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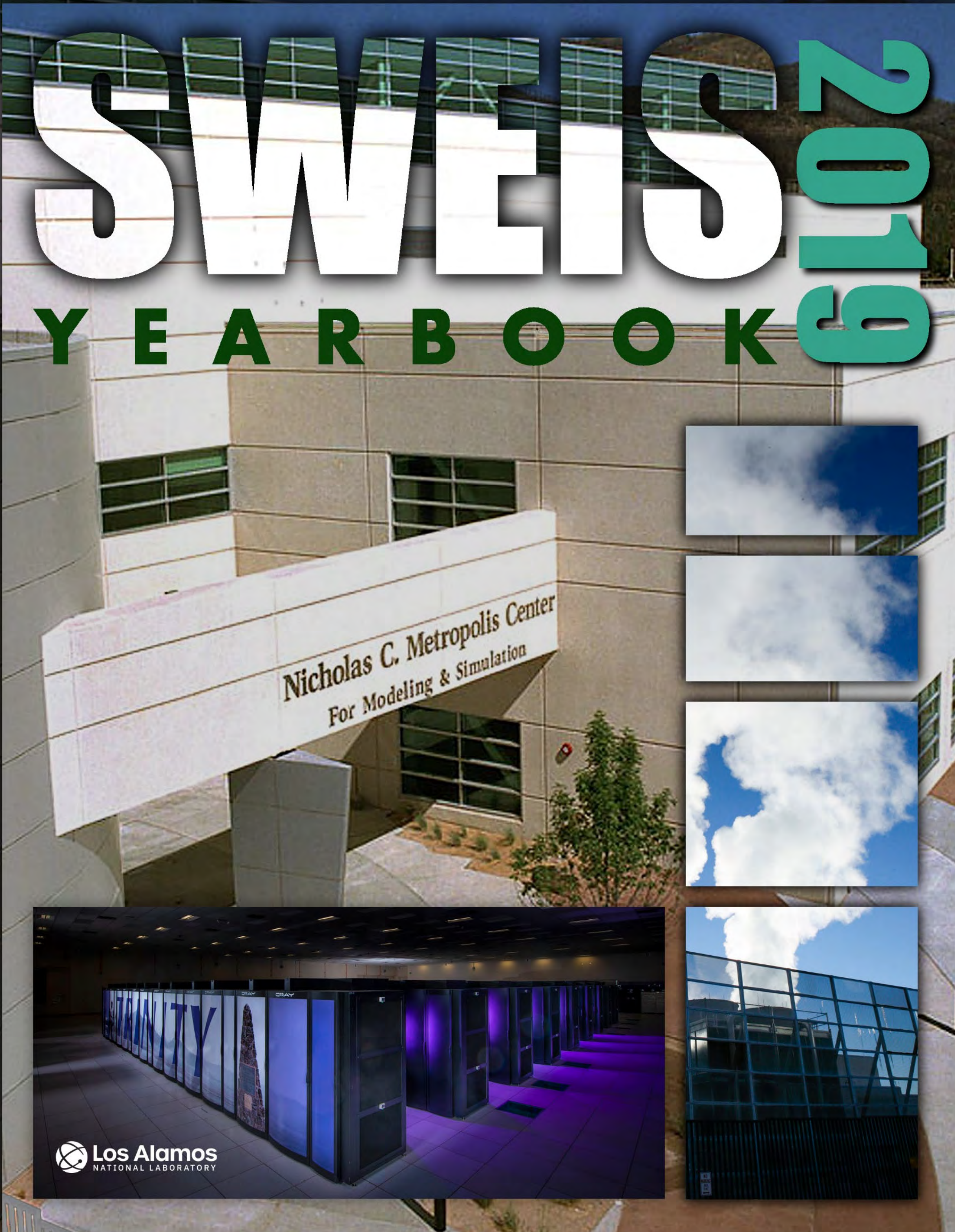
SWEIS 2019 YEARBOOK



Los Alamos
NATIONAL LABORATORY

Front Cover:

The Nicholas C. Metropolis Center (TA-03-2327) is the home of the Trinity Supercomputer, one of the world's fastest and most advanced computers. (Photos courtesy of the LANL Image Library)

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SWEIS Yearbook 2019

Comparison of 2019 Data with Projections of the 2008 Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory

Los Alamos
NATIONAL LABORATORY

Prepared by:

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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 (CY) 2019. During CY 2019, LANL operations mostly fell within the 2008 SWEIS projections. Several Key Facilities exceeded the 2008 SWEIS levels for waste generation quantities, but the exceedances were infrequent, non-routine events that do not reflect day-to-day LANL operations. Chemical waste volumes in CY 2019 exceeded annual waste volumes for the Non-Key Facilities. This outcome was the result of the disposition of press filter cakes and reverse osmosis reject water from the Sanitary Effluent Reclamation Facility (SERF). Although chemical waste volumes exceeded projections for CY 2019, LANL has generated less than half of the cumulative chemical waste analyzed in the 2008 SWEIS because, in most years, LANL has generated less chemical waste volumes than projected. Gas, electricity, and water consumption remained within the 2008 SWEIS levels projected for utilities in CY 2019. At the end of CY 2019, there were 13,522 employees. Although the number of employees slightly exceeds the 2008 SWEIS No Action Alternative for CY 2019, the total number of employees from 2008 through 2018 was fewer than the number of employees projected in the 2008 SWEIS No Action Alternative. The DOE/NNSA issued an amended Record of Decision in September 2020 that selected to implement additional elements of the Expanded Operations Alternative for an increase in pit production, which includes an increase in the projected number of LANL employees to 15,400.

Background

In 1999, the DOE published a SWEIS for the continued operation of LANL. In September 1999, DOE issued a Record of Decision (ROD) for this document, announcing that it would expand operations at LANL, as the need arises, to increase the level of existing operations to the highest reasonably foreseeable levels and to fully implement the mission elements assigned to LANL. DOE considered the relationship between the short-term uses of the environment and the maintenance and enhancement of long-term productivity and also the impacts of the projects and activities associated with this decision an irreversible or irretrievable commitment of resources.

DOE committed to several mitigation measures to reduce the impacts of continuing to operate LANL at the levels outlined in the ROD. As a result, 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 adequacy 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 published 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, which was the 1999 SWEIS Expanded Operations Alternative, with the addition of some elements of a new 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 operations data collected for CY 2019 with the 2008 SWEIS projections approved in the RODs.

The Yearbook addresses capabilities and operations by using the concept of "Key Facilities" and "Non-Key Facilities," as presented in the 2008 SWEIS.

Operations Levels and Operations Data Levels

The 2008 SWEIS defined capabilities and activity levels for Key and Non-Key Facilities. These operations levels for CY 2019 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 CY 2019, 21 construction and modification projects were undertaken. Table 1 provides details.

Table 1. CY 2019 Construction and Modification Projects

Key Facility	Construction/Modification Project
Chemistry and Metallurgy Research (CMR) Building	Continued Projects: • Relocation of analytical chemistry and materials characterization to the Plutonium Facility Building (TA-55-0004*) and the Radiological Laboratory/Utility/Office Building *TA = Technical Area-Number-Building Number
Sigma Complex	Continued Projects: • Construction of the 4,000-square-foot addition • Construction for the Large Chamber High-Voltage Electron Beam Welder
Machine Shops	Continued Projects: • Relocation of uranium machining equipment to Sigma Building
Nicholas C. Metropolis (Metropolis Center)	Continued Projects: • Construction on the Exascale Class Computer Cooling Equipment
High Explosives Processing	New Projects in CY 2019: • Completed TA-16-0260 Bay 5 renovations • Completed TA-08-0022 facility renovations and installed the K-15 Microtron (15-million-electron-volt radiography machine) • Completed the TA-16 temporary vault-type-room installation • Completed TA-16-0410 and -0414 heating, ventilation, and air conditioning (HVAC) upgrades • Completed TA-22-0034 HVAC and fire suppression upgrades

Key Facility	Construction/Modification Project
High Explosives Testing	Continued Projects: • Completed the construction of a domestic and fire suppression waterline (also known as Area 1 waterline) New Projects for CY 2019: • Completed the Dual-Axis Radiographic Hydrodynamic Test Facility chiller renovation project
Weapons Engineering Tritium Facility	New Projects for CY 2019: • Completed the modernization liquid nitrogen system project • Completed the canopy fire sprinkler upgrades
Target Fabrication Facility	New Projects for CY 2019: • Began modifications in Room C16 for machining operations
Bioscience Facilities	New Projects for CY 2019: • In 2019, the Commercially Engineered Facility Construction module arrived; began building construction
Los Alamos Neutron Science Center (LANSCE)	New Projects for CY 2019: • Installed a polar crane into the Proton Radiography Facility • Began construction for a new storage building located to the north of Area C
Solid Radioactive Chemical Waste Facility (SRCW)	New Projects for CY 2019: • Triad began using TA-60-0017 as a central accumulation area for mission-essential waste generated from sites across LANL
Plutonium Facility	Continued Projects: • Continued decontamination, decommissioning, and demolition and repurposing of existing laboratory space in the Plutonium Facility (TA-55-0004) • Continued the TA-55 Reinvestment Project construction

During CY 2019, 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	Continued Projects: • Began construction on the basement floor
TA-03 Substation	Continued Projects: • Construction was on hold during 2019 and will resume in CY 2020
Roof Assessment Management Program	Continued Projects: • Re-roofed 33 facilities and repaired 15 facility roofs
Supplemental Environmental Projects	Continued Projects: • Completed the design for road improvements at the intersection of State Route 4 and East Jemez Road • Completed the La Mesita East Low Impact Development Project at TA-53 • Completed construction of the upper Canon de Valle Wetland Enhancement project • Continued construction on the mid-Mortandad watershed project in 2019
TA-72 Outdoor Range Upgrade Project	Continued Projects: • Began construction on the TA-72 Outdoor Firing Range in October 2018; continued into CY 2019
Steam Plant Replacement Project	Continued Projects: • Continued construction in 2019

Project Title	Construction/Modification Project
Multi-Use Office Building	New Projects for CY 2019: • Began construction in November 2019
Sensitive Compartmented Information Facility Modular Office Building	New Projects for CY 2019: • Began construction in August 2019

In CY 2019, 75 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
CMR	• Destructive and nondestructive analysis • Nonproliferation training • Actinide research and development • Fabrication and processing
High Explosives Testing Facility	• High explosives pulsed-power experiments
Tritium Facilities	• High-Pressure Gas Fills and Processing • Diffusion and Membrane Purification • Metallurgical and materials research • Hydrogen isotopic separation
Bioscience Facilities	• In vivo monitoring
LANSCE	• Material test station • High-power microwaves and advanced accelerators
SRCW	• Waste retrieval • Decontamination operations
Plutonium Complex	• Fabrication of ceramic-based reactor fuels

During CY 2019, all Key Facility programmatic activities operation levels were within the 2008 SWEIS projections.

In CY 2019, several Key Facilities exceeded 2008 SWEIS waste projections. All exceedances were caused by infrequent, non-routine events. The following facilities exceeded 2008 SWEIS projections for waste generation. Table 4 provides details.

Table 4. CY 2019 Waste Exceedances

Waste Type	Key Facility	Reason for Exceedance
Chemical/Hazardous	Sigma Complex	Disposal of legacy graphite and cleanup of asbestos in soil
	High Explosives Processing Facilities	Disposal of empty drums, spent chemicals from etching machine, and concrete
	High Explosives Testing Facilities	Disposal of concrete from post-shot firing debris and the removal of asphalt from TA-40
	Target Fabrication Facility	Disposal of construction debris and beryllium trash
	Radioactive Liquid Waste Treatment Facility (RLWTF)	Disposal of roof material and asbestos from roof replacement project and the disposal of empty drums
	Plutonium Facility Complex	Disposal of a hydraulic oil spill at TA-55 construction site and the disposal of concrete
Low-Level Waste	RLWTF	Disposal of a wastewater by-product of the treatment process of radioactive liquid waste evaporator bottom at TA-50
Mixed Low-Level Radioactive Waste	Sigma Complex	Disposal of equipment associated with electrochemistry operations and removal of uranium contaminated electronics and copper solder
	Radiochemistry Facility	Disposal of lead-contaminated materials from routine housekeeping and maintenance operations
	LANSCE	Disposal of mercury-contaminated waste from Flight Path Shutter System

In CY 2019, the Non-Key Facilities exceeded chemical waste volumes projected in the 2008 SWEIS because of the disposal of press filter cakes and reverse osmosis water from the SERF.

Site-Wide Operations Data and Affected Resources

The Yearbook evaluates the effects of LANL operations during CY 2019 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 CY 2019 totaled approximately 314 curies, less than one percent of the annual projected radiological air emissions of 34,000 curies[1] projected in the 2008 SWEIS. The maximum offsite dose to the maximally exposed individual was 0.41 millirem—well below the 8.2 millirem per year dose 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 emission measurements 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 CY 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 (EPA) for CY 2019. These stationary combustion sources at LANL emitted approximately 47,257.5 metric tons of carbon dioxide equivalents in CY 2019.

Since 1999, the total number of permitted outfalls was reduced from 55 to 11 regulated under the National Pollutant Discharge Elimination System (LANL permit number NM0028355). In CY 2019, 7 of the 11 outfalls flowed, totaling an estimated 115.4 million gallons—well under the 2008 SWEIS projected volume of 279.5 million gallons per year.

During CY 2019, groundwater monitoring and groundwater investigations were performed pursuant to the 2016 State of New Mexico Environment Department Compliance Order on Consent (Consent Order)(NMED 2016b). DOE-Environmental Management installed no wells during 2019.

In 2018, responsibilities for multi-sector general permit (MSGP) compliance at the Laboratory transitioned. On May 1, 2018, N3B took over management of three facilities covered under the permit at TA-54 (Area G, Area L, and the Maintenance Facility West). On November 1, 2018, Triad was awarded the Laboratory's Management and Operating contract. These changes resulted in the U.S. EPA's issuance of three new MSGP tracking numbers—two for N3B and one for Triad. The current 2015 MSGP permit expires on June 4, 2020, and will need to be reissued.

