanced public access. The exhibit was developed in conjunction with New Mexico Highlands University's Program in Interactive Cultural Technology (PICT) and focuses on the interpretation of Manhattan Project sites located at LANL.

3.9.3 Cultural Resources Management Plan

In 2017, the Cultural Resources Management Plan was updated and revised (LANL 2017m). Like its predecessor, the CRMP 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 revised CRMP was provided to more than 20 tribes and the public for review and comment. It provides high-level guidance for implementation of the Traditional Cultural Properties Comprehensive Plan (LANL 2000) 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 revised CRMP is implemented through an updated Programmatic Agreement between DOE/NNSA, the New Mexico State Historic Preservation Office, and the Advisory Council on Historic Preservation and it was signed in August 2017.

In 2017 outreach activities included tours of historical sites at LANL including V-Site, Gun Site, and the Slotin building. Several public presentations related to LANL history and historic properties were also provided to the Los Alamos Historical Society, New Mexico State University, Highlands University, and the University of New Mexico. Tours of two archaeological sites (Tsirege and Nake'muu) were provided 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.

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 2017 support this projection. These data are reported in the 2017 Annual Site Environmental Report (LANL 2018c).

The SWEIS biological assessment (LANL 2006), evaluated actions described in the 2008 SWEIS No Action Alternative and some actions in 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).

3.10.1 Conditions of the Forests and Woodlands

The forests and woodlands in and around the LANL area have undergone significant changes in the past few decades. Wildfire, insect activity, and drought have impacted forest and woodland trees and have caused tree mortality in many areas.

LANL is located in a fire-prone region, which means 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 boundaries 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 2016, the LANL Five-Year Wildland Fire Management Plan was issued (2016–2020) (LANL 2016d). The Wildland Fire Management Program goal is to protect life, infrastructure, and the environment from the devastating effects from wildfire.

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

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 (LANL 2014) 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 2017, DOE/NNSA updated the Threatened and Endangered Species Habitat Management Plan to modify the habitat boundaries for the lower section of Water Canyon Mexican Spotted Owl Area of Environmental Interest due to habitat degradation resulting from long-term drought and fire (LANL 2017a). LANL also continued annual surveys for the Mexican Spotted Owl, the Southwestern Willow Flycatcher, and the Jemez Mountains Salamander in calendar year 2017, pursuant to the Threatened and Endangered Species Habitat Management Plan.

3.10.3 Biological Assessments and Compliance Packages

During calendar year 2017, the following biological assessments were prepared.

- *Biological Assessment of Changing Habitat Boundaries in Lower Water Canyon and for the Construction of a New Building at Los Alamos National Laboratory (LANL 2017n).* During calendar year 2017, the following floodplain and/or wetland assessments were prepared.
- *Floodplain Assessment for the North Ancho Canyon Aggregate Area Cleanup in Technical Area 39 at Los Alamos National Laboratory (LANL 2017o).*
- *Floodplain Assessment for the Middle Los Alamos Canyon Aggregate Area Investigations in Technical Area 02 at Los Alamos National Laboratory (LANL 2017p)*.
- *Floodplain Assessment for the Non potable Water Line from the Los Alamos Canyon Reservoir to the Los Alamos Townsite (LANL 2017q)*.
- *Floodplain Assessment for the Upper Cañon de Valle Watershed Enhancement Project in Technical Area 16 at Los Alamos National Laboratory (LANL 2017r)).*
- *Floodplain Assessment for the North Ancho and Lower Sandia Controls Supplemental Environmental Projects at Los Alamos National Laboratory (LANL 2017o).*
- *Floodplain and Wetland Assessment for the Mortandad Wetland Enhancement and the DP Dissipater Projects at Los Alamos National Laboratory (LANL 2017s).*

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 2017, DOE/NNSA removed approximately 10 structures, eliminating 25,925 square feet of LANL's footprint. Table 3-33 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
2017	25,925	1,041,486

* Multiply square feet by 0.092903 to get square meters.

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 year 2017, 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 year 2017.

Table 3-33. Calendar Year 2017 DD&D Facilities Construction and Demolition Debris[a]

Building Number[b]	DD&D Completed	Waste Volumes (cubic meters)						
		Construction/ Demolition Debris[d]	Asbestos[c]	Universal Waste	Recyclable Metal[d]	Recyclable Asphalt/ Concrete[d]	Recyclable Wood	Equipment Salvaged[d]
53-0044	02/02/2017	94.8	3.8	0.1	93.4	4.4	0	0
53-0045	02/02/2017	79.0	3.8	0.1	93.4	4.4	0	0
53-0046	02/02/2017	79.0	3.8	0.1	93.4	4.4	0	0
53-0047	02/02/2017	79.0	3.8	0.1	93.4	4.4	0	0
57-0018	05/08/2017	19.0	0	0.1	81.6	106.7	0	0
57-0056	05/16/2017	0	0	0.1	13.6	35.6	0	0
57-0082	05/24/2017	6.3	0	0.1	271.8	24.9	0	0
57-0017	06/12/2017	60.0	15.3	0.2	68.0	124.5	0	0
03-0251	06/28/2017	0	0	0	1.4	0	0	0
Total		**494.1**	**61**	**0.9**	**952.7**	**344.9**	**0**	**0**
2008 SWEIS		**246,409[a]**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/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. Waste Volumes that are tracked in tons, cubic meters volume calculated using the conversion factors as identified in the Volume-to-Weight Conversion Factors U.S. Environmental Protection Agency Office of Resource Conservation and Recovery (EPA 2016) .
e. N/A = not available

Table 3-34. DD&D Waste Projections for Calendar Year 2017

Building Number	DD&D Completed	Waste Volumes			
		Chemical Waste[a]	LLW[b,c]	Mixed LLW[b]	TRU[b]
Technical Area 03, Building 35	07/28/2017	0	1,743	0	0
Total 2017		0	1,743	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 Technical Area 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

LANL operations data mostly fell within the 2008 SWEIS projections. Several facilities exceeded the 2008 SWEIS levels for waste generation quantities; however, all were infrequent, non-routine events that do not reflect day-to-day LANL operations. Chemical waste volumes in calendar year 2017 exceeded annual volumes for the Non-Key Facilities as a result of the disposition of press filter cakes and reverse osmosis reject water from the Sanitary Effluent Reclamation Facility.