The 2008 SWEIS combined transuranic (TRU) and mixed TRU waste into one waste category because they are both managed for disposal at the Waste Isolation Pilot Plant (WIPP). In CY 2019, 42 shipments (29 from Triad and 13 from N3B) containing TRU and mixed TRU waste were transported to WIPP.

In CY 2019, DOE/NNSA removed three structures at LANL, which eliminated 29,588 square feet of the Laboratory's footprint.

Water consumption for CY 2019 was 269.1 million gallons. The 2008 SWEIS projection for annual water consumption was 459.8 million gallons. Improvements to the SERF operations have led to increased use of recycled effluent in cooling towers in CY 2019. In CY 2019, energy consumption was 438,264 megawatt-hours. The 2008 SWEIS projection for annual energy consumption was 651,000 megawatt-hours. Gas consumption for CY 2019 was 947,718 thousand decatherms. The 2008 SWEIS projection for annual gas consumption was 1.2 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 CY 2019 was 221 person-rem, lower than the 280 person-rem annual workforce dose projected in the 2008 SWEIS. There were 140 recordable cases of occupational injury and illness in CY 2019. In addition, approximately 56 cases resulted in days away, restricted, or transferred duties.

In the 2008 SWEIS No Action Alternative, the 2005 levels of employment at the Laboratory were projected to remain steady at 13,504 employees. At the end of CY 2019, there were 13,522 employees (including Triad and N3B employees). Although the number of employees slightly exceeds the 2008 SWEIS No Action Alternative for CY 2019, the total number of employees from 2008 through 2018 was fewer than the number of employees projected in the 2008 SWEIS No Action Alternative. In CY 2019, one tract of DOE land was conveyed to Los Alamos County as part of the *Environmental Impact Statement for Land Conveyance and Transfer* (DOE 1999a). In CY 2019, LANL biological resources staff continued annual surveys under the *Threatened and Endangered Species Habitat Management Plan* (LANL 2017a). No archaeological excavations occurred on LANL property. Measured parameters for cultural resources were below 2008 SWEIS projections. The 1999 SWEIS projected that 15 prehistoric sites would be affected by the expansion of Area G into Zones 4 and 6 at TA-54. The 2008 SWEIS projected the disturbance of 41 acres of new land at TA-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/NNSA completed the required consultation with the New Mexico State Historic Preservation Office for the demolition of eight historic buildings in fiscal year 2019. Under an Interagency Agreement for preservation assistance between the National Park Service and DOE/NNSA, LANL cultural resources staff worked with the National Park Service on one priority project at Manhattan Project National Historical Park.

CONTENTS

Figures

Tables

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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 not all individuals can be mentioned here, the major contributors from each of the Key Facilities and other operations are included.

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ALARA	as low as reasonably achievable
AOC	Area of Concern
BSL	biosafety level
CEFC	Commercially Engineered Facility Construction
CGP	Construction General Permit
CMR	Chemical and Metallurgy Research (Building)
CMRR	CMR Replacement (Project)
CRMP	Cultural Resources Management Plan
CY	calendar year
DARHT	Dual-Axis Radiographic Hydrodynamic Test (Facility)
DART	days away, restricted, or transferred
DD&D	decontamination, decommissioning, and demolition
DNA	deoxyribonucleic acid
DOE	(U.S.) Department of Energy
DOE-EM	DOE's Office of Environmental Management
DOE-VPP	DOE's Voluntary Protection Program
EA	environmental assessment
ECCCE	Exascale Class Computer Cooling Equipment
EIS	environmental impact statement
EM	Environmental Management
EPA	Environmental Protection Agency
FY	fiscal year
GHG	greenhouse gas (emissions)
HVAC	heating, ventilation and air conditioning
HWA	Hazardous Waste Act
IVML	In Vivo Measurements Laboratory
IWESST	Institutional Worker, Environment, Safety, and Security Team
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
LANSCE	Los Alamos Neutron Science Center
LINAC	linear accelerator
LLW	low-level radioactive waste
MeV	million electron volts
MLLW	mixed low-level (radioactive) waste
MQMC	Mark Quality Manufacturing Center
MSGP	multi-sector general permit
MVA	megavolt amperes

Acronym	Definition
N3B	Newport News Nuclear BWXT-Los Alamos, LLC Alamos
NAICS	North American Industry Classification System
NEPA	National Environmental Policy Act
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
OSRP	Off-Site Source Recovery Program
RCRA	Resource Conservation and Recovery Act
RF	radiofrequency
RLUOB	Radiological Laboratory/Utility/Office Building
RLWTF	Radioactive Liquid Waste Treatment Facility
ROD	Record of Decision
SCIF	Sensitive Compartmented Information Facility
SEA	Supplemental Environmental Assessment
SERF	Sanitary Effluent Reclamation Facility
SPEIS	Supplemental Programmatic Environmental Impact Statement
SRCW	Solid Radioactive and Chemical Waste (facilities)
SWEIS	Site-Wide Environmental Impact Statement
SWMU	Solid Waste Management Unit
SWWS	Sanitary Wastewater System
TA	Technical Area
TRC	total recordable case
TRP	Technical Area 55 Reinvestment Project
TRU	transuranic
TSF	temporary storage facility
TWF	Transuranic Waste Facility
USC	United States Code
WCATS	Waste Compliance and Tracking System
WESST	Worker, Environment, Safety and Security Team
WETF	Weapons Engineering Tritium Facility
WIPP	Waste Isolation Pilot Plant

1 INTRODUCTION

1.1 Site-Wide Environmental Impact Statement

In 1999, the U.S. Department of Energy (DOE) published a Site-Wide Environmental Impact Statement (SWEIS) for Continued Operation of the Los Alamos National Laboratory (LANL or the Laboratory) (DOE 1999a). DOE published its Record of Decision (ROD) for the 1999 SWEIS in September 1999 (DOE 1999b), 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 published in May 2008 (DOE 2008a). The 2008 SWEIS analyzed the potential environmental impacts of future operations at LANL. In September 2008, DOE/NNSA published 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 (SPEIS) (DOE 2008c). DOE/NNSA did not make any decisions regarding nuclear weapons production at LANL before the completion of the 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 published 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.

In addition, through CY 2019, DOE/NNSA prepared five supplement analyses to the 2008 SWEIS and published an 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 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 2011c) to assess activities of the Offsite Source Recovery Project (OSRP) 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 2011d), in response to the supplement analysis on the OSRP.

Reference Number	Issue Date	Summary
DOE/EIS-0380-SA-03	May 2016	DOE/NNSA prepared a supplement analysis to the 2008 SWEIS for the proposal to implement facility modifications 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 that the environmental impacts of the proposed actions were bounded by analyses presented in the 2008 SWEIS (DOE 2016b).
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 that no substantial changes would occur and that the proposed actions were bounded by analyses presented in the 2008 SWEIS (DOE 2016c).
DOE/EIS-0380-SA-05	April 2018	DOE/NNSA prepared 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).

On June 10, 2019, DOE/NNSA announced its National Environmental Policy Act (NEPA) strategy for pit production. The strategy outlined DOE/NNSA's intent to prepare a site-specific document for the proposal to authorize expanding pit production at LANL to no fewer than 30 pits per year no later than during 2026 (DOE 2019a). A sixth supplement analysis to the 2008 SWEIS was prepared for producing no fewer than 30 pits per year at the Laboratory during calendar year (CY) 2019 and CY 2020. DOE/NNSA published an amended ROD in September 2020 concerning implementing additional elements of the Expanded Operations Alternative for an increase in pit production. Details for the CY 2020 activities will be provided in the SWEIS Yearbook 2020.

1.2 2008 SWEIS Yearbook

The DOE/NNSA and LANL have implemented a program in which 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 on operations (research, production, services, and environmental impacts) and capabilities and is not necessarily confined to a single structure, building, or Technical Area (TA). All buildings and structures that are not part of a Key Facility are identified as a "Non-Key Facilities."

Each Yearbook focuses on the following information:

- **Facility and process modifications or additions.** These items include projected activities for which NEPA coverage was provided by the SWEIS and some post-SWEIS activities for which NEPA coverage was provided through categorical exclusions, environmental assessments (EAs), or environmental impact statements (EISs).

- **Site-wide effects of operations for the calendar year.** These effects include measurements of site-wide effects such as
  - number of workers,
  - radiation doses,
  - workplace incidents,
  - utility requirements,
  - air emissions,
  - liquid effluents, and
  - solid wastes.

These effects also include changes in ecological resources and other resources for which DOE/NNSA has long-term stewardship responsibilities as an administrator of federal lands.

- **Summary and conclusion.** Chapter 4 summarizes calendar year data for LANL regarding overall facility constructions and modifications, facility operations and operations data, and environmental parameters. These data form the basis of the conclusion for whether LANL is operating within the envelope of the 2008 SWEIS.
- **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.** These data are comparable with 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).
- **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.

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 serves as a summary of environmental information collected and reported by the various groups at LANL and provides Laboratory managers with a guide to determine

[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, DOE 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 on-site 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 forradionuclides.

[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.”

whether activities are within the SWEIS operating envelope. The Yearbook provides DOE/NNSA with information needed to evaluate the adequacy of the 2008 SWEIS and enables decision-making on if and when a new SWEIS is needed.

1.3 CY 2019 SWEIS Yearbook

This Yearbook represents data collected for CY 2019 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.

In November 2018, the prime contractor of management and operations for the DOE/NNSA operation of LANL transitioned from Los Alamos National Security, LLC (LANS), to Triad National Security, LLC (Triad).

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 (FY) 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 (CY 2008 through CY 2019) and then compared with the projected total for DOE-EM operations data. The Key Facilities and Non-Key Facilities waste volumes will continue to be compared with the projected estimates identified in Table 5-39 of the 2008 SWEIS. In addition, beginning in the 2017 SWEIS Yearbook, an approximate number of waste shipments and disposal locations will be tracked in Section 3.3, Solid Radioactive and Chemical Wastes.

In April 2018, Newport News Nuclear BWXT-Los Alamos, LLC (N3B) took over the legacy waste cleanup management and operations.

1.4 NEPA Documents Prepared in CY 2019

In June 2019, the NNSA published the "The Final Environmental Assessment for the Construction and Operation of a Solar Photovoltaic Array at Los Alamos National Laboratory, Los Alamos, New Mexico" (DOE 2019b). The EA analyzed a proposal for LANL to construct and operate a 10-megawatt, ground-mounted solar photovoltaic system and associated facilities. The proposed solar photovoltaic array is located on approximately 55 acres, 50 of which are located within a previously disturbed area that was used as a borrow pit in the northwest corner of TA-16 at LANL. The solar photovoltaic array and power transmission line would be designed, constructed, and operated to increase on-site electrical power generation and provide for efficient and sustainable electrical power capability and resilience. DOE issued a Finding of No Significant Impact with mitigation measures.

In July 2019, the NNSA published the "Final Supplemental Environmental Assessment for the Wildfire Hazard Reduction and Forest Health Improvement Program at Los Alamos National Laboratory, Los Alamos, New Mexico"(DOE 2019c). In 2000, DOE issued the "Environmental Assessment for the Wildfire Hazard Reduction and Forest Health Improvement Program at Los Alamos National Laboratory"(DOE 2000). The EA evaluated the potential environmental impacts of strategies for addressing wildland fires that threaten operations at LANL. In 2019, DOE issued this final supplemental EA to address new strategies that reflect conditions that have changed at LANL since the 2000 EA was issued, including longer fire seasons, changes in vegetation, and global climate change. The DOE issued a Finding of No Significant Impact with mitigation measures (DOE 2019d).

NEPA subject matter experts review proposed projects through LANL's Integrated Review Tool to determine if associated impacts have been analyzed in the 2008 SWEIS or other existing NEPA documents. The Integrated Review Tool is an entry portal to the permit requirements and identification system, the excavation/fill/soil disturbance permit request, and LANL's site-selection process. In 2019, Triad NEPA subject matter experts reviewed approximately 1,000 proposed projects. About 92 percent of LANL projects reviewed were determined to have coverage under the 2008 SWEIS, Appendix L, which is used as umbrella coverage for routine actions that are covered by categorical exclusions for activities such as general maintenance, support activities, safety and environmental improvements, and footprint-reduction efforts. Projects or activities that do not have coverage under existing NEPA documents require new or additional analyses. Four projects received NEPA coverage under DOE categorical exclusions in 2019:

- TA-68 Water Canyon Test Site Expansion (DOE 2019e)
- Los Alamos National Laboratory Cellular and Radio Communications Upgrades (DOE 2019f)
- Construction and Operation of TA-03 Parking Structure (DOE 2019g)
- Construction and Operation of TA-50 Parking Structure (DOE 2019h)

2 FACILITIES AND OPERATIONS

LANL operations are conducted within numerous facilities that are located in 49 designated TAs, including TA-00, which consists of leased space within the Los Alamos townsite and White Rock and TA-57 at Fenton Hill. In 2019, LANL managed 897 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 U.S. Government and administered by DOE/NNSA and DOE-EM . Much of the undeveloped area at LANL provides a buffer for security, safety, and possible future expansion. Although the number of structures changes with time (due to frequent addition or removal of temporary structures and miscellaneous buildings), the current number includes approximately 744 permanent buildings and 115 temporary structures (i.e., trailers and transportable buildings). In CY 2019, Triad leased approximately 38 buildings and trailers within the Los Alamos County and in Carlsbad, New Mexico.

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

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

Key Facilities include operations,[4] capabilities, and location and are not necessarily confined to a single structure, building, or TA. 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 TA, 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 TAs, respectively.

In 2008, Pajarito Site (TA-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 2018). For the purpose of the 2008–2019 SWEIS Yearbooks, Pajarito Site has been removed as a Key Facility. In addition, the 2008 SWEIS recognized the Nicholas C. Metropolis Center

[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.

(Metropolis Center)—also known as the Strategic Computing Complex—as a new Key Facility because of the amount of electricity and water it uses.

This chapter discusses each of the 15 Key Facilities from three aspects:

- significant facility construction and modifications,
- types and levels of operations, and
- environmental effects of operations that have occurred during CY 2019.

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 data that resulted from LANL operations continue to fall within the environmental envelope established in the 2008 SWEIS. Modifications and construction activities that were completed before CY 2019 are summarized in previous Yearbooks.

Since the issuance of the 2008 SWEIS, DOE/NNSA and LANL have published four lists that identify nuclear facilities at LANL (LANL 2018). Appendix C provides a summary of the current nuclear facilities. In each section of Chapter 2, tables have been added that identify the nuclear facilities currently listed by DOE/NNSA within a Key Facility.

Chapter 2 also discusses Non-Key Facilities, which include buildings and structures that are not part of a Key Facility but make up the balance of LANL facilities. The Non-Key Facilities comprise approximately half of LANL land and all or the majority of 30 of the 49 TAs, including TA-00. The Non-Key Facilities include important buildings and operations such as

- the Nonproliferation and International Security Center,
- the National Security Sciences Building,
- the main administration building, and
- the TA-46 Sanitary Wastewater System.

Routine maintenance, support activities, safety and environmental improvements, and footprint reduction are ongoing 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 TAs and the Key Facilities.

Table 2-1. Key and Non-Key Facilities

Key Facility	TAs	Size (acres)
Chemical and Metallurgy Research (CMR) Building	03	14
Sigma Complex	03	10
Machine Shops	03	7
Materials Science Laboratory	03	2
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
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 TAs	11,840
All Non-Key Facilities	30 of 49 TAs	14,218
Total LANL		26,058

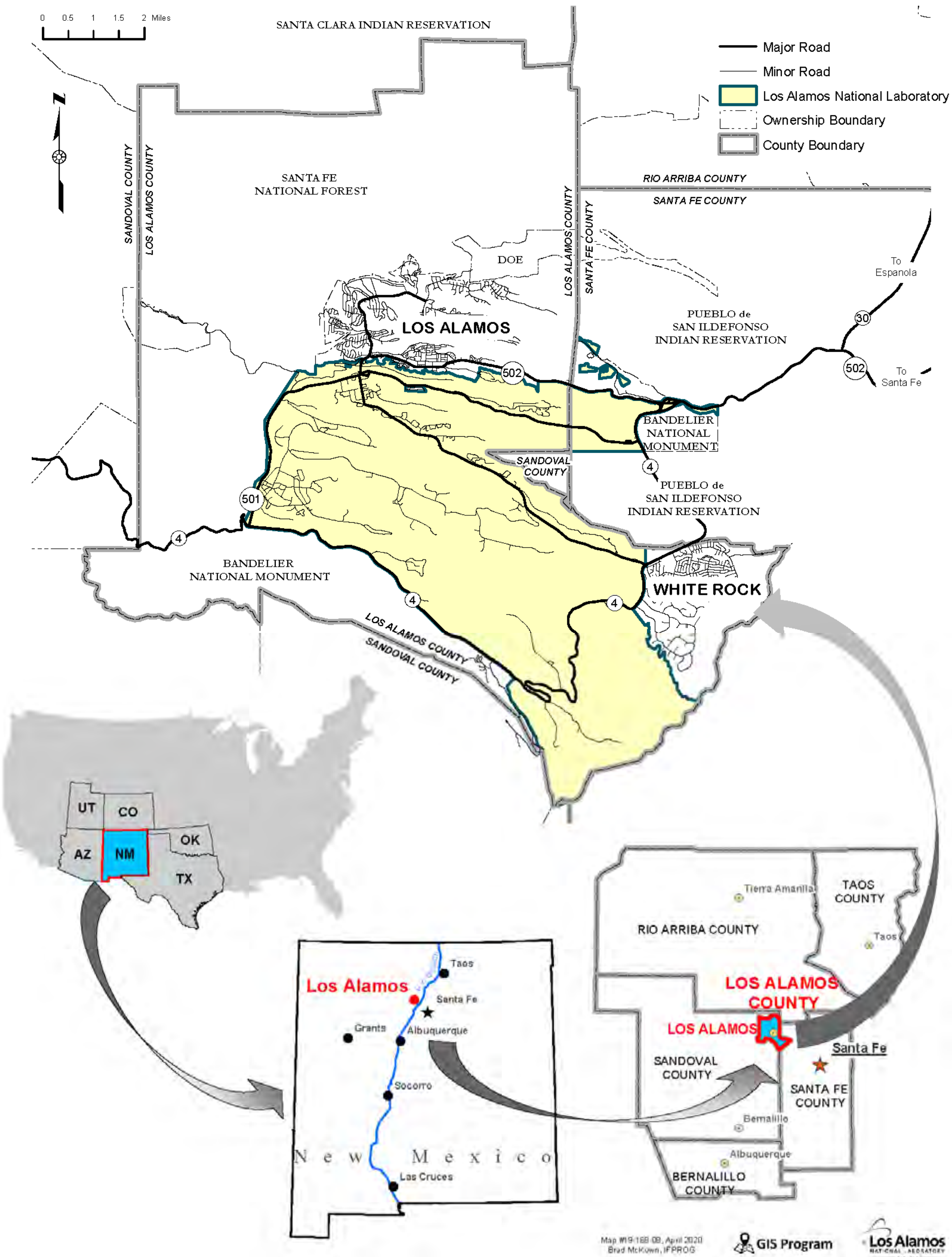

Figure 2-1. Location of LANL

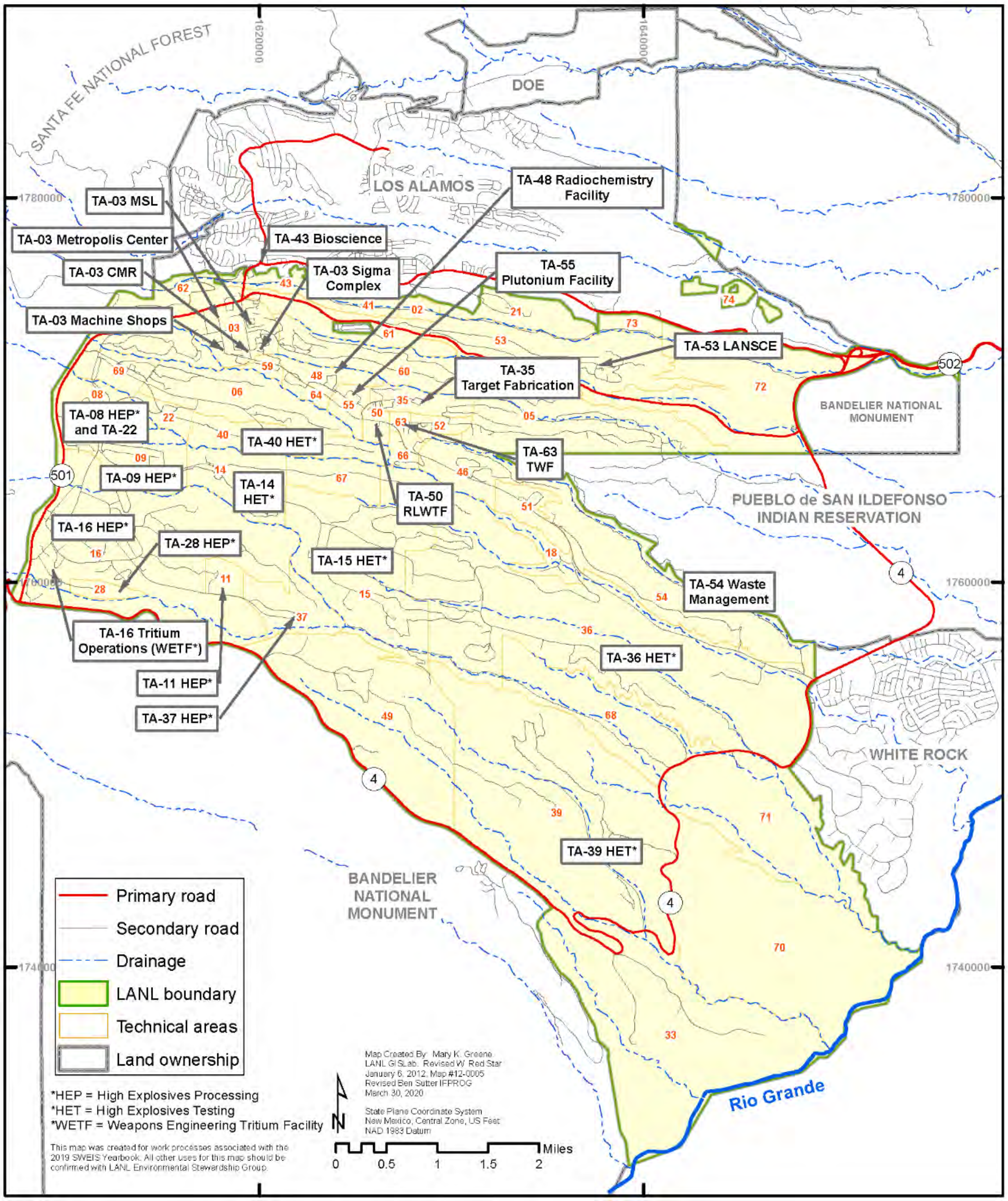

Figure 2-2. Location of Technical Areas and Key Facilities

2.1 Chemical and Metallurgy Research Building (TA-03)

The CMR Building was designed and constructed to the 1949 Uniform Building Code and occupied in 1952 to house

- analytical chemistry,
- plutonium metallurgy,
- uranium chemistry, and
- engineering design and drafting activities.

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 CY 2018.

Table 2-2. CMR Buildings with Nuclear Hazard Classification

Building	Description	2008 SWEIS	LANL 2019[a]
TA-03-0029	CMR	2	2

[a] List of LANL nuclear facilities (LANL 2018).

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 TA-55
- Conduct decontamination, decommissioning, and demolition (DD&D) of the CMR Building

In November 2003, DOE/NNSA published an EIS for the CMRR Project (DOE 2003). It evaluated the potential for environmental impacts that could result 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 published in February 2004, DOE/NNSA decided to replace the CMR Building with a new Hazard Category 2 Nuclear Facility at TA-55 and to completely vacate and demolish the CMR Building (DOE 2004). Since the the 2004 ROD, several changes have occurred that required further NEPA analysis. Table 2-3 discusses the NEPA history for CMRR. On February 13, 2012, DOE/NNSA deferred the CMRR Nuclear Facility, and on August 21, 2014, DOE cancelled the CMRR Nuclear Facility.

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 Nuclear Facility components were adequately addressed in the CMRR EIS.	DOE/NNSA determined that the proposed actions were adequately bounded by the analyses of impacts projected by the 2003 CMRR EIS and, at the time, no supplemental CMRR EIS was required.
DOE/EIS-0350-S1	August 2011	DOE/NNSA issued a Supplemental EIS for the CMRR Nuclear Facility to evaluate the potential environmental impacts from revised alternatives for constructing and operating the CMRR Nuclear Facility and from ancillary projects that had been proposed since publication of the CMRR EIS (DOE 2011b).	DOE/NNSA selected the Modified CMRR Nuclear Facility Alternative described in the Supplemental EIS to proceed with the design and construction of the CMRR Nuclear Facility at LANL (DOE 2011a).
DOE/EIS-0350-SA-2	January 2015	DOE/NNSA prepared a supplement analysis (DOE 2015a) to the CMRR EIS to analyze the proposal to relocate analytical chemistry and materials characterization capabilities from the CMR Building to the Radiological Laboratory/ Utility/Office Building (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 2015a).
DOE/EA-2052	July 2018	DOE/NNSA prepared an EA to analyze the proposal to recategorize the RLUOB from a Radiological Facility to a Hazard Category 3 Nuclear Facility (DOE 2018a).	A Finding of No Significant Impact was issued in July 2018, in which it was determined that there would be no significant impacts, and no EIS would be required (DOE 2018c).

Construction of the RLUOB (TA-55-0400) was completed in CY 2012, and radiological operations began in August 2014.

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 2004). The project was placed on hold in 2004 and was not restarted until 2009. In 2010, installation of the confinement vessel disposition enclosure and glovebox began, and vessel processing began in 2014. Since 2014, nine vessels have been processed; one vessel was processed in CY 2019.

In CY 2019, 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 (TA-55-0004). 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 the RLUOB, installation of the enclosures continued.

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 CY 2019, 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 (TA-03)

The Sigma Complex Key Facility consists of three principal buildings: the Sigma Building (TA-03-0066), the Beryllium Technology Facility (TA-03-0141), and the Forming Building (TA-03-0159), 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 CY 2016, a 4,000-square-foot addition was proposed to be added on the northeast corner of the main Sigma Building (TA-03-0066). 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 TA-03-0102 would be relocated to the Sigma Building to improve the efficiency of machining operations that support hydrodynamic tests and other mission-critical programs (DOE 2017a). Initial construction efforts began in CY 2018. Construction on a large chamber high-voltage electron beam welder was initiated in CY 2018 and was completed in CY 2019.

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 CY 2019, and all were below operational levels projected in the 2008 SWEIS. As stated above, the uranium machining equipment will be relocated from the Radiological Hazardous Machine Shops at TA-03-0102 into the new addition at the Sigma Building during CY 2021–CY 2022. This area will be known as the Sigma Precision Machine Shop. The three machining capabilities from the machine shop have been combined with the existing Sigma Complex capabilities (see 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 two exceptions. In CY 2019, chemical waste generation at the Sigma Complex exceeded 2008 SWEIS projections because of the cleanup of legacy graphite pieces that no longer serve their intended purpose. Mixed low-level waste (MLLW) generation also exceeded 2008 SWEIS projections at the Sigma Complex because of the disposal associated with an equipment upgrade with electrochemistry operations and the disposal of electronics and copper contaminated from equipment removal (see Table A-4).

2.3 Machine Shops (TA-03)

The Machine Shops Key Facility consists of two buildings: the Nonhazardous and Hazardous Materials Machine Shop (TA-03-0039) and the Radiological Hazardous Materials Machine Shop (TA-03-0102). 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. In CY 2018, plans to relocate uranium machining equipment and operations to the Sigma Building (TA-03-0066) were finalized. The depleted uranium operations are proposed to be co-located within the Sigma Complex in CY 2021–CY 2022 depending on funding for the Mod Inspection Lab design and construction.