The purpose of the calendar year 2017 Yearbook is to compare LANL operations data to 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 2017 data indicate that the Laboratory was operating within the SWEIS envelope.

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

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APPENDIX A OF THE SWEIS YEARBOOK – CALENDAR YEAR 2017 CAPABILITY AND OPERATIONS TABLES FOR KEY AND NON-KEY FACILITIES

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

Capability	2008 SWEIS Projections	2017 Operations
Analytical Chemistry	Support actinide research and processing activities by processing approximately 7,000 samples per year.	Received less than 1,250 samples and conducted approximately 2,700 analytical processes involving micrograms to gram quantities of material.
Uranium Processing	Recover, process, and store LANL's highly enriched uranium inventory.	Highly enriched uranium items were processed to meet disposal/shipping requirements.
Destructive and Nondestructive Analysis	Evaluate up to 10 secondary assemblies per year through destructive/non-destructive analyses and disassembly.	No activity.
Nonproliferation Training	Conduct nonproliferation training using special nuclear material.	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.
	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.
	Analyze TRU waste disposal related to validation of Waste Isolation Pilot Plant performance assessment models.	No activity. Project was completed in 2001.
	Perform TRU waste characterization.	No activity.
	Analyze gas generation as could occur in TRU waste during transportation to the Waste Isolation Pilot Plant.	No activity.
	Demonstrate actinide decontamination technology for soils and materials.	No activity.
	Develop actinide precipitation method to reduce mixed wastes in LANL effluents.	No activity.
	Process up to 400 kilograms of actinides per year between Technical Area 55 and the CMR Building.	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.

Capability	2008 SWEIS Projections	2017 Operations
	Process neutron sources other than sealed sources.	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.
	Produce 1,320 targets per year for isotope production.	No activity.
	Separate fission products from irradiated targets.	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.
Large Vessel Handling[b]	Process up to two large vessels from the Dynamic Experiments Program annually.	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 Containment Vessel Disposition Project.

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

Parameter	Units[a]	2008 SWEIS Projections	2017 Operations
Radioactive Air Emissions			
Total Actinides[b]	Ci/yr	7.60E-4	2.86E-6
Krypton-85	Ci/yr	1.00E+2	Not measured[c]
Xenon-131m	Ci/yr	4.50E+1	Not measured[c]
Xenon-133	Ci/yr	1.50E+3	Not measured[c]
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	10,886	155
LLW	m^3/yr	1,835	13.7
MLLW	m^3/yr	19	0
TRU	m^3/yr	42[d]	2.7
Mixed TRU	m^3/yr	[d]	21.6

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

b. 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. 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	2017 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.
Characterization of Materials	Perform research and development on properties of ceramics, oxides, silicides, composites, and high-temperature materials.	Total of 210 assignments and approximately 700 specimens were characterized.
	Analyze up to 36 tritium reservoirs per year.	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.	Activity performed as projected.
Fabrication of Metallic and Ceramic Items	Fabricate stainless steel and beryllium components for up to 80 pits per year.	Fabricated approximately 15 stainless steel and specialty alloy pit components.
	Fabricate up to 200 reservoirs for tritium per year.	Fabricated 20 reservoirs for tritium testing.
	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.
	Fabricate non-nuclear components for research and development: about 100 major hydrotests and 50 joint test assemblies per year.	Fabricated components for approximately 30 hydrotests and for less than five joint test assemblies.
	Fabricate beryllium targets.	Provided material for the production of experimental test components for several different weapons and global security customers.
	Fabricate targets and other components for accelerator production of medical isotopes research.	Fabricated 15 targets for accelerator production of medical isotopes.
	Fabricate test storage containers for nuclear materials stabilization.	No activity.

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

Parameter	Units[a]	2008 SWEIS Projections	2017 Operations
Radioactive Air Emissions[b]			
Uranium-234	Ci/yr	6.60E-5	Not measured[b]
Uranium-238	Ci/yr	1.80E-3	Not measured[b]
NPDES Discharge			
04A022	MGY	5.8	.48[c]
Wastes			
Chemical	kg/yr	9,979	24,584.2[d]
LLW	m^3/yr	994	290.5
MLLW	m^3/yr	4	0
TRU	m^3/yr	0[e]	0
Mixed TRU	m^3/yr	0[e]	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. In calendar year 2017, chemical waste generation at the Sigma Complex exceeded 2008 SWEIS projections due to 19,481.8 kilograms of beryllium contaminated waste. This accounted for 79 percent of the total chemical waste generated at the Sigma Complex.

e. The 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	2017 Operations
Fabrication of Specialty Components	Provide fabrication support for the dynamic experiments program and explosives research studies.	Specialty components were fabricated at levels projected.
	Support up to 100 hydrodynamic tests per year.	Fewer than 10 hydrodynamic tests were supported.
	Manufacture up to 50 joint test assembly sets per year.	None.
	Provide general laboratory fabrication support as requested.	Activity performed as projected.
Fabrication Utilizing Unique Materials	Fabricate items using unique and unusual materials such as depleted uranium and lithium.	Fabrication of unique materials was conducted at levels below those projected.
Dimensional Inspection of Fabricated Components	Perform dimensional inspection of finished components.	Activity performed as projected.
	Perform other types of measurements and inspections.	No activity.

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

Parameter	Units[a]	2008 SWEIS Projections	2017 Operations
Radioactive Air Emissions			
Uranium isotopes[b]	Ci/yr	1.50E-04	Not measured[c]
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	474,002	3,145.9
LLW	m^3/yr	604	0
MLLW	m^3/yr	0	0
TRU	m^3/yr	0[d]	0
Mixed TRU	m^3/yr	0[d]	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 129 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	2017 Operations
Materials Processing	Support development and improvement of technologies for materials formulation.	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.
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.
	Develop and improve techniques for these and other types of studies.	Activity was performed as projected.
Advanced Materials Development	Synthesize and characterize single crystals and nanophase and amorphous materials.	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.
	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.
Materials Characterization	Perform materials characterization activities to support materials development.	Activity was performed as projected.
Applied Energy Research[a]	Perform materials, including nanomaterials, development for catalysis, sensing photovoltaics, energy production, hydrogen storage, and functional polymer membranes.	Activity was performed as projected.

a. This capability was 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	2017 Operations
Radioactive Air Emissions			
	Ci/yr	Negligible	Not measured[b]
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	590	529.3
LLW	m^3/yr	0	0
MLLW	m^3/yr	0	0
TRU	m^3/yr	0[c]	0
Mixed TRU	m^3/yr	0[c]	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. The 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	2017 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.