In CY 2019, the following facility modifications were made to the Machine Shops Key Facility:

- A new chiller was installed in TA-03-0102 for heat-treat operations. This chiller will result in more efficient heat-treat operations.
- CY 2019 Weapons Fabrication Services Group took ownership of the vault located in TA-03-0039 Room 26. This modification included a minor electrical upgrade to Room 26. A new Mod Inspection Lab has been constructed and is located in TA-03-0039 Room 27. The project received partial Beneficial Occupancy in November 2020, full Beneficial Occupancy is expected during CY 2021. The machine shop in Room 26 and the new inspection lab in Room 27 together were named the PF Mark Quality Manufacturing Center (MQMC).

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 CY 2019, and all were below operational levels projected in the 2008 SWEIS. The workload at the Machine Shops is directly linked to research and development and production requirements. The operations related to the uranium machining will be reported in the Sigma Complex Key Facility capabilities table (Table A-3).

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-4 provides operations data details.

2.4 Materials Science Laboratory Complex (TA-03)

The Materials Science Laboratory Complex comprises several buildings in TA-03 (TA-03-0032, -0034, -1415, -1420, -1698, -1819, and -2002). TA-03-1698 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:

- materials processing,
- mechanical behavior in extreme environments,
- advanced materials development,
- materials characterization, and
- 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 CY 2019, all five of the capabilities were active, and all were below operational levels projected in the 2008 SWEIS (Table A-5).

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-6 provides operations data details.

2.5 Nicholas C. Metropolis Center for Modeling and Simulation

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 TA-03-2327. 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 and the Central Computing Facility—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). The analysis resulted in a 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).

[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).

[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.

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:

- The installation of additional processors to increase functional capability 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.

Several supercomputers have been 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 (ECCCE) 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 CY 2021 and will require additional cooling and power for up to 500 petaflops of computing. Work also commenced on modifying the power distribution within the Metropolis Center to maximize power to the computer floor.

In 2016, the DOE/NNSA NEPA Compliance Officer issued a NEPA determination for this project (DOE 2016a). DOE 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 2018, the design for new computing capability was completed, and construction began and continued through 2019. Construction of the ECCCE is scheduled for completion in 2020.

A conceptual design for a minor construction electrical upgrade project needed for the Advanced Technology System-5 computer was completed in 2019. The upgrade is expected to increase computing power with an electrical power load up to approximately 50 megawatts. Construction is expected to commence in 2022. Due to investments in operational efficiency for mechanical cooling, the ATS-5 computer is not expected to require any construction upgrades, instead operating within existing potable and non-potable capabilities.

2.5.2 *Operations at the Metropolis Center*

The 2008 SWEIS identified one capability at the Metropolis Center. This capability was active in CY 2019 and was performed at operational levels projected in the 2008 SWEIS (Table A-7).

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, and personnel occupy 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. Metropolis Center capabilities enable remote-site user access to the computing platform, and its co-laboratories and visualization theaters 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 on 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 CY 2019, the Metropolis Center used approximately 10.6 peak megawatts of electricity, 3.2 million gallons of groundwater, and 40.3 million gallons of reclaimed water from the SERF. Operations data levels at the Metropolis Center remained below levels projected in the 2008 SWEIS. Table A-9 provides operations data details.

2.6 High Explosives Processing Facilities (TA-08, -09, -11, -16, -22, and -37)

High Explosives Processing Facilities, located in all or parts of six LANL TA buildings, include

- production and assembly facilities,
- analytical and synthesis laboratories,
- test facilities,
- explosives storage magazines,
- units for treating hazardous explosive waste by open burning, and
- a facility for treatment of explosives-contaminated wastewaters.

[7] The 2008 SWEIS analyzed 15 megawatts of electrical power and 51 million gallons (193 million liters) of groundwater per year. 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).

Activities consist primarily of the 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 TA-09, -11, and -16. TA-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 work occurs at TA-16-0260.) The completed shapes are shipped to customers, both onsite and offsite, for use in experiments and open detonations. Personnel at TA-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 TA-16 Engineering Complex
- Removal or demolition of vacated structures that are no longer needed

The TA-16 Engineering Complex project was cancelled. Construction and modifications to buildings in the High Explosives Processing area were initiated or completed in CY 2019, including

- completion of TA-16-0260 Bay 5 renovations;
- completion of TA-08-0022 facility renovations and installation of the K-15 Microtron (15-million-electron-volt [MeV] radiography machine);
- completion of the TA-16 temporary vault-type-room installation;
- completion of upgrades to TA-16-0410 and -0414 heating, ventilation, and air conditioning (HVAC); and
- completion of TA-22-0034 HVAC and fire suppression upgrades.

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 CY 2019, and all were below operational levels projected in the 2008 SWEIS. The plastics research and development capability is currently being performed in other facilities. Table A-11 provides operations details.

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 per year. In CY 2019, 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 CY 2019, 1,636 high explosives components were inspected at TA-08. Materials testing at TA-22 expended less than 4 pounds (1.8 kilograms) of pentaerythritol tetranitrate–based detonators.

In CY 2019, high explosives processing and high explosives laboratory operations generated approximately 9,079 gallons (34,367 liters) of explosives-contaminated water, which was treated at the High Explosives Wastewater Treatment Facility using an evaporator system. This effort resulted in zero liquid discharge. All high explosives burning operations are conducted at TA-16-0388. Approximately 1,229 pounds (557 kilograms) of water-saturated high explosives and 2,960 pounds (1,342 kilograms) of high explosives–contaminated scrap metal were treated annually. No explosives-contaminated solvents were treated. Approximately 3,454 gallons (13,074 liters) of propane was expended annually to treat these materials. Non-detonable, explosives-contaminated equipment was steam cleaned in TA-16-0260 and salvaged or sent for recycling.

In CY 2019, efforts continued to develop protocols for obtaining stockpile-returned materials, to develop new test methods, and to procure new equipment to support requirements for science-based studies on stockpile and energetic materials. Completion of one detonator lot typically takes 18 months from start to finish. Two major product lines were manufactured in CY 2019.

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 CY 2019, chemical waste generation at the High Explosives Processing Facility exceeded 2008 SWEIS projections because of the disposal of empty drums (36 percent of the total), the disposal of spent chemicals from the etching machine (24 percent of the total), and the disposal of concrete from TA-16 (22 percent of the total). These wastes accounted for 83 percent (34,714 kilograms) of the total chemical waste at the High Explosives Processing Facilities. Table A-12 provides operations data details.

2.7 High Explosives Testing Facilities (TA-14, -15, -36, -39, and -40)

High Explosives Testing Facilities, located in all or parts of five TAs, comprise more than half (22 square miles) of the land area occupied by LANL and include 16 associated firing sites (sites specifically designed to conduct experiments with explosives). All firing sites are situated in remote locations within canyons. Major buildings within this Key Facility are located at TA-15 and include the Dual-Axis Radiographic Hydrodynamic Test (DARHT) Facility (TA-15-0312) and the Vessel Preparation Building (TA-15-0534). 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 (TA-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 CY 2019; however, the following modifications and upgrades to existing facilities were completed in CY 2019:

- The construction of a domestic and fire suppression waterline (also known as Area 1 waterline) from DARHT to Lower Slobbovia
- The DARHT chiller renovation project

2.7.2 *Operations at the High Explosives Testing Facilities*

The 2008 SWEIS identified seven capabilities at this Key Facility. No high explosives pulsed-power experiments were conducted. All seven of the capabilities were active in CY 2019, and all were below operational levels projected in the 2008 SWEIS. Table A-13 provides operations details.

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 CY 2019, 1,658 pounds (752.1 kilograms) of depleted uranium was expended. The quantity of expended depleted uranium includes the quantity of depleted uranium expended during material sanitization.

Four hydrotests were performed at the DARHT Facility in CY 2019. Intermediate-scale dynamic experiments containing beryllium using single-walled steel containment vessels continued at the Eenie Firing Site TA-36-0003, along with other programmatic experiments. A steel vessel was 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 generated at the High Explosives Testing Facilities exceeded the 2008 SWEIS projections because of the disposal of post-shot concrete debris—which accounted for 53 percent of the total chemical waste generated—and the removal of asphalt from TA-40—which accounted for 15 percent of the total chemical waste generated at the High Explosives Treatment facility. Table A-14 provides operations data details.

2.8 Tritium Facility (TA-16)

The Weapons Engineering Tritium Facility (WETF) at TA-16 is the principal building in this Key Facility. Operations at WETF consist of tritium research, development, and processing to meet requirements of the present and future Stockpile Stewardship Program.

WETF structures include TA-16-0205, -0329, -0450, and -0824. The majority of tritium operations are conducted in TA-16-0205. TA-16-0450 is physically connected to but radiologically separated from TA-16-0205 and is not currently operational with tritium. TA-16-0329 and -0824 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. Tritium emissions from TA-55 are included as part of the Plutonium Complex Facility.

WETF is a Hazard Category 2 Nuclear Facility (Table 2-4). In CY 2019, the tritium inventory at WETF was greater than 30 grams.

Table 2-4. WETF Buildings with Nuclear Hazard Classification

Building	Description	2008 SWEIS	LANL 2019[a]
TA-16-0205	WETF	2	2
TA-16-0450	WETF	2	2

[a] List of LANL nuclear facilities (LANL 2018)

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 TA-21 Tritium Facilities

The DD&D of TA-21 Tritium Facilities was completed in 2010. Construction and modifications to WETF that were completed in CY 2019 include

- the TA-16 WETF canopy fire sprinkler and
- the TA-16 WETF modernization liquid nitrogen system project.

2.8.2 *Operations at the Tritium Facilities*

The 2008 SWEIS identified eight capabilities for this Key Facility.[8] Six of the eight capabilities were active in CY 2019. All capabilities were below operational levels projected in the 2008 SWEIS. Gas processing operations were conducted in CY 2019. Table A-15 provides details.

Five flanged tritium waste containers (containing LLW) have classified tritium waste and are stored at WETF. These containers have 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. The Nevada National Security Site (NNSS) has approved a waste stream profile that will allow for the disposal of the contents of these containers. Two containers are ready to be shipped to NNSS, but the rest will require repackaging to meet the NNSS disposal requirements. Shipments in CY 2020 will be discussed in the SWEIS Yearbook 2020.

[8] The 2008 SWEIS identified nine capabilities for this Key Facility. In CY 2010, the radioactive liquid waste treatment capability ended with the demolition of TA-21 tritium buildings.

2.8.3 *Operations Data for the Tritium Facilities*

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

2.9 Target Fabrication Facility (TA-35)

The Target Fabrication Facility (TA-35-0213) 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 houses laboratories and machine shops to provide world-class design, fabrication, assembly, characterization, and field support for the wide range of targets.

2.9.1 *Construction and Modifications at the Target Fabrication Facility*

The 2008 SWEIS projected no major facility modifications to this Key Facility. In CY 2019, modifications were initiated for Room C16 for machining operations.

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 CY 2019, and all were below operational levels projected in the 2008 SWEIS. Table A-17 provides operations details. The primary measurement of activity for this facility is production of targets for research and testing (laser and physics testing).

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. Chemical waste generation at the Target Fabrication Facility exceeded 2008 SWEIS projections because of fire alarm and chiller construction debris and the disposal of beryllium-contaminated lab waste, which accounted for 60 percent (7,366.3 kilograms) and 30 percent (3,664.1 kilograms) of the total chemical waste generated. Table A-18 provides operations data details.

2.10 Bioscience Facilities (TA-43, -03, -35, and -46)

Bioscience Facilities include the main Health Research Laboratory (TA-43-0001) and additional offices and laboratories located at TA-35-0085 and -0254 and TA-03-0562, -1076, and -4200. Operations at TA-43 and TA-35-0085 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 (BSLs) 1 and 2, cellular components (e.g., ribonucleic acid, deoxyribonucleic acid [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 TA-62.

The Los Alamos Science Complex was proposed to be constructed at TA-62 on approximately 15 acres. DOE/NNSA cancelled the project.

In CY 2018, DOE/NNSA issued a categorical exclusion for a new modular BSL-2 facility. This facility—referred to as the Commercially Engineered Facility Construction (CEFC) module—would be a replacement facility for Bioscience operations that are currently conducted at TA-43-0001. The former location of the Press Building (TA-03-0035) was evaluated for installation in 2018 (DOE 2018d). In CY 2019, the site was prepared for the construction of the Bioscience Research Laboratory. The CEFC module arrived, and building construction continued into 2020.

During CY 2004, construction was finalized on the BSL-3 facility. The BSL-3 facility (TA-03-1076) is a windowless, single-story, 3,202-square-foot, standalone biocontainment facility. 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*, with 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 before release for public comment. In CY 2018, the EIS was withdrawn by the DOE/NNSA, and the facility is undergoing readiness work to enable BSL-2 and chemical operations. In 2019, the building underwent significant upgrades to the HVAC control systems and other facility systems. Building occupancy was transferred to the Bioscience Division, and they initiated programmatic start-up plans.

2.10.2 *Operations at the Bioscience Facilities*

The 2008 SWEIS identified 12 capabilities for this Key Facility. Eleven capabilities were active in CY 2019, and all were at or below levels projected in the 2008 SWEIS. The in vivo monitoring program capability has been discontinued. Table A-19 provides details for operations.

Work with radioactive materials at this Key Facility is limited because of 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 that adhere 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 Laboratory (IVML) program maintains equipment and facilities for the direct (in vivo) monitoring of personnel for intakes of radioactive materials in TA-43-0001. On November 19, 2018, the decision was made to discontinue all IVML operations at the Health Research Laboratory. All radioactive sources and equipment have been removed from the facility.

In CY 2019, 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 (TA-48)

The Radiochemistry Facility, including all of TA-48 (116 acres), 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. TA-48 contains six major research buildings: 01, 17, 28, 45, 107, and 08.

2.11.1 *Construction and Modifications at the Radiochemistry Facility*

The 2008 SWEIS projected no major facility modifications to the Radiochemistry Facility. No major construction or modifications occurred in CY 2019.

2.11.2 *Operations at the Radiochemistry Facility*

The 2008 SWEIS identified 10 capabilities at the Radiochemistry Facility.[9] All 10 capabilities were active in CY 2019. Table A-21 provides details on operations.

2.11.3 *Operations Data for the Radiochemistry Facility*

Operations data levels at the Radiochemistry Facility remained below levels projected in the 2008 SWEIS with one exception. MLLW exceeded 2008 SWEIS projections because of the disposal of lead-contaminated materials from routine housekeeping and maintenance operations. These materials accounted for 64 percent (5.4 cubic meters) of the total MLLW at the Radiochemistry Key Facility. Table A-22 provides operations data details.

2.12 Radioactive Liquid Waste Treatment Facility (TA-50)

The RLWTF is located in TA-50 and consists of six primary structures:

- the RLWTF Building (TA-50-0001),
- the influent storage building for low-level radioactive liquid wastes (TA-50-0002),
- the influent storage building for TRU radioactive liquid waste (TA-50-0066),
- a 100,000-gallon (380,000-liter) influent tank for LLW (TA-50-0090),
- a facility for the storage of secondary liquid wastes (TA-50-0248), and
- the Waste Mitigation and Risk Management Facility (TA-50-0250).

[9] The 2008 SWEIS identified 11 capabilities at the Radiochemistry Facility. In CY 2012, the hydrotest sample capability moved from TA-48 to TA-15.

TA-50-0250 has the capacity to store 300,000 gallons of low-level influent during 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—TA-50-0250—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. The RLWTF Building is the largest structure in TA-50, with 40,000 square feet under roof.

Table 2-5. RLWTF Buildings with Nuclear Hazard Classification

TA-50 Building	Description	2008 SWEIS	LANL 2019*
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 2018).

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 TA-50
- Construct and operate evaporation tanks in TA-52

The following construction and modifications took place during CY 2019:

- Construction of a replacement low-level radioactive liquid waste treatment facility began in CY 2015. The project ended in 2018; however, the new facility will not be used for an estimated 3 years because of needed post-project modifications. The design of the replacement TRU Liquid Waste Facility was completed during CY 2017; a re-design began in 2019.
- Solar evaporation tanks were installed at TA-52 in CY 2012 but have yet to be used. Startup awaits New Mexico Environment Department (NMED) approval of a ground water discharge permit application submitted in August 2012 and post-project modifications, such as replacement of the tank liner and leak detection system. A soil moisture-monitoring system was installed beneath the solar evaporation tanks in 2019.

2.12.2 *Operations at the RLWTF*

The 2008 SWEIS identified two capabilities at this Key Facility: waste transport and waste treatment. Both capabilities were active in CY 2019 and were below operational levels projected in the 2008 SWEIS (Table A-23).

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. During CY 2019, the RLWTF received 3.6 million liters of influent, less than one percent of which was delivered by truck (6 tankers). A total of 2.5 million liters of treated water was discharged to the environment via the effluent evaporator. Approximately 81,000 liters of treated water was discharged to Mortandad Canyon. There was little TRU radioactive liquid waste activity during CY 2019. Six waste transfers were received from TA-55; no treatment or solidification occurred.

Operations data levels at the RLWTF remained below levels projected in the 2008 SWEIS with two exceptions. In 2019, chemical waste generation exceeded 2008 SWEIS projections because of waste from a roof replacement and asbestos removal project at TA-50—which accounted for 57 percent (2,249.8 kilograms) of the chemical waste generated—and from the disposal of empty drums—which accounted for an additional 10 percent of the total chemical waste generated. LLW generation exceeded 2008 SWEIS projections because of a wastewater byproduct of the treatment process of radioactive liquid waste evaporator bottoms at TA-50, which accounted for approximately 98 percent (786.2 cubic meters) of the LLW generated at the RLWTF.

2.13 Los Alamos Neutron Science Center (TA-53)

LANSCE lies entirely within TA-53. This Key Facility comprises more than 400 structures, including one of the largest buildings at LANL. TA-53-0003, which houses the linear accelerator (LINAC), comprises 315,000 square feet. Activities consist of:

- neutron science and nuclear physics research,
- proton radiography,
- the development of accelerators and diagnostic instruments, and
- production of medical radioisotopes.

The majority of LANSCE (the User Facility) is composed of the 800-MeV LINAC, a proton storage ring, and five major experimental areas:

- the Manuel Lujan Neutron Scattering Center,
- the Weapons Neutron Research Facility,
- the Isotope Production Facility,
- Experimental Area B (known as the Ultracold Neutron Facility), and
- Experimental Area C (the Proton Radiography Facility).

Experimental Area A, formerly used for nuclear physics experiments using pi mesons[10] (including cancer therapy research and isotope production), is currently inactive and was emptied of most beam and experimental equipment in CY 2009. TA-53-0365 is currently being used for modern LANSCE LINAC injector and radiofrequency system development. LANSCE is classified as an Accelerator Facility, regulated under DOE Order 420.2C, and currently operates under two main Safety Basis documents: *LANSCE Safety Assessment Document* (TA53-SB-SAD-Vols.I-VIII-113-004.R5) and *LANSCE Accelerator Safety* (TA53-SB-ASE-113-005.R5) (LANL 2015b, a).

[10] Pi meson is any of three subatomic particles: $\pi 0$, $\pi +$, and $\pi -$.

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 2019, a polar crane was installed into the Proton Radiography facility and groundbreaking took place for a new storage building that is to be located to the north of Area C.

2.13.2 *Operations at LANSCE*

The 2008 SWEIS identified eight capabilities at this Key Facility. Six of the eight capabilities were active in CY 2019, and all six fell below operational levels projected in the 2008 SWEIS. During CY 2019, LANSCE operated the LINAC 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 lower than the 6,400 hours at 1,250 microamps per year 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 one exception. In 2019, MLLW exceeded 2008 SWEIS projections because of the disposal of mercury-contaminated waste, which accounted for 82 percent (15.3 cubic meters) of the total MLLW. Table A-26 provides operations data details.

2.14 Solid Radioactive and Chemical Waste Facilities (TA-50, -54, -55, -60, and -63)

SRCW Facilities are now located at TA-50, -54, -55, -60, and -63. 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. As previously discussed, N3B assumed operational and management control of several facilities in TA-54 for waste activities (see Table 2-6). This change in management at TA-54 initiated a need for a temporary central accumulation waste storage area for Triad. In 2018, Triad established a less-than-90-day, large temporary area at TA-60-0017 to store waste generated LANL-wide. Waste accumulated at TA-60-0017 includes hazardous and mixed wastes—more specifically, hazardous chemical and mixed low-level radioactive waste. Triad is no longer using the temporary storage facility (TSF) at Area L in TA-54. This area is now managed by N3B and is used primarily for remediation wastes or wastes generated from remediation efforts.

In 2020, DOE, Triad, and N3B submitted a Class 2 permit modification request to add a new Resource Conservation Recovery Act (RCRA)-permitted hazardous waste management unit to the Permit for TA-60-0017. Currently LANL is authorized to store waste at TA-60-0017 for only less than 90 days. A Class 2 Permit Modification to the LANL Hazardous Waste Permit to add TA-60-0017 as a TSF would allow for additional storage of enduring mission hazardous and mixed wastes up to 1 year.

The 2008 SWEIS recognized structures at the SRCW Facilities 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. In May 2018, operational control of several Hazard Category 2 Nuclear facilities in TA-54 was transferred from DOE/NNSA to DOE-EM (see ownership in the description).

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

Building	Description	2008 SWEIS	LANL 2018[a]
50-69	Triad – Waste Characterization, Reduction, and Repackaging Facility	2	2
50-69 Outside	Triad – Nondestructive Analysis Mobile Activities	N/A[b]	2
50-69 Outside[c]	Triad – Drum Storage	2	2
54-Area G[d]	N3B – LLW Storage/Disposal	2	2[e]
54-2	N3B – TRU Storage Building	N/A	2[e]
54-8	N3B – MLLW/LLW Storage Building	2	2[e]
54-33	N3B – TRU Drum Preparation	2	2[e]
54-38	Triad – Radioassay and Nondestructive Testing Facility	2	2[e]
54-48	N3B – TRU Waste Management Dome	2	2[e]
54-49	N3B – TRU Waste Management Dome	2	2[e]
54-153	N3B – TRU Waste Management Dome	2	2[e]
54-224	N3B – Mixed Waste Storage Dome	N/A	2[e]
54-229	N3B – TRU Waste Management Dome	2	2[e]
54-230	N3B – TRU Waste Management Dome	2	2[e]
54-231	N3B – TRU Waste Management Dome	2	2[e]
54-232	N3B – TRU Waste Management Dome	2	2[e]
54-283	N3B – TRU Waste Management Dome	2	2[e]
54-375	N3B – TRU Waste Management Dome	2	3[e]
54-412	N3B – TRU Waste Management Building	N/A	2[e]
54-1027	N3B – Hazardous, Chemical, Mixed, and Tritiated Waste Storage Shed	N/A	2[e]
54-1028	N3B – Hazardous, Chemical, Mixed, and Tritiated Waste Storage Shed	N/A	2[e]
54-1030	N3B – Hazardous, Chemical, Mixed, and Tritiated Waste Storage Shed	N/A	2[e]
54-1041	N3B – Hazardous, Chemical, Mixed, and Tritiated Waste Storage Shed	N/A	2[e]
54-Pad1[f]	N3B – Storage Pad	2	2[e]
54-Pad10[g]	N3B – Storage Pad	2	2[e]
54-Pad281	N3B – LLW Storage	N/A	2[e]
63-144	Triad – Transuranic Waste Facility (TWF)	N/A	2

[a] List of LANL nuclear facilities (LANL 2018).
[b] N/A = not available.
[c] Drum storage includes drum staging/storage pad and waste container temperature equilibration activities outside TA-50-0069.
[d] This area 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] Hazard Category Nuclear Facilities at TA-54 that are now under N3B operational control were removed from the List of LANL nuclear facilities in January 2019. N3B is in the process of preparing a nuclear facilities list.
[f] Pad 1 was formerly the TA-54-0226, TRU Waste Storage Dome.
[g] Pad 10 was originally designated as Pads 2 and 4 in the 2008 SWEIS.

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 (WCATS) was specifically designed to manage LANL's waste from generation to disposition. Waste tracking includes information on

- the waste generating process,
- the quantity,
- the chemical and physical characteristics of the waste,
- the regulatory status of the waste,
- applicable treatment and disposal standards, and
- the final disposition of the waste.

These data are ultimately used to assess operational efficiency, to help ensure environmental protection, and to demonstrate regulatory compliance.

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 2016 State of New Mexico Environment Department Compliance Order on Consent (Consent Order)

These waste management facilities were scheduled to replace LANL's existing facilities for solid waste management. In CY 2014, construction began at TA-63-0144 on the new TWF. Construction was completed, and startup authorization and Critical Decision-4 were 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 no longer than 1 year, which is 260 drums fewer than projected in the 2008 SWEIS (1,500 drums per year).

In 2019, Triad began using TA-60-0017 as a central accumulation area for mission-essential waste generated from sites across LANL. Triad is no longer using the TSF at Area L in TA-54. This area is now managed by N3B and is used primarily for remediation wastes or wastes generated from remediation efforts.

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 CY 2019, and all four fell below operational levels projected in the 2008 SWEIS. The primary measurements of activity for this facility are volumes of newly generated chemical/ hazardous, LLW, and TRU wastes managed by Triad and N3B and volumes of legacy TRU waste and MLLW in storage at TA-54 managed by N3B. Table A-27 represents both legacy waste operations and the new TWF operations.

2.14.3 *Operations Data for the Solid Radioactive and Chemical Waste Facilities*

Operations data levels at SRCW Facilities remained below levels projected in the 2008 SWEIS. Table A-28 provides operations data details.

2.15 Plutonium Facility Complex (TA-55)

The Plutonium Facility Complex consists of six primary buildings and many support, storage, security, and training structures located throughout TA-55. The Plutonium Facility (TA-55-0004) is categorized as a Hazard Category 2 Nuclear Facility. In addition, TA-55 includes two low-hazard chemical facilities (TA-55-0003 and TA-55-0005) and one low-hazard energy source facility (TA-55-0007). The DOE/NNSA listing of LANL nuclear facilities for 2019 (LANL 2018) retained TA-55-0004 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 2019[a]
Plutonium Facility (TA-55-0004)	Plutonium Processing	2	2

[a] List of LANL nuclear facilities (LANL 2018).

2.15.1 *Construction and Modifications at the Plutonium Facility Complex*

The 2008 SWEIS projected two facility modifications:

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

The TRP consists of three separate line items (TRP I, TRP II, and TRP III). Each line item is split into subprojects. During CY 2019, TRP II activities continued. The TRP III planning stage, which included ventilation system replacement in TA-55-0041, continued in 2019.

The TA-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 standalone facility could be built. Work continued in CY 2019.

The following construction and modification projects were initiated and continued in CY 2019:

- DD&D and equipment improvements 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 TA-55-0004 addresses deficiencies identified through structural analysis that was conducted to evaluate the ability of the TA-55 Plutonium Facility safety structures, systems, and components to meet their credited safety functions, as defended in the Documented Safety Analysis (LANL 2016b). Project planning and construction activities continued through CY 2019.
- As discussed in Section 2.1.1, construction activities began in TA-55-0004, as described in the supplemental 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 CY 2019. For all six active capabilities, activity levels were below those projected by the 2008 SWEIS.

During 2017, LANL was directed to prepare a 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). During 2018, LANL continued data call support to describe potential environmental impact for the dilute and dispose alternative for the Surplus Plutonium Disposition Program. DOE/NNSA is collecting information from LANL and Savannah River Site to support a new EIS for this program. LANL's effort to prepare a Critical Decision-0 package was halted in 2019 because of continued funding restrictions.