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

Parameter	Units[a]	2008 SWEIS Projections	2017 Operations
Radioactive Air Emissions			
Not projected[b]	Ci/yr	Not projected[b]	Not measured[b]
NPDES Discharge			
03A027[c]	MGY	17.7[d]	0
Wastes			
Chemical	kg/yr	0	0
LLW	m^3/yr	0	0
MLLW	m^3/yr	0	0
TRU	m^3/yr	0[e]	0
Mixed TRU	m^3/yr	0[e]	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 and is a no flow outfall.
d. Previous Yearbooks incorrectly listed the No Action Alternative discharge amount for the Metropolis Center.
e. The 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	2017 Operations
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 12,000 pounds (5454 kilograms) of high explosives and less than 1,000 pounds (454 kilograms) 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.
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.
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 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	2017 Operations
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.	276 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.	Conducted safety and environmental testing related to stockpile assurance and new materials development as projected.
	Conduct up to 15 safety and mechanical tests per year.	Fewer than 20 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 all activities as projected. No major product lines were completed in calendar year 2017.

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.

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

Parameter	Units[a]	2008 SWEIS Projections	2017 Operations
Radioactive Air Emissions			
Uranium-238	Ci/yr	9.96E-7	Not measured[b]
Uranium-235	Ci/yr	1.89E-8	Not measured[b]
Uranium-234	Ci/yr	3.71E-7	Not measured[b]
NPDES Discharge			
05A055	MGY	0.06	0
Wastes			
Chemical	kg/yr	13,154	57,463.94[c]
LLW	m^3/yr	15	5.4
MLLW	m^3/yr	<1	0
TRU	m^3/yr	0[d]	0
Mixed TRU	m^3/yr	0[d]	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. In calendar year 2017, chemical waste generation at the High Explosives Processing Facility exceeded 2008 SWEIS projections due to the disposal of non-routine maintenance and construction debris which accounted for 73 percent (39,900 kilograms) of the chemical waste generated at the HEP facility, 28 percent (16,915 kilograms) from propylene glycol/water mixture used for Weapons Facilities Operations maintenance operations, and 9 percent (5,292 kilograms) from Technical Area 09, Building 45 maintenance and construction activities.

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

Capability	SWEIS Projections	2017 Operations
Volume of Materials Required[a]	Conduct about 1,800 experiments per year.	608 experiments conducted.
	Use up to 6,900 pounds (3,130 kilograms) of depleted uranium in experiments annually.	365 pounds (165 kilograms) of depleted uranium was expended.
Hydrodynamic Tests	Develop containment technology. Conduct baseline and code development tests of weapons configuration. Conduct 100 major hydrodynamic tests per year.	Five 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.
Explosives Research and Testing	Conduct tests to characterize explosive materials.	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.
High Explosives Pulsed-Power Experiments	Conduct experiments using explosively driven electromagnetic power systems.	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.
Other Explosives Testing	Conduct advanced high explosives or weapons evaluation studies.	Activity performed as projected.

a. 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	2017 Operations
Radioactive Air Emissions			
Depleted Uranium[b]	Ci/yr	1.5E-1	Not measured[c]
Uranium-234	Ci/yr	3.4E-2	Not measured[c]
Uranium-235	Ci/yr	1.5E-3	Not measured[c]
Uranium-238	Ci/yr	1.4E-1	Not measured[c]
Chemical Usage[d]			
Aluminum[d]	kg/yr	45,720	<1,000
Beryllium	kg/yr	90	<25
Copper[d]	kg/yr	45,630	<10
Depleted Uranium	kg/yr	3,931.4	<500
Iron[d]	kg/yr	30,210	<5,000
Lead	kg/yr	241.4	<1
Tantalum	kg/yr	450	<100
Tungsten	kg/yr	390	<300
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	35,380	496,598.9[e]
LLW	m^3/yr	918	490.9
MLLW	m^3/yr	8	2.49
TRU[e]	m^3/yr	<1[f]	0
Mixed TRU	m^3/yr	[f]	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 27 percent 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. Relative percentages are based on activity (curies) of each isotope, not mass.

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. In calendar year 2017 chemical waste generation exceeded the 2008 SWEIS projections due to the removal of PCB contaminated soil, which accounted for 68 percent (338,312 kilograms) of the chemical waste generated and to the removal of asphalt from Technical Area 40 which accounted for 15 percent (72,574.7 kilograms) of the chemical waste generated.

f. The 2008 SWEIS combined TRU and mixed TRU waste. Both categories are managed for disposal at WIPP.

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

Capability	2008 SWEIS Projections	2017 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.
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.	Four gas boost system tests (all below 100 grams) and 14 associated gas analyses and processing were performed.
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.
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.
Gas Analysis	Measure the composition and quantities of gases (in support of tritium operations).	Activity performed as projected.
Calorimetry	Perform calorimetry measurements in support of tritium operations.	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).
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.

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

Parameter	Units[a]	2008 SWEIS	2017 Operations
Radioactive Air Emissions			
Technical Area 16/WETF, Elemental tritium	Ci/yr	300	8.2
Technical Area 16/WETF, Tritium in water vapor	Ci/yr	500	73.8
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	1,724	591.6
LLW	m^3/yr	482	26.5
MLLW	m^3/yr	3	0
TRU	m^3/yr	0[b]	0
Mixed TRU	m^3/yr	0[b]	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. 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	2017 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.
	Perform approximately 100 high-energy-density physics tests per year.	Activity performed as projected.
	Analyze up to 36 tritium reservoirs per year.	No activity.
Polymer Synthesis	Produce polymers for targets and specialized components for approximately 12,400 laser and physics tests per year.	Characterized using computed tomography, optical, structural, and chemical methods
	Perform approximately 100 high-energy-density physics tests per year.	Supported polymeric materials efforts for B61 Life Extension Program, ALT, and hydro test programs through synthesis, part production, and aging experiments.
Chemical and Physical Vapor Deposition	Coat targets and specialized components for about 12,400 laser and physics tests per year.	Activity performed as projected.
	Support approximately 100 high-energy-density physics tests per year. Support plutonium pit rebuild operations.	Supported plutonium pit rebuild operations.