The Plutonium Sustainment Program at LANL continues to prepare to meet the requirement of re-establishing War Reserve pit production by the beginning of FY 2024 and establishing a production capacity of 30 pits per year in FY 2026. DOE/NNSA announced its NEPA strategy for pit production on June 10, 2019. The strategy outlines DOE/NNSA's intent to prepare a site-specific document for the proposal to authorize expanding pit production at LANL to no fewer than 30 pits per year no later than during 2026 (DOE 2020). A supplement analysis to the 2008 SWEIS was prepared for producing no fewer than 30 pits per year at Los Alamos in CY 2019 into CY 2020. The DOE issued an amended ROD in September 2020 selecting to implement elements of the Expanded Operations Alternative for an increase in pit production.

2.15.3 *Operations Data for the Plutonium Facility Complex*

Operations data levels at the Plutonium Facility Complex remained below levels projected in the 2008 SWEIS with one exception. In CY 2019, chemical waste generation exceeded 2008 SWEIS projections because of waste from a hydraulic oil spill at TA-55 construction site, which accounted for 39 percent of the total waste (8,607.8 kilograms), and concrete removal, which accounted for 17 percent of the total chemical waste (3,803.8 kilograms). Table A-29 provides operations data detail.

2.15.4 *Off-Site Source Recovery Program*

The Off-Site Source Recovery Program (OSRP) is a U.S. Government activity sponsored by the NNSA's Office of Global Material Security and managed at LANL through the Nuclear Engineering & Nonproliferation Division. The OSRP is tasked to recover and manage sealed radioactive sources from domestic and international locations. The sealed radioactive sources are delivered to the TA-03-0030 warehouse and are transported by truck to TA-55 or other approved LANL or subcontracted facilities for storage.

The OSRP recovers and manages unwanted radioactive sealed sources and other radioactive material that:

- present a risk to national security, public health, or 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[11] (42 USC); or
- are DOE owned.

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). On July 8, 2011, DOE/NNSA issued an amended ROD in the Federal Register (DOE 2011b) that stated that 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 used 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 if (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 DOE/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 2017d).

Of the planned countries slated for source repatriation in CY 2019, the OSRP recovered 4 radiological sources from Japan and 1,464 sources from United States–domestic locations.

2.16 Non-Key Facilities

The balance (and majority) of LANL buildings are referred to in the 2008 SWEIS as Non-Key Facilities. Non-Key Facilities house operations that do not have the potential to cause significant environmental impacts. These buildings and structures are located in 30 of LANL's 49 TAs 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.

[11] 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.

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 SERF	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 TA-49	2013
TA-49 Training Facility Expansion	2016
TA-72 Armory Cleaning Facility	2016
Unmanned Aerial Systems User Facility	2016
Fire Station One Upgrades at TA-03-0041	2017
Supplemental Environmental Projects: Triennial Review; Surface Water Sampling	2018
Otowi West Entrance Rehabilitation	2018

New projects that were still under construction or were completed in CY 2019 are discussed in the following paragraphs.

Oppenheimer Collaboration Center Renovation

Description: The Oppenheimer Collaboration Center (LANL's research library) at TA-03-0207, is being renovated. The renovation covers 8,280 square feet of the first floor and establishes multiple collaboration, meeting, seating, and private workspaces. The second floor is being modified to meet Americans with Disabilities Act requirements, and the existing lobby and meeting spaces are being updated. The basement floor is being converted from the traditional library configuration with book stacks to a modern office area for LANL students and new employees who are awaiting security clearances.

Status: Construction began in CY 2015. Work on the first and second floors has been completed. The basement floor design is complete, and construction began in CY 2018.

TA-03 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 TA-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). Construction began in CY 2018 after design was completed. Construction is approximately 90 percent complete and is expected to be finalized by CY 2022.

Roof Asset Management Program

Description: The Roof Asset Management Program 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; and
- protection of essential equipment and personnel that are housed within the structures across the Laboratory from outside element infiltration.

Before the program, roofing concerns were usually 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: A total of 426 facilities have been re-roofed since 2004. FY 2019 saw 33 facilities replaced and 15 facilities repaired within the Weapons Facilities Operations, TA-55, and TA-50.

Supplemental Environmental Projects

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 2016a) between DOE/NNSA and the NMED signed in 2016 included five projects that DOE/NNSA intends to implement by 2019:

- Roads – Improve transportation routes at LANL used for the transportation of TRU waste to WIPP.
- Triennial Review – Conduct an independent, external triennial review of environmental regulatory compliance and operations.
- Watershed Enhancement – Design and install engineering structures in and around LANL to slow storm water flow and decrease sediment load to improve water quality in the area.
- Surface Water Sampling – Conduct increased sampling and improve monitoring capabilities for storm water runoff in and around LANL; share the results of sampling and monitoring with the public and the NMED.
- 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: The Triennial Review and Surface Water Sampling requirements were completed in 2018 and will not be discussed. In CY 2019, the following activities were completed in support of the Supplemental Environmental Projects or were in the design phase, with the exception of the following Watershed Enhancement Projects:

- Road Improvement Project – Improve routes at the Laboratory used for the transportation of transuranic waste to WIPP. The U.S. Army Corps of Engineers selected a design engineering firm to manage the redesign of the State Route 4 and East Jemez Road intersection. The selected firm, Bohannon Houston, developed five options for the redesign of the intersection. The Integrated Project Team consisted of the County of Los Alamos, the County of Santa Fe, the New Mexico Department of Transportation, the National Park Service, the NNSA, and the Pueblo de San Ildefonso. After reviewing all five designs, a concept was selected, and Bohannon Houston submitted a cost estimate to complete the design and construction. The design was completed in August 2019. Funding for the intersection construction is being pursued.
- Watershed Enhancement Project – Design and install engineering structures in and around the Laboratory to reduce storm water velocity and decrease sediment load to improve water quality in the area. This project includes a Low Impact Development Master Plan for the Laboratory (LANL 2017b).
  - Construction on the main gate entry storm water pond was coordinated with the Potable Water Line Replacement Project activities, detailed below. The project was certified to the NMED in April 2019; however, additional work on the Potable Water Line Project in this area postponed final completion to December 2019.
  - The La Mesita East Low Impact Development Project at TA-53 was completed in November 2019 and certified to the NMED in December 2019.
  - The upper Cañon de Valle project construction activities began in September 2018. Construction was completed in April 2019 and certified to the NMED in April 2019.
  - The mid-Mortandad watershed project design was completed in April 2018, and construction activities began in October 2018. Construction was completed in February 2020.
- Potable Water Line Replacement Project – Replace aging potable water lines and install metering equipment for Laboratory potable water systems.
  - In 2019, we completed construction of Phases A & B waterlines, including installation of the meters, air-relief valves, pressure-relief valves, etc. The lines are completely operational, and the only remaining activities are to cut and cap four locations of the old line, finish site restoration, and repair and replace asphalt and concrete.

TA-72 Outdoor Range Upgrade Project

Description: DOE/NNSA proposes to upgrade the TA-72 Outdoor Firing Range to meet all current and future training requirements. To support ongoing and future crucial missions in a highly productive and safe manner, LANL requires a highly trained and well-equipped protective force. The current LANL Protective Force Training facilities are in need of renovation. The planned upgrades to the TA-72 Outdoor Firing Range will provide the Protective Force with the various modes of training, including realistic simulated and live firing training necessary to maintain a tactically proficient fighting force. The scope of this project will include the creation of a new 200-yard firing range with 10 lanes (Range 5), adjustable lighting for night fire, rotating targets, and installation of a speaker system. A new 2,400-square-foot warehouse will also be constructed to store targets and firing range supplies and to house a restroom.

Status: Construction on the TA-72 Outdoor Firing Range began in October 2018. Construction continued into calendar 2019. The project was completed in September 2020. The new firing range is expected to be operational in 2021.

Steam Plant Replacement Project

Description: DOE/NNSA proposes to replace the TA-03 Steam Plant capabilities. The project will be designed, constructed, and operated to increase on-site electrical power generation and provide for a more reliable, efficient, and sustainable TA-03 building heating capability.

This project will be constructed in a three-phased approach within the footprint of the existing TA-03 Steam Plant and the steam condensate pipeline corridors. The steam plant facility will be designed for an operating life of not less than 30 years.

Status: In May 2018, DOE/NNSA categorically excluded this project (DOE 2018e). Construction work began in August 2019. The project is expected to be completed during 2021.

Sensitive Compartmented Information Facility (SCIF) Modular Office Building

Description: DOE/NNSA proposes to construct a modular office building that will conform to Intelligence Community Technical Specifications for accreditation—an ongoing process following the project from beginning to end. Once finished, the modular building will house personnel from Global Security.

Status: The project received NEPA coverage under the 2008 SWEIS (DOE 2008a). Construction work began in early 2019. The project was completed in July 2020. At a ribbon-cutting ceremony in July, the new SCIF modular office building was officially named the Donald M. Kerr Office Building, in honor of the former Laboratory director.

Multi-Use Office Building at TA-03

Description: DOE/NNSA proposes to construct a multi-use office building in TA-03 to provide classified office space for personnel from weapons, utilities, and general research groups.

Status: The project received NEPA coverage under the 2008 SWEIS as reaffirmed in the 2018 Supplement Analysis of the 2008 SWEIS (DOE 2018b). Construction work began in November 2019. The project is expected to be completed during 2021.

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-32. During CY 2019, no new capabilities were added to the Non-Key Facilities, and none of the seven existing capabilities were 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 one exception. Chemical waste generated in CY 2019 exceeded annual volumes projected in the 2008 SWEIS because of 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 that contains dissolved solids. These waste products accounted for about 80 percent of the total chemical waste generated at Non-Key Facilities (see table A-32 for details).

In CY 2019, the Non-Key Facilities generated about 84 percent of the total LANL chemical waste volume, about 7 percent of the total LLW volume, 4 percent of the total MLLW volume, and 20 percent of the total TRU waste volumes (see table 3-8 for 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 April 2018, N3B began management of LANL's legacy waste cleanup operations.

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 townsite) ownership.

Characterization and remediation efforts are regulated by NMED for hazardous constituents under the *New Mexico HWA* (NMSA1978, § 74-4-10) and the *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 Compliance Order on Consent (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, 6 newly identified sites, an additional site resulting from the split of SWMU 00-033, and the 24 sites split during a consolidation effort were potentially subject to the new Consent Order requirements. Of these sites, 166 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 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. From the start of the Consent Order through the end of 2019, NMED issued 361 Certificates of Completion, 276 Certificates of Completion without Controls, and 85 Certificates of Completion with Controls. The total number of corrective action sites remaining in the investigation process at LANL is 1,044.

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 4 SWMUs and 1 AOC were split into 10 new SWMUs and 2 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 2016 Consent Order, 135 sites are deferred for investigation and corrective action. These areas 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 declared 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 are complete. Corrective actions for the deferred sites will be implemented under LANL's Hazardous Waste Facility Permit if not completed before the end date of the Consent Order.

2.17.2 *Environmental Cleanup Operations*

DOE-EM and N3B developed and/or revised two progress/letter reports and two supplemental investigation reports documenting environmental cleanup operations that occurred in CY 2019. In addition to the 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.

Subsurface vapor monitoring began again in 2019 at Material Disposal Area C at TA-50. Monitoring is scheduled to continue on a semiannual basis.

Table 2-9 provides summaries of the site, aggregate area, and canyon investigations conducted and/or reported in CY 2019.

Table 2-9. Summary of Site, Aggregate Area, and Canyon Investigations Conducted and/or Reported in CY 2019 under the Environmental Remediation Program

Document/Activity	TA(s)	No. Sites Investigated	No. Samples Collected	No. Sites where Cleanup Conducted	No. Sites where Extent Defined/ Not Defined	Conclusions/Recommendations
Supplemental Investigation Report for S-Site Aggregate Area, Revision 1 (N3B 2019a)	11, 13, 16	61	No additional samples were collected in 2019.	No site cleanups were conducted in 2019.	41/20	Corrective action complete without controls is recommended for 40 sites for which extent is defined and that pose no potential unacceptable human health risk under the residential scenario and no unacceptable ecological risk. Corrective action complete with controls is recommended for one site for which extent is defined and that poses no potential unacceptable human health risk under the industrial scenario and no unacceptable ecological risk. Additional sampling and analyses are recommended for eight sites for which extent is not defined. Three sites could not be completely characterized because of existing structures, and nine sites could not be directly characterized because of historical property preservation restraints. A Phase II investigation work plan will be developed based on the conclusions and recommendations presented in this supplemental investigation report.
Progress Report: Fieldwork Completion and Status for the Known Cleanup Sites Campaign at Solid Waste Management Units 15-007(c), 15-008(b), and 39-002(a)	15, 39	3	Collection in 2019: 82 samples at 80 locations at SWMU 15-007(c); 283 samples from 281 locations at SWMU 15-008(b); 15 samples from 3 locations at SWMU 39-002(a)	2 site clean ups were conducted in 2019: ~19 yd^3 of MLLW from SWMU 15-007(c); ~1760 yd^3 of MLLW from SWMU 15-008(b)	3/0	The lateral and vertical extent of all chemicals of potential concern at SWMUs 15-007(c), 15-008(b), and 39-002(a) have been defined. The overall concentrations of lead at SWMU 15-007(c) and lead and copper at SWMU 15-008(b) in soil and tuff associated with these sites were remediated by removing soils where soil screening levels were exceeded. No remediation was necessary at SWMU 39-002(a) because all soil screening level values were below NMED levels.

Document/Activity	TA(s)	No. Sites Investigated	No. Samples Collected	No. Sites where Cleanup Conducted	No. Sites where Extent Defined/ Not Defined	Conclusions/Recommendations
Supplemental Investigation Report for Potrillo and Fence Canyons Aggregate Area, Revision 1 (N3B 2019b)	15, 36	16	No samples collected in 2019.	No site cleanup was conducted in 2019.	9/7	Corrective action complete without controls is recommended for six sites for which extent is defined and that pose no potential unacceptable human health risk under the residential scenario and no unacceptable ecological risk. Corrective action complete with controls is recommended for one site for which extent is defined and that poses no potential unacceptable human health risk under the industrial scenario and no unacceptable ecological risk. Additional sampling and analyses are recommended for seven sites for which extent is not defined. Remediation and sampling are recommended for three sites that pose potential unacceptable human health risk or dose under one or more scenarios and for two sites that pose potential ecological risks. A Phase II investigation work plan will be developed based on the conclusions and recommendations presented in this supplemental investigation report.
Letter Report: TA-21 (DD&D) and Cleanup Campaign (September 2019)	21	5	No samples collected in 2019.	No site cleanup was conducted in 2019.	0	In 2019, the subcontractor began potholing to locate the industrial waste lines associated with SWMUs 21-022(b), 21-022(c), 21-022(d), 21-022(e), and 21-022(g). Work continued during August and September to locate and mark the industrial waste lines for SWMUs 21-022(b), 21-022(c), 21-022(d), 21-022(e), and 21-022(g) and to relocate the Material Disposal Area T fence. Building 0021-257 interior equipment strip-out work also started in August and continued during September 2019. Recommendation to continue implementing the TA-21 DD&D work plan.

2.17.3 *Site/Facility Categorization*

No new nuclear environmental sites were added to or removed from the LANL Nuclear Facilities list during 2019 (Table 2-10). 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 2018[a]
TA-21; SWMU 21-014	Material Disposal Area A (General's Tanks)	2	2[b]
TA-21; Consolidated Unit 21-016(a)-99	Material Disposal Area T	2	2[b]
TA-35; AOC 35-001	Material Disposal Area W	3	3[b]
TA-49; SWMUs 49-001(a), 49-001(b), 49-001(c), and 49-001(d)	Material Disposal Area AB	2	2[b]
TA-54; SWMU 54-004	Material Disposal Area H	3	3[b]
TA-54; Consolidated Unit 54-013(b)-99	Material Disposal Area G, as an element of TA-54 Waste Storage and Disposal Facility, Area G	2	2[b]

[a] List of LANL nuclear facilities (LANL 2018a).

[b] Hazard Category Nuclear Facilities that are now under N3B operational control were removed from the List of LANL nuclear facilities in January 2019. N3B is in the process of preparing a nuclear facilities list.

3 SITE-WIDE 2019 OPERATIONS DATA AND AFFECTED RESOURCES

This chapter summarizes operational data at the site-wide level. It compares actual operating data with 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 CY 2019 totaled approximately 314 curies, about 0.9 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 39 curies in CY 2019. The total point source emissions from LANSCE was approximately 275 curies in CY 2019.

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 CY 2019, non-point emissions were approximately 16 curies.

Maximum offsite dose to the maximally exposed individual was 0.41 millirem in 2019. 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 2020a).

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 nonradioactive air pollutants. As such, LANL is required to estimate emissions rather than perform actual stack sampling. As Table 3-1 shows, CY 2019 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[a]

Pollutants	2008 SWEIS (tons/year)	CY 2019 Operations (tons/year)
Carbon monoxide	58.0	10.5
Nitrogen oxides	201.0	21.7
Particulate matter	11.0	2.2
Sulfur oxides	0.98	0.5

[a] 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 TA-03 Power Plant, the Combustion Gas Turbine Generator, and the TA-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 2019 (LANL 2020b). In CY 2019, more than half of the criteria pollutants (nitrogen oxides and carbon monoxide) originated from the TA-03 Power Plant.

In 2019, LANL reapplied for a new Title V Operating Permit from NMED. This permit will include 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 CY 2019 actual emissions from all sources included in the permit. Emissions from small boilers and heaters are included in these totals. In 2019, 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 CY 2019. 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 Report (LANL 2020b).

Table 3-2. Emissions for Criteria Pollutants as Reported on LANL's Title V Operating Permit Emissions Reports[a]

Pollutants	2008 SWEIS (tons/year)	Title V Facility-Wide Emission Limits (tons/year)	2019 Emissions (tons/year)
Carbon monoxide	58.0	225	24.6
Nitrogen oxides	201.0	245	35.0
Particulate matter	11.0	120	3.5
Sulfur oxides	0.98	150	0.5

[a] 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 are based on an emission factor of less than one percent. An emission factor is required because some cutting or melting activities result with emissions of metal particulates. Fuels such as propane and acetylene are assumed to be completely combusted; therefore, no emissions are reported.

Table 3-3 gives information on total volatile organic compounds and hazardous air pollutants estimated from research and development operations. Projections from the 2008 SWEIS are not presented because the 2008 SWEIS projections for volatile organic compounds and hazardous air pollutants were expressed as concentrations rather than emissions. 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. However, in a few cases, procurement values and operational processes were further evaluated so that actual air emissions could be reported instead of procurement quantities. In CY 2019, the hazardous air pollutant and volatile organic compound emissions were 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	2019
Hazardous air pollutants	24	4.9
Volatile organic compounds	200	12.0

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, the TA-60 Asphalt Batch Plant, the TA-03 Power Plant, the Combustion Gas Turbine, and all boilers. In CY 2019, these stationary combustion sources emitted 47,257.5 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 GHG emissions from LANL's stationary combustion sources by emission type in metric tons per year.[12]

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

Gas	Units	2008 SWEIS[b]	2019 Emissions
Methane	metric tons/year	–	0.89
Nitrous oxide	metric tons/year	–	0.089
Carbon dioxide	metric tons/year	–	47,208.7
Total Emissions	metric tons carbon dioxide equivalents/year	–	47,257.5

[a]LANL GHG Emissions Electronically Submitted to the EPA (LANL 2020b).
[b]The 2008 SWEIS did not project GHG emissions.

[12]The 2008 SWEIS did not project GHG emissions.

3.2 Liquid Effluents

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

Outfall Reduction Program. From January 1, 2019, through December 31, 2019, LANL had 11 wastewater outfalls (10 industrial outfalls and 1 sanitary outfall) that were regulated under NPDES Permit No. NM0028355. Based on discharge monitoring reports prepared by LANL, 7 permitted outfalls recorded flows in CY 2019, totaling approximately 115.4 million gallons. This amount is approximately 16.9 million gallons more than in CY 2018 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 CY 2019 are provided in 2019 Annual Site Environmental Reports (LANL 2020c). CY 2019 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

Watershed	No. of Outfalls 2008 SWEIS	No. of Permitted Outfalls 2019	Discharge 2008 SWEIS (million gallons)	Discharge 2019 (million gallons)
Guaje	0	0	0	0
Los Alamos	5	1	45.6	25.8
Mortandad	5	4	44.3	4.6
Pajarito	0	0	0	0
Pueblo	0	0	0	0
Sandia	6[a]	5[a]	187.3	85.0
Water[b]	5	1	2.26	0
Totals	21	11	279.5	115.4

[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 TA-03 and ultimately discharged to Sandia Canyon via Outfall 001.
[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 CY 2019, the bulk of the discharges came from Non-Key Facilities. Key Facilities accounted for approximately 35.3 million gallons of the total in CY 2019. LANSCE discharged approximately 26 million gallons in CY 2019, about 5.6 million gallons more than CY 2018, accounting for about 65 percent of the total discharge from all Key Facilities.

Table 3-6. NPDES Annual Discharges by Facility

Key Facility	No. of Outfalls 2008 SWEIS	No. of Permitted Outfalls in CY 2019	Discharge 2008 SWEIS (million gallons)	Discharge CY 2019 (million gallons)
Plutonium Complex (03A181)	1	1	4.1	3.0
Tritium Facility	2	None	17.4	0
CMR Building	1	None	1.9	0
Sigma Complex (04A022)	2	1	5.8	1.6[a]
High Explosives Processing (05A055)	3	1	0.06	0
High Explosives Testing	2	None	2.2	0
LANSCE (03A113, 03A048)	4	2	29.5[b]	26.0
Metropolis Center (001)	1	1	17.7[c]	10.2[d]

Key Facility	No. of Outfalls 2008 SWEIS	No. of Permitted Outfalls in CY 2019	Discharge 2008 SWEIS (million gallons)	Discharge CY 2019 (million gallons)
Biosciences	None	None	0	0
Radiochemistry Facility	None	None	0	0
RLWTF (051)	1	1	4.0	0.021
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
SRCW Facilities	None	None	0	0
Subtotal, Key Facilities	17	7	82.66[e]	40.8
Subtotal, Non-Key Facilities (001, 13S, 03A160, 03A199)	4	4	200.9	74.6[f]
Totals	21[g]	11	283.5e	115.4

[a] Estimated discharge from roof drains, cooling system, and emergency cooling system at TA-03-0066.
[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) were directed to Outfall 001 beginning September 9, 2016.
[e] The revised total from previous Yearbooks is due to the addition of the Expanded Operations Alternative discharge amount for the Metropolis Center.
[f] Discharges to Outfall 03A160 (National High Magnetic Field Laboratory) were directed to the Sanitary Wastewater System (SWWS) beginning on May 3, 2018.
[g] In previous Yearbooks, the number 15 was reported because as of August 1, 2007, there were only 15 permitted outfalls. However, the 2008 SWEIS projected 21 outfalls under the No Action Alternative. Therefore, this number has been updated to accurately reflect that projection.

LANL has three principal wastewater treatment facilities: the SWWS Plant at TA-46 (a Non-Key Facility), the RLWTF at TA-50, and the High Explosive Wastewater Treatment Facility at TA-16 (both Key Facilities). The RLWTF (Outfall 051) discharges into Mortandad Canyon. The High Explosive Wastewater Treatment Facility did not discharge wastewater in CY 2019.

As previously stated, discharges from the Non-Key Facilities made up the majority of the total CY 2019 discharge from LANL. The total for CY 2019—74.6 million gallons—was about 126.3 million gallons less than the 200.9 million gallons total annual discharge from Non-Key Facilities.

Non-Key Facilities projected in the 2008 SWEIS. Two Non-Key Facilities—the TA-46 SWWS Plant and the TA-03 Power Plant (both of which discharge through Outfall 001)—account for about 96.7 percent of the total discharge from Non-Key Facilities and about 53.6 percent of all water discharged by LANL in CY 2019.

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

LANL and external subcontractors apply individually for NPDES CGP coverage and are co-permittees at most construction sites. Compliance with the NPDES CGP includes developing and implementing a Storm Water Pollution Prevention Plan before soil disturbance may begin and conducting site inspections once soil disturbance has commenced. A Storm Water Pollution Prevention Plan describes:

- project activities and potential pollutants,
- site conditions,
- best management practices (sediment and erosion control measures), and
- permanent control measures required to minimize the discharge of pollutants from the site.

Compliance with the NPDES CGP 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.

In 2019, Triad was responsible for 33 storm water pollution prevention plans for construction sites and performed 783 inspections, with sites found fully compliant during 89.5 percent of the inspections. N3B implemented six construction projects under the CGP. Each project included preparing and implementing a site-specific storm water pollution prevention plan and regular inspections to document compliance with CGP requirements. No corrective actions were documented. The U.S. Army Corps of Engineers managed three construction projects at the Laboratory during 2019, including their storm water pollution prevention plans. They conducted 96 inspections. Items found not to be in compliance were addressed with corrective actions that rehabilitated storm water pollution prevention measures.

Multi-Sector General Permit. The NPDES Multi-Sector General Permit for Storm Water Discharges Associated with Industrial Activities (MSGP) regulates storm water discharges from specific industrial activities and their associated facilities. Industrial activities conducted at the Laboratory covered under the MSGP include:

- metal and ceramic fabrication,
- wood product fabrication,
- hazardous waste treatment and storage,
- vehicle and equipment maintenance,
- recycling activities,
- electricity generation,
- warehousing activities, and
- asphalt manufacturing.

In 2018, responsibilities for MSGP compliance at the Laboratory transitioned from LANS to N3B for legacy waste cleanup work and from LANS to Triad for management and operation of the Laboratory. These changes resulted in the U.S. EPA's issuance of three new MSGP tracking numbers identified in Table 3-7.

Table 3-7. MSGP Tracking Numbers by Operator and Covered Industrial Activity

Permit Tracking No.	Industrial Activities Covered	Responsible Operator	Operator Role	Date Permit Coverage Began
NMR050011	Land transportation and warehousing at TA-54 Maintenance Facility West	N3B	Environmental Management Legacy Cleanup	A notice of intent to discharge was authorized by EPA on or before 4/30/18
NMR050012	Hazardous waste treatment, storage, or disposal facilities (Sector K) at TA-54, Areas G and L	N3B	Environmental Management Legacy Cleanup	A notice of intent to discharge was authorized by EPA on or before 4/30/18
NMR050013	Wood product fabrication, vehicle and equipment maintenance, recycling activities, electricity generation, warehousing activities, and asphalt manufacturing	Triad	NNSA Management and Operations	11/01/2018

A permit tracking number is issued by the EPA to an operator to authorize storm water discharge for a specific facility or group of sites at a facility that is conducting industrial activities that are regulated under the General Permit. MSGP coverage, implementation, and compliance are now operator and facility specific; therefore, annual activities are reported separately for each operator.

The MSGP is issued for a 5-year period. The 2015 MSGP expired on June 4, 2020. The new MSGP was issued on January 15, 2021, and becomes effective March 1, 2021.