Table A-18. Target Fabrication Facility (Technical Area 35) Operations Data

Parameter	Units[a]	2008 SWEIS	2017 Operations
Radioactive Air Emissions			
	Ci/yr	Negligible	Not measured[b]
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	3,810	4,392.1[c]
LLW	m^3/yr	10	0
MLLW	m^3/yr	<1	0
TRU	m^3/yr	0[d]	0
Mixed TRU	m^3/yr	0[d]	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. In calendar year 2017 chemical waste generation at the Target Fabrication Facility exceeded the 2008 SWEIS projections due to the disposal of acid used to clean the heat exchanger; this accounted for 81 percent of the total chemical was generated (3, 556.2 kilograms.)

d. 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	2017 Operations
Biologically Inspired Materials and Chemistry	Determine formation and structure of biomaterials for bioenergy.	Activity performed as projected.
	Synthesize biomaterials.	Activity performed as projected.
	Characterize biomaterials.	Activity performed as projected.
Cell Biology	Study stress-induced effects and responses on cells.	Activity performed as projected.
	Study host-pathogen interactions.	Activity performed as projected.
	Determine effects of beryllium exposure.	No activity.
Computational Biology	Collect, organize, and manage information on biological systems.	Activity performed as projected.
	Develop computational theory to analyze and model biological systems.	Activity performed as projected.
Environmental Microbiology	Study microbial diversity in the environment; collect and analyze environmental samples.	Activity performed as projected.
	Study biomechanical and genetic processes in microbial systems.	Activity performed as projected.
Genomic Studies	Analyze genes of living organisms such as humans, animals, microbes, viruses, plants, and fungi.	Activity performed as projected.
Genomic and Proteomic Science	Develop and implement high-throughput tools. Perform genomic and proteomic analysis.	Activity performed as projected.
	Study pathogenic and nonpathogenic systems.	Activity performed as projected.
Measurement Science and Diagnostics	Develop and use spectroscopic tools to study molecules and molecular systems.	Activity performed as projected.
	Perform genomic, proteomic, and metabolomic studies.	Activity performed as projected.
Molecular Synthesis and Isotope Applications	Synthesize molecules and materials.	Activity performed as projected.
	Perform spectroscopic characterization of molecules and materials.	Activity performed as projected.
	Develop new molecules that incorporate stable isotopes.	Activities performed as projected at a reduced level of effort.

Capabilities	2008 SWEIS Projection	2017 Operations
	Develop chem-bio sensors and assay procedures.	No activity.
	Synthesize polymers and develop applications for them.	Activity performed as projected.
	Utilize stable isotopes in quantum computing systems.	No activity.
Structural Biology	Research three-dimensional structure and dynamics of macromolecules and complexes. Use various spectroscopy techniques.	Activity performed as projected.
	Perform neutron scattering.	No activity anymore
	Perform x-ray scattering and diffraction.	No activity.
Pathogenesis	Perform genome-scale, focused, and computationally enhanced experimental studies on pathogenic organisms.	Activity performed as projected.
Biothreat Reduction and Bioforensics	Analyze samples for biodefense and national security purposes.	Activity performed as projected.
	Identify pathogen strain signatures using DNA sequencing and other molecular approaches.	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.	Performed 227 whole-body client counts. Also, performed other counts associated with quality control, system calibrations, and intercomparision program.

* This is not a Bioscience Division capability; however, it is located at Technical Area 43, Building 1, 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	2017 Operations
Radioactive Air Emissions			
Not estimated	Ci/yr	Not estimated	Not measured[b]
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	13,154	1,879.3
LLW	m^3/yr	34	0
MLLW	m^3/yr	3	0
TRU	m^3/yr	0[c]	0
Mixed TRU	m^3/yr	0[c]	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	2017 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.
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.
Ultra-Low-Level Measurements	Perform chemical isotope separation and mass spectrometry at current levels.	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.
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 approximately 200 shipments. Increased diversity of isotopes produced. Production of elements with Z>86.
Actinide and TRU Chemistry	Perform radiochemical operations involving alpha-emitting radionuclides.	Activity performed as projected.
Data Analysis	Re-examine archive data and measure nuclear process parameters of interest to weapons radiochemists.	Activity performed as projected.

Capability	2008 SWEIS Projections	2017 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:
	  ○ Ligand design and synthesis for selective extraction of metals.
	  ○ Soil washing.
	  ○ Membrane separator development.
	  ○ Ultrafiltration.
		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.
Sample Counting	Measure the quantity of radioactivity in samples using alpha-, beta-, and gamma-ray counting systems.	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 2008a).

Table A-22. Radiochemistry Facility (Technical Area 48) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2017 Operations
Radioactive Air Emissions			
Mixed Fission Products[b]	Ci/yr	1.5E-4	Not measured[b]
Plutonium-239	Ci/yr	1.2E-5	No emissions[c]
Uranium isotopes	Ci/yr	4.8E-7	6.65E-09
Arsenic-72	Ci/yr	1.2E-4	No emissions[c]
Arsenic-73	Ci/yr	2.5E-3	No emissions[c]
Arsenic-74	Ci/yr	1.3E-3	No emissions[c]
Beryllium-7	Ci/yr	1.6E-5	No emissions[c]
Bromine isotopes[d]	Ci/yr	9.3E-4	4.96E-04
Germanium-68[e]	Ci/yr	8.9E-3	8.88E-03
Rubidium-86	Ci/yr	3.0E-7	No emissions[c]
Selenium-75	Ci/yr	3.8E-4	2.89E-05
Other Activation Products[f]	Ci/yr	5.5E-6	3.59E-04
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	3,311	1,547.3
LLW	m^3/yr	268	39.4
MLLW	m^3/yr	4	3.5
TRU	m^3/yr	0[g]	0
Mixed TRU	m^3/yr	0[g]	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[a]	2017 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.
	Support, certify, and audit generator characterization programs.	Activity performed as projected.
	Maintain the waste acceptance criteria for the RLWTF.	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.)	262,000 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[b]: • 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 • 0 cubic meters of mixed LLW • 0 cubic meters TRU/Mixed TRU waste • 0 kilograms of hazardous waste
Radioactive Liquid Waste Treatment	Pretreat 190,000 liters per year of liquid TRU waste.	No activity.
	Solidify, characterize, and package 17 cubic meters per year of TRU waste sludge.	No activity.
	Treat 20 million liters per year of liquid LLW.	Processed 3.6 million liters of liquid LLW
	Dewater, characterize, and package 60 cubic meters per year of LLW sludge.	2.1 cubic meters of LLW sludge (10 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.

Capability	2008 SWEIS Projections[a]	2017 Operations
	Discharge treated liquids through an NPDES outfall.	No water was discharged through the NPDES outfall. 3.4 million liters of treated water were evaporated.

a. 2008 SWEIS Projection updated to the Expanded Operations Alternative.

b. All waste is sent off-site for disposal because Technical Area 54 is now operated by N3B.

Table A-24. Radioactive Liquid Waste Treatment Facility (Technical Area 50) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2017 Operations
Radioactive Air Emissions			
Americium-241	Ci/yr	Negligible	No emissions[b]
Plutonium-238	Ci/yr	Negligible	No emissions[b]
Plutonium-239	Ci/yr	Negligible	1.68E-08
Thorium-228	Ci/yr	Negligible	No emissions[b]
Thorium-230	Ci/yr	Negligible	No emissions[b]
Thorium-232	Ci/yr	Negligible	No emissions[b]
Uranium isotopes	Ci/yr	Negligible	1.77E-07
NPDES Discharge			
051	MGY	4.0	0
Wastes			
Chemical	kg/yr	499	974.9[c]
LLW	m^3/yr	298	649.4[d]
MLLW	m^3/yr	2.2	0
TRU	m^3/yr	13.7[e]	0
Mixed TRU	m^3/yr	[e]	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 2017, chemical waste generated at RLWTF exceeded 2008 SWEIS projections due to the clean-up of an accidental diesel spill, which accounted for 94 percent (920.3 kilograms) of the chemical waste generated.

d. In calendar year 2017, LLW generation at RLWTF exceeded 2008 SWEIS projections due to a wastewater by-product of the treatment process of Radioactive Liquid Waste evaporator bottoms at Technical Area 50, which accounted for approximately 94 percent (608 cubic meters) of the LLW generated at RLWTF.

e. 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	2017 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+ at up to 350 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 up to 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 2017 (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.
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.
	Perform remote handling and packaging of radioactive material, as needed.	Remote handling and packaging of radioactive material was performed at the Isotope Production Facility.
Neutron Research and Technology[a]	Conduct 1,000 to 2,000 experiments/year using neutrons from the Lujan Center and Weapons Neutron Research Facility.	118 neutron beam experiments were conducted at the Lujan Center and Weapons Neutron Research Facility.

Capability	2008 SWEIS Projections	2017 Operations
	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.
Materials Test Station	Irradiate materials and fuels in a fast-neutron spectrum and in a prototype temperature and coolant environment.	No activity.
Subatomic Physics Research	Conduct 5 to 10 physics experiments per year at Manuel Lujan Center and Weapons Neutron Research Facility.	No activity.
	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.*	40 high explosive and 10 static experiments were conducted.

Capability	2008 SWEIS Projections	2017 Operations
	Conduct research using ultracold neutrons; operate up to 10 microamperes per year of negative beam current.	Ultracold neutrons collected data for the 45Ca, Nab, SNS-EDM and UCNTau experiments. Parts of the neutron source were modified to improve production.
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 2017: • 16 rubidium chloride targets and 6 rubidium targets for strontium-82; • Two rubidium chloride targets for testing the new raster; • 14 gallium targets for gallium-68; • one antimony target for tellurium-119; • two germanium targets for arsenic-73; • one thorium target at low energy for protactinium-230; • one dysprosium target for holmium-163; and • three research samples for cross section measurements, energy 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.
Radioactive Liquid Waste Treatment (Solar Evaporation at Technical Area 53)	Treat about 520,000 liters per year of radioactive liquid waste.	In calendar year 2017, LANSCE received 305,950 liters of radioactive liquid waste into its holding tanks, including 16,280 liters from other sites. A total of 322,610 liters were discharged to the evaporation tanks in calendar year 2017.

* 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	2017 Operations
Radioactive Air Emissions			
Argon-41	Ci/yr	8.87E+2	1.13E+02
Particulate and Vapor Activation Products	Ci/yr	Not projected[a]	2.08E-03
Carbon-10	Ci/yr	2.65E+0	2.75E-01
Carbon-11	Ci/yr	2.25E+4	1.32E+02
Nitrogen-13	Ci/yr	3.10E+3	2.41E+01
Oxygen-15	Ci/yr	3.88E+3	2.28E+01
Tritium as Water	Ci/yr	Not projected[b]	2.21E+01
NPDES Discharge			
Total Discharges	MGY	29.5[c]	27.9
03A048	MGY	Not projected [d]	27.7
03A113	MGY	Not projected [d]	0.2
Wastes			
Chemical	kg/yr	16,783	25,676.9[e]
LLW	m^3/yr	1,070	379.0
MLLW	m^3/yr	1	2.7[f]
TRU	m^3/yr	0[g]	0
Mixed TRU	m^3/yr	0[g]	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 2017, chemical waste generated at LANSCE exceeded 2008 SWEIS projections due to the general clean-up from an office fire at Building 31; this contributed to 40 percent (10,269.3 kilograms) of chemical waste generated.

f. In calendar year 2017, MLLW generated at LANSCE exceeded 2008 SWEIS projections due entirely to the wastes generated from the removal of the Lujan Flight Path, an experimental area.

g. 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)

Capability	2008 SWEIS Projections	2017 Operations
Waste Characterization, Packaging, and Labeling	Characterize 640 cubic meters of newly generated TRU waste.	No activity
	Characterize 8,400 cubic meters of legacy TRU waste.	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.
	Ventilate TRU waste retrieved from below-ground storage.	No activity.
	Perform coring and visual inspection of a percentage of TRU waste packages.	No activity.
	Overpack and bulk small waste, as required.	Activity performed as projected.
	Support, certify, and audit generator characterization programs.	Activity performed as projected.
	Maintain waste acceptance criteria for LANL waste management facilities.	Activity performed as projected.
	Maintain waste acceptance criteria for offsite treatment, storage, and disposal facilities.	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.
	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.
Waste Transport, Receipt, and Acceptance	Ship 540 cubic meters per year of newly generated TRU waste to the Waste Isolation Pilot Plant.	No activity.
	Ship 8,400 cubic meters per year of legacy TRU waste to the Waste Isolation Pilot Plant.	No activity.
	Ship LLW to offsite disposal facilities.	Shipped approximately 3,647 cubic meters of LLW for offsite disposal.

Capability	2008 SWEIS Projections	2017 Operations
	Ship 55 cubic meters of MLLW for offsite treatment and disposal in accordance with Environmental Protection Agency land disposal restrictions.	Shipped approximately 60 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 8,000 metric tons 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.	Activity performed as projected.
	Collect chemical and mixed wastes from LANL generators and transport to Consolidated Remote Storage Sites and Technical Area 54.	Activity performed as projected.
	Receive, on average, 5 to 10 shipments per year of LLW and TRU waste from offsite locations.	No activity.
		TWF: Received 2 shipments of TRU waste from LANL generators in calendar year 2017
	Ship approximately 2,340 cubic meters of remote-handled legacy TRU waste to the Waste Isolation Pilot Plant.	No activity.
Waste Storage	Stage chemical and mixed wastes before shipment for offsite treatment, storage, and disposal	Activity performed as projected.
	Store TRU waste until it is shipped to the Waste Isolation Pilot Plant.	Activity performed as projected.
	Store MLLW pending shipment to a treatment facility.	Activity performed as projected.
	Store LLW uranium chips until sufficient quantities are accumulated for stabilization campaigns.	No activity.
	Store TRU waste generated by DD&D and remediation activities.	Activity performed as projected.

Capability	2008 SWEIS Projections	2017 Operations
	Manage and store sealed sources for the Offsite Source Recovery Project at increased types and quantities.	Activity performed as projected.
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.
Waste Treatment	Compact up to 2,300 cubic meters per year of LLW.	No activity*
	Process 2,300 cubic meters of TRU waste through size reduction at the Decontamination and Volume Reduction System.	No activity.
	Demonstrate treatment (e.g., electrochemical) of liquid MLLW.	No activity.
	Stabilize 870 cubic meters of uranium chips.	No activity.
	Process newly generated TRU waste through new TRU Waste Facility.	Receipt of TRU waste at TWF commenced in October 2017
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.
	Dispose additional LLW generated by DD&D and remediation activities.	No Activity.
	Migrate operations in Area G to Zones 4 and 6, as necessary, to allow continued onsite disposal of LLW.	No activity.
Decontamination Operations	Decontaminate approximately 700 personnel respirators and 300 air-proportional probes for reuse per month.	No Activity.
	Decontaminate vehicles and portable instruments for reuse (as required).	No Activity.
	Decontaminate precious metals for resale using an acid bath.	No Activity.

Capability	2008 SWEIS Projections	2017 Operations
	Decontaminate scrap metals for resale by sandblasting the metals.	No Activity.
	Decontaminate 200 cubic meters of lead for reuse by grit blasting.	No Activity.

* LANL does not perform compaction any more.

Table A-28. Solid Radioactive and Chemical Waste Facilities (Technical Areas 54 and 50) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2017 Operations
Radioactive Air Emissions[b]			
Tritium	Ci/yr	6.09E+1	Not measured[b]
Americium-241	Ci/yr	2.87E-6	No emissions[c]
Plutonium-238	Ci/yr	2.24E-5	1.78E-10
Plutonium-239	Ci/yr	8.46E-6	3.85E-11
Uranium-234	Ci/yr	8.00E-6	No emissions[c]
Uranium-235	Ci/yr	4.10E-7	No emissions[c]
Uranium-238	Ci/yr	4.00E-6	1.27E-08
Other Radionuclides	Ci/yr	Negligible	2.76E-10
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes[d]			
Chemical	kg/yr	907	17,836.2 [e]
LLW	m^3/yr	229	288.6[f]
MLLW	m^3/yr	8	163.9[g]
TRU	m^3/yr	27[h]	37.3[i]
Mixed TRU	m^3/yr	[h]	82.6[i]

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. 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.

e. In calendar year 2017, chemical waste generation at SRCW exceeded 2008 SWEIS projections due the disposal of Area L sump water collected from rain and snow events which contributed to 55 percent (9,797 kilograms) of the waste generated at the Solid Radioactive Chemical Waste Facilities

f. In calendar year 2017, LLW generation at SRCW exceeded 2008 SWEIS projections due to waste generated from TA-54 from ongoing construction, demolition, and maintenance activities which contributed to 41 percent (111 cubic meters) of the total LLW waste generated at SRCW Facilities.

g. In calendar year 2017, MLLW generation at Solid Radioactive Chemical Waste exceeded 2008 SWEIS projections due to consolidating and packaging of MLLW waste which contributed to 70 percent (108 cubic meters) of the total MLLW waste generated at SRCW Facilities.

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

i. In calendar year 2017, TRU and mixed TRU waste generation at Solid Radioactive Chemical Waste exceeded 2008 SWEIS projections due to repackaging efforts made at the facility which contributed to 77 percent (82 cubic meters) of the total TRU and mixed TRU waste generation at SRCW Facilities.

Table A-29. Plutonium Facility Complex (Technical Area 55) Comparison of Operations

Capability	2008 SWEIS Projection	2017 Operations
Plutonium Stabilization	Recover, process, and store existing plutonium inventory.	Activity performed as projected.
Manufacturing Plutonium Components	Produce nominally 20 plutonium pits per year.	Fewer than 20 qualified pits were produced.
	Fabricate parts and samples for research and development activities, including parts for dynamic and subcritical experiments.	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).
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.
	Operate the 40-millimeter Impact Test Facility and other test apparatus.	Activities were performed as projected.
	Develop expanded disassembly capacity and disassemble up to 200 pits per year.	Fewer than 200 pits were disassembled/converted.
	Process up to 5,000 curies of neutron sources (including plutonium and beryllium and americium-241).	No activity.
	Process neutron sources other than sealed sources.	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.
	Process pits through the Special Recovery Line (tritium separation).	Activity performed as projected.
	Perform or alloy decontamination of 28 to 48 uranium components per month.	Fewer than 48 uranium components were decontaminated per month.

Capability	2008 SWEIS Projection	2017 Operations
Actinide Materials Science and Processing Research and Development (cont.)	Conduct research in support of DOE actinide cleanup activities and on actinide processing and waste activities at DOE sites.	Activity performed as projected.
	Fabricate and study nuclear fuels used in terrestrial and space reactors.	No activity.
	Fabricate and study prototype fuel for lead test assemblies.	No activity.
	Develop safeguards instrumentation for plutonium assay.	Activity performed as projected.
	Analyze samples.	Activity performed as projected.
Fabrication of Ceramic-Based Reactor Fuels	Make prototype mixed oxide fuel.	No activity.
	Build test reactor fuel assemblies.	No activity.
	Continue research and development on other fuels.	No activity.
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.
	Recover, recycle and blend up to 18 kilograms per year plutonium-238.	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.
	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.
	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.
	Store sealed sources collected under DOE's Offsite Source Recovery Program.	Activity performed as projected.

Capability	2008 SWEIS Projection	2017 Operations
	Store mixed oxide fuel rods and fuel rods containing archive and scrap metals from mixed oxide fuel lead assembly fabrication.	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	2017 Operations
Radioactive Air Emissions			
Plutonium isotopes[b]	Ci/yr	1.95E-5	2.96E-10
Tritium in Water Vapor	Ci/yr	7.50E+2	1.39E+00
Tritium as a Gas	Ci/yr	2.50E+2	2.79E-01
NPDES Discharge			
03A181	MGY	4.1	
Wastes			
Chemical	kg/yr	8,618	17,644.7[c]
LLW	m^3/yr	757	307.2
MLLW	m^3/yr	15	72.4[d]
TRU	m^3/yr	336[e]	30.2
Mixed TRU	m^3/yr	[e]	69.4

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 due to disposal of cooling system descaling liquid, water from the maintenance of an access control system gate at Technical Area 55, and the disposal of unused/unspent products

d. MLLW at the Plutonium Facility Complex exceeded 2008 SWEIS projections due to the disposal of lead contaminated materials from routine housekeeping and maintenance operations, which contributed to 98 percent (71 m^3) of the total MLLW generated at the Plutonium Facility.

e. 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	2017 Operations
Radioactive Air Emissions[b]			
Tritium	Ci/y	9.1E+2	No emissions
Plutonium	Ci/y	3.3E-6	No emissions
Uranium	Ci/y	1.8E-4	No emissions
NPDES Discharge			
Total Discharges	MGY	200.9	73
001	MGY	[c]	61.6[d]
13S	MGY	[c]	0
03A160	MGY	28.5	0.2[e]
03A199	MGY	[c]	11.2
Wastes			
Chemical	kg/yr	651,000	3,429,956.5[f]
LLW	m^3/yr	1,529	2,720.4[g]
MLLW	m^3/yr	31	0.2
TRU	m^3/yr	23[h]	0
Mixed TRU	m^3/yr	[h]	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. Discharges to Outfall 03A027 (Metropolis Center) have been directed to Outfall 001 beginning September 9, 2016.
e. Discharges to Outfall 03A160 (NHMFL) have been directed to the SWWS beginning on May 3, 2018.
f. The total chemical waste for 2017 exceeded 2008 SWEIS projections due to press filter cakes from Sanitary Effluent Reclamation Facility; this accounted for 25% (869,021 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 72% (2,461,480 kilograms) of the total chemical waste from Non-Key Facilities.
g. The total LLW exceeded 2008 SWEIS projections for Non-Key Facilities due to the demolition of Technical Area 18 Casa 2 and 3, which accounted for 42% (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.

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APPENDIX B OF THE SWEIS YEARBOOK – CALENDAR YEAR 2017 CHEMICAL USAGE AND ESTIMATED EMISSIONS

Key Facility	Toxic Air Pollutants[15]	CAS Number	2017 Usage	2017 Estimated Air emissions
High Explosives Processing Facilities	Acetone	67-64-1	12.656	4.430
	Acetylene	74-86-2	0.329	0.000
	Ethanol	64-17-5	248.213	86.874
	Hydrogen chloride	7647-01-0	28.875	10.106
	Isopropyl alcohol	67-63-0	40.821	14.287
	Methylene bisphenyl isocyanate (MDI)	101-68-8	4.543	1.590
	Nitric acid	7697-37-2	22.694	7.943
	Pentaerythritol	115-77-5	0.500	0.175
	Propane	74-98-6	171.973	0.000
	Toluene	108-88-3	3.468	1.214
High Explosives Testing Facilities	Acetone	67-64-1	6.328	2.215
	Ethanol	64-17-5	0.395	0.138
	Nitric acid	7697-37-2	0.756	0.265
	Nitromethane	75-52-5	948.560	331.996
	Propane	74-98-6	73.703	0.000
	Sulfur hexafluoride	2551-62-4	486.929	170.425
Bioscience Facilities	1,4-Dioxane	123-91-1	1.036	0.363
	Acetone	67-64-1	88.593	31.008
	Acetonitrile	75-05-8	25.263	8.842
	Acrylic acid	79-10-7	0.500	0.175
	Chlorine	7782-50-5	2.268	0.794
	Chloroform	67-66-3	23.732	8.306
	Diethanolamine	111-42-2	0.500	0.175
	Ethanol	64-17-5	401.727	140.604
	Ethyl acetate	141-78-6	158.754	55.564
	Ethyl ether	60-29-7	9.996	3.499
	Formamide	75-12-7	1.247	0.436
	Hexane (other isomers)* or n-Hexane	110-54-3	140.369	49.129
	Hydrogen chloride	7647-01-0	0.840	0.294
	Methyl alcohol	67-56-1	3.168	1.109
	Methyl isobutyl ketone	108-10-1	0.802	0.281
	Methylene chloride	75-09-2	222.747	77.961
	n,n-Dimethylformamide	68-12-2	13.395	4.688

[15]All toxic air pollutants are measured at kilograms per year.

Key Facility	Toxic Air Pollutants[15]	CAS Number	2017 Usage	2017 Estimated Air emissions
Bioscience Facilities (cont.)	Propionic acid	79-09-4	0.498	0.174
	Tetrahydrofuran	109-99-9	7.134	2.497
	Toluene	108-88-3	1.734	0.607
	Triethylamine	121-44-8	3.695	1.293
LANSCE	Acetylene	74-86-2	19.409	0.000
	Ethanol	64-17-5	18.317	6.411
	Isopropyl alcohol	67-63-0	1.156	0.405
	Propane	74-98-6	663.326	0.000
	Sulfur hexafluoride	2551-62-4	249.250	87.237
	Tungsten as W insoluble compounds	7440-33-7	6.000	0.060
Plutonium Facility Complex	1,4-Dioxane	123-91-1	1.036	0.363
	Acetylene	74-86-2	26.317	0.000
	Cadmium, elemental & compounds, as Cd	7440-43-9	0.432	0.151
	Chlorine	7782-50-5	18.144	6.350
	Ethanol	64-17-5	0.374	0.131
	Hydrogen chloride	7647-01-0	14.175	4.961
	Hydrogen fluoride, as F	7664-39-3	1.748	0.612
	Hydrogen peroxide	7722-84-1	1.665	0.583
	Isopropyl alcohol	67-63-0	8.915	3.120
	Methyl 2-cyanoacrylate	137-05-3	0.588	0.206
	Nitric acid	7697-37-2	125.194	43.818
	Oxalic acid	144-62-7	0.750	0.263
	Potassium hydroxide	1310-58-3	50.001	17.500
	Propane	74-98-6	171.973	0.000
	Sulfuric acid	7664-93-9	5.523	1.933
	Tetrahydrofuran	109-99-9	0.888	0.311
Radiochemistry Facility	1,4-Dioxane	123-91-1	0.414	0.145
	Acetic acid	64-19-7	1.051	0.368
	Acetone	67-64-1	78.422	27.448
	Acetonitrile	75-05-8	3.148	1.102
	Acetophenone	98-86-2	0.257	0.090
	Benzene	71-43-2	6.153	2.154
	Beryllium	7440-41-7	0.231	0.081
	Cadmium, elemental & compounds, as Cd	7440-43-9	3.241	1.134
	Chlorobenzene	108-90-7	1.110	0.389

Key Facility	Toxic Air Pollutants[15]	CAS Number	2017 Usage	2017 Estimated Air emissions
Radiochemistry Facility (cont.)	Chromium, metal & Cr(III) compounds, as Cr	7440-47-3	0.900	0.315
	Cobalt, elemental & inorganic compounds, as Co	7440-48-4	1.114	0.011
	Dicyclopentadiene	77-73-6	1.000	0.350
	Diethanolamine	111-42-2	0.250	0.088
	Ethanol	64-17-5	22.402	7.841
	Ethyl acetate	141-78-6	0.902	0.316
	Ethyl ether	60-29-7	35.201	12.320
	Ethylene dichloride	107-06-2	1.253	0.439
	Hexane (other isomers)* or n-Hexane	110-54-3	26.888	9.411
	Hydrogen bromide	10035-10-6	40.661	14.231
	Hydrogen chloride	7647-01-0	292.220	102.277
	Hydrogen fluoride, as F	7664-39-3	6.689	2.341
	Hydrogen peroxide	7722-84-1	26.307	9.208
	Iodine	7553-56-2	4.930	1.726
	Isopropyl alcohol	67-63-0	39.473	13.816
	Isopropyl ether	108-20-3	0.362	0.127
	Manganese dust & compounds or fume	7439-96-5	0.950	0.333
	Methyl alcohol	67-56-1	15.048	5.267
	Methyl isobutyl ketone	108-10-1	0.401	0.140
	Methylene chloride	75-09-2	2.380	0.833
	Molybdenum	7439-98-7	2.570	0.900
	n-Heptane	142-82-5	0.684	0.239
	Nickel, metal (dust) or soluble & inorganic compounds	7440-02-0	1.114	0.390
	Nitric acid	7697-37-2	1518.178	531.362
	Pentane (all isomers)	109-66-0	15.275	5.346
	Phosphoric acid	7664-38-2	16.388	5.736
	Potassium hydroxide	1310-58-3	0.500	0.175
	Propane	74-98-6	1395.888	0.000
	Pyridine	110-86-1	43.646	15.276
	Silver (metal dust & soluble compounds, as Ag)	7440-22-4	2.625	0.919
	Sulfuric acid	7664-93-9	6.167	2.159
	tert-butyl Alcohol	75-65-0	0.780	0.273

Key Facility	Toxic Air Pollutants[15]	CAS Number	2017 Usage	2017 Estimated Air emissions
Radiochemistry Facility (cont.)	Tetrahydrofuran	109-99-9	25.952	9.083
	Toluene	108-88-3	16.473	5.766
	Triethylamine	121-44-8	1.458	0.510
	Tungsten, as W insoluble compounds	7440-33-7	2.413	0.024
	Yttrium	7440-65-5	1.118	0.391
	Zirconium compounds, as Zr	7440-67-7	1.628	0.016
RLWTF	Hydrogen chloride	7647-01-0	189.528	66.335
	Mercury, numerous forms	7439-97-6	1.694	0.017
	Phosphorus	7723-14-0	0.269	0.094
	Sulfuric acid	7664-93-9	843.696	295.294
	Tin numerous forms	7440-31-5	23.390	0.234
Solid Radioactive and Chemical Waste Facilities	Propane	74-98-6	516.300	0.000
Target Fabrication Facility	Acetone	67-64-1	14.238	4.983
	Acrylic acid	79-10-7	2.624	0.919
	Divinyl benzene	1321-74-0	0.930	0.326
	Epichlorohydrin	106-89-8	0.590	0.207
	Ethanol	64-17-5	30.583	10.704
	Ethyl acetate	141-78-6	0.902	0.316
	Ethyl ether	60-29-7	1.785	0.625
	Hydrogen fluoride, as F	7664-39-3	1.500	0.525
	Isopropyl alcohol	67-63-0	50.241	17.584
	Methacrylic acid	79-41-4	0.500	0.175
	Methyl acrylate	96-33-3	0.239	0.084
	Methyl alcohol	67-56-1	12.672	4.435
	n,n-Dimethylformamide	68-12-2	3.800	1.330
	Nitric acid	7697-37-2	0.303	0.106
	Propane	74-98-6	49.135	0.000
	Styrene	100-42-5	0.906	0.317
	Tetrahydrofuran	109-99-9	21.312	7.459
	Triethylamine	121-44-8	0.365	0.128
Tritium	Ethanol	64-17-5	12.640	4.424
	Isopropyl alcohol	67-63-0	2.355	0.824

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APPENDIX C OF THE SWEIS YEARBOOK – CALENDAR YEAR 2017 NUCLEAR FACILITIES LIST

List of Los Alamos National Laboratory Nuclear Facilities

LIST–SBD-503-R0.1

Prepared by:

Gregory D. Smith
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Signature

6/1/17
Date

Approver:

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6/1/17
Date

☒ Unclassified ☐ UCNI ☐ Classified ☐ OUO	Derivative Classifier Name: SHAWNA EISELE SB-PF Signature: Shawna J E	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


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