The MSGP requires the implementation of control measures, development of Storm Water Pollution Prevention Plans, and monitoring of storm water discharges from eight active permitted sites. Compliance with the requirements is achieved by:

- developing and implementing facility-specific Storm Water Pollution Prevention Plans;
- implementing corrective actions that are 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 MSGP, 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 could 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 2019 have been completed. In 2019, Triad completed the following tasks:

- 96 inspections of storm water controls at the 8 active permitted sites
- 1 annual inspection at each of 39 sites that have no-exposure status
- 90 samples collected at 8 active permitted sites

- 361 sampling equipment inspections
- 46 visual inspections at 15 monitored discharge points
- 66 visual inspections at 16 substantially identical discharge points
- 234 corrective actions, including
  - 28 corrective actions to mitigate exceedances
  - 9 additional storm water control measures installed at 6 active permitted sites
  - 63 control measures maintained, repaired, or replaced at 7 active permitted sites
  - 85 actions to remedy control measures inadequate to meet non-numeric effluent limits
  - 58 corrective actions to address unauthorized releases (spills) or discharges
- Discontinued monitoring for 17 pollutants at 8 active permitted sites by meeting permit-defined criteria under Triad's Permit Tracking Number NMR050013
  - Quarterly benchmarks: Discontinued monitoring of two pollutants at one active permitted site because the average of four results did not exceed the benchmark
  - Impaired waters pollutants: 15 pollutants at 8 permitted sites were not expected to be present and were not detected

N3B completed the following corrective actions in 2019:

- TA-54 Areas G and L – The combined results of routine facility inspections, visual assessments, and benchmark and impairment sampling generated 22 corrective actions. Of these, 13 were due to baseline monitoring exceedances of total magnesium levels in storm water, 7 were due to the discovery of storm water controls in a deteriorated state, 1 was due to the observance of poor housekeeping conditions at Area L, and 1 corrective action was due to the discovery of a hydraulic fluid leak at Area G. All corrective actions initiated during 2019 MSGP monitoring were completed within 45 days of discovery. No incidents of noncompliance with the Multi-Sector General Permit are known regarding this facility.
- TA-54 Maintenance Facility West – The combined results of routine facility inspections, visual assessments, and impairment sampling generated two corrective actions. Both were initiated in response to minor releases; one incident involved approximately 5 gallons of diesel fuel from a forklift; the second involved a release of hydraulic fluid from staged equipment on the site. In both cases, immediately following discovery, the impacted soil was removed and managed appropriately. Corrective actions were completed within 45 days of discovery. No incidents of noncompliance with the Multi-Sector General Permit are known regarding this facility.

NPDES Individual Permit for Storm Water Discharges from SWMUs/AOCs. The NPDES Individual Permit for Storm Water Discharges (Individual Permit) authorizes discharges of storm water from certain SWMUs and AOCs (hereafter called sites) at the Laboratory. The U.S. Environmental Protection Agency (EPA) issued the original permit in 2010, and it has been administratively continued until a new permit is issued. The 2010 permit conditions will be in effect until a new permit is issued. A draft permit was issued by the EPA in November 2019 for public comment; however, the end of the public comment period has been extended three times from the original date of January 28, 2020 to March 31, 2020; then to May 31, 2020; and then again to July 31, 2020.

The Individual Permit lists 405 sites that must be managed in compliance with the terms and conditions of the Individual Permit to prevent the transport of pollutants of concern to surface waters via storm water run-off. Potential pollutants of concern within these sites include metals, organic chemicals, high explosives, and radionuclides. In some cases, these pollutants of concern are present in soils within 3 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). To minimize or eliminate discharges of pollutants in storm water, 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. These control measures include run-on, run-off, erosion, and sedimentation controls, which are routinely inspected and maintained as needed.

For purposes of monitoring and management, sites are grouped into small subwatersheds 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 locations to determine the effectiveness of the controls. The permit required the installation of baseline controls at all 405 sites, which were installed and certified to the EPA in 2010 to 2011. When target action levels are exceeded based on New Mexico surface 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:

- installation and maintenance of control measures,
- storm water confirmation sampling to determine effectiveness of control measures,
- additional corrective action (if a target action level is exceeded),
- reporting results of fieldwork and monitoring, and
- certification of corrective action complete or requests for alternative compliance to the EPA.

Regarding storm water sampling, site-monitoring areas that have not collected a sufficient storm water sample to date are referred to as being in “extended baseline monitoring.” This status means that we have not entered corrective action at that site-monitoring area. Site-monitoring areas that have had target action levels exceeded in storm water samples have entered corrective action, and one path to completion of corrective action is the installation of “enhanced” controls. After installation of the enhanced controls is complete, additional storm water sampling is required. This sampling is referred to as “corrective action monitoring.”

To comply with the requirements of the Individual Permit, the following tasks were completed in 2019:

- Published the 2018 update to the Site Discharge Pollution Prevention Plan (N3B 2019c), which identifies pollutant sources, describes the control measures, and defines the monitoring at all permitted sites
- Published the “Storm Water Individual Permit Annual Report for Reporting Period January 1–December 31, 2019” (N3B 2020), which presents the compliance status for all

permitted sites, activities conducted, and milestones accomplished to comply with the Individual Permit

- Completed 1,094 inspections of storm water controls at the 250 site-monitoring areas
- Completed 1,152 sampling equipment inspections
- Conducted storm water monitoring at 132 site-monitoring areas
- Collected extended baseline control confirmation samples at 13 site-monitoring areas
- Collected corrective action enhanced control confirmation samples at four site-monitoring areas
- Installed 46 additional control measures at 31 site-monitoring areas
- Held two public meetings as required by the Individual Permit
- Submitted alternative compliance requests to EPA for 14 site/site-monitoring area combinations
- Submitted analytical resulting to the EPA following certification of enhanced controls at seven site/site-monitoring area combinations
- Submitted certification of corrective action complete following a certificate of completion from the NMED to the EPA for 16 site/site-monitoring area combinations
- Submitted Individual Permit reapplication to the EPA on June 15, 2019

3.3 Solid Radioactive and Chemical Wastes

LANL is required to manage a wide variety of waste types—solids, liquids, semi-solids, and contained gases—because of the complex array of facilities and operations that generate such wastes. These waste streams are regulated as solid, hazardous,[13] LLW,[14] TRU,[15] or wastewater by state and federal regulations. The institutional requirements that relate 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 ultimately are used to assess operational efficiency, ensure environmental protection, and demonstrate regulatory compliance and include:

- information on waste generating processes,
- waste quantities,

[13] A solid waste is a hazardous waste if it is specifically listed as a known hazardous waste or meets the characteristics of hazardous waste as defined by the RCRA.

[14] Low-level waste includes items that have become contaminated with radioactive material or have become radioactive through exposure to neutron radiation.

[15] Transuranic waste is material contaminated with transuranic elements that have atomic numbers higher than uranium on the periodic table of elements.

- chemical and physical characteristics of the waste,
- regulatory status of the waste,
- applicable treatment and disposal standards, and
- final disposition of the waste.

Although there are a variety of waste types, the 2008 SWEIS categorizes wastes as chemical, LLW, MLLW,[16] or TRU. Mixed TRU waste is combined with TRU waste because they both are managed for disposal at WIPP. Table 3-8 summarizes the waste types and total generation for LANL in CY 2019.

Table 3-8. LANL Waste Types and Generation for CY 2019

Waste Type	Units	LANL Waste Generators			Total CY
		Key Facility Total	Non-Key Facility	N3B	
Chemical	10^3 kilograms per year[a]	364	1,966	0.5	2,330.5
LLW	cubic meters per year[b]	1,688	142	203	2,033
MLLW	cubic meters per year[b]	60	3	2,065	2,128
TRU[c]	cubic meters per year[b]	24	6	0	30
Mixed TRU[c]	cubic meters per year[b]	91	N/A	N/A	91

[a] The 2008 SWEIS lists chemical waste projections in kilograms per year. Waste numbers are recorded here as 103 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 WCATS.
[c] The 2008 SWEIS combines TRU and Mixed TRU wastes into one waste category because they are both managed for disposal at WIPP.

Radioactive and chemical waste generation at LANL are a result of LANL operation (i.e., research, production, maintenance, and construction) and DOE-EM (N3B) 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 that belong to one of three categories: Key Facilities, Non-Key Facilities, and DOE-EM legacy waste cleanup. Normal LANL operations generate radioactive and chemical waste from Key Facilities and Non-Key Facilities. DOE-EM legacy waste cleanup operations, now listed as N3B, generate radioactive and chemical waste.

The 2008 SWEIS projected radioactive and chemical waste volumes for Key Facilities and Non-Key Facilities are identified in 2008 SWEIS Chapter 5 (page 5-139), Table 5-39, Radioactive and Chemical Waste Projections from Routine Operations. The 2008 SWEIS projections for DOE-EM legacy waste generation are identified in 2008 SWEIS Appendix I (I-185), Table I-70, Removal Option Annual Waste Generation Rates. Comparisons of the 2018 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 FY 2016. The annual total of Key Facilities and Non-Key Facilities waste generation will continue to be compared with the projected estimates identified in Table 5-39 of the 2008 SWEIS.

[16] MLLW contains both radioactive and hazardous waste components and are regulated by RCRA and the Atomic Energy Act.

Previously, the N3B annual waste generation total was compared with the FY projection identified in 2008 SWEIS Table I-70; however, there are no FY projections beyond 2016. To ensure that N3B annual waste generation meets the 2008 SWEIS projections, the annual waste generation total will be added to the cumulative total and then compared with the projected total for N3B operations.

Most of the waste generated at Key Facilities, Non-Key Facilities, or from N3B 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 LLW would be disposed of onsite. The majority is transported offsite for treatment and disposal.

TRU and mixed TRU wastes are characterized, certified, and placed in drums or boxes that 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 2019, the approximate total number of radiological shipments was 27,811, approximately 25 percent of the projected total.

The 10-year maximum projection for chemical (hazardous) waste shipments is 4,749 (2008 SWEIS Table K-5, page K-24), which represents the total number of shipments for chemical (hazardous) waste from LANL. Since the issuance of the 2008 SWEIS through 2018, the total number of chemical (hazardous) waste shipments is approximately 1,475; approximately 31 percent of the projected total.

In CY 2019, approximately 168 radiological waste shipments and 230 chemical waste shipments were made to offsite 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 (polychlorinated biphenyls 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 nonradioactive wastes. In addition, construction and demolition debris is a component of those chemical wastes that, in most cases, are sent directly to offsite disposal facilities. Construction and demolition debris consists primarily of asbestos and construction debris from DD&D

projects. Construction and demolition debris is disposed in solid waste landfills, under regulations promulgated pursuant to RCRA Subtitle D. (Note: Hazardous wastes are regulated pursuant to RCRA Subtitle C). DD&D waste volumes generated for CY 2019 are tracked in Section 3.11.2 of this Yearbook.

In CY 2019, the total volume of chemical waste generated at Key Facilities was below the annual volume projected in the 2008 SWEIS (Table 3-9). Volumes from Non-Key Facilities in CY 2019 exceeded 2008 SWEIS projections because of the disposal of press filter cakes and reverse osmosis reject water from the SERF. Table 3-9 summarizes chemical waste generation at Key Facilities and Non-Key Facilities during CY 2019. Although chemical waste volumes exceeded projections for CY 2019, LANL has generated less than half of the cumulative chemical waste analyzed in the 2008 SWEIS because in most years LANL has generated less chemical waste volumes than projected.

Table 3-9. Chemical Waste Quantities from Key Facilities and Non-Key Facilities for CY 2019

Waste Generator	2008 SWEIS[a]	CY 2019[a]
Key Facilities	596	364
Non-Key Facilities	650	1,966

[a] 10^3 kilograms per year.

In CY 2019, the total volume of chemical waste generated from N3B operations contributed less than one percent of the total chemical waste generated. At the conclusion of 2019, chemical waste from N3B operations was $.5 \times 10^3$ kilograms, approximately 18 percent of the total estimated cumulative chemical waste projected in the 2008 SWEIS for N3B operations. Table 3-10 summarizes chemical waste generation in relation to N3B operations.

Table 3-10. Chemical Waste Quantities from N3B Operations for CY 2019

Waste Generator	2008 SWEIS Projection Total[a]	Cumulative Total (2007–2018)[a]	2019 Cumulative Total[a]	Percentage of Total Projected Waste Generation by N3B[e]
N3B	41,209.78[b,c]	7,546	7,546.5[d]	18

[a] 10^3 kilograms.
[b] Used conversion 1,100 kilograms per cubic meter. The 1,100 kilograms was derived from adding all of the Environmental Management chemical waste for CY 2008.
[c] Projected total waste generation from Implementation of Consent Order, Removal Option, 2008 SWEIS (Table I-70).
[d] The total sum of the chemical waste generated from Environmental Management operations from CY 2007 through CY 2019.
[e] The 2019 cumulative total divided by the 2008 SWEIS projection, total multiplied by 100.

In CY 2019, approximately 230 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, Liquid Environmental Solutions, and Veolia (Table 3-11).

Table 3-11. Chemical Waste Shipped Offsite during CY 2019

Offsite Treatment and Disposal Facility	2019 Trucks from LANL
Waste Management – New Mexico	98
Liquid Environmental Solutions	64
Veolia	45
Solid Waste Disposal	12
Clean Harbors – Colorado	4
Stericycle	4
Clean Harbors – Arizona	1
Clean Harbors – Nebraska	1
Lighting Resources – Texas	1
Mesa	0
TOTAL	230

3.3.2 *Low-Level Radioactive Wastes*

In CY 2019, Non-Key Facilities LLW volumes remained below the projected volume for Key Facilities. Table 3-12 summarizes LLW generation during CY 2019.

Table 3-12. LLW Quantities from Key Facilities and Non-Key Facilities for CY 2019

Waste Generator	2008 SWEIS[a]	2019[a]
Key Facilities	7,646	1,688
Non-Key Facilities	1,529	142

[a] Cubic meters per year.

In CY 2019, 203 cubic meters of LLW was generated from N3B operations (Table 3-8). At the conclusion of 2019, the cumulated LLW volume from N3B operations was 65,703 cubic meters, which is approximately 8 percent of the total estimated LLW projected in the 2008 SWEIS for Environmental Management operations.

Table 3-13 summarizes LLW generation for N3B operations.

Table 3-13. LLW Waste Quantities from N3B Operations for CY 2019

Waste Generator	2008 SWEIS Projection Total[a]	Cumulative Total (2007–2018)[a]	2019 Cumulative Total[a]	Percentage of Total Projected Waste Generation by N3B[d]
N3B	811,345[b]	65,500[c]	65,703	8

[a] Cubic meters.
[b] Projected total waste generation from Implementation of Consent Order, Removal Option, 2008 SWEIS (Table I-70).
[c] The total sum of the LLW generated from N3B operations from 2007 through 2018.
[d] The 2019 cumulative total divided by the 2008 SWEIS projection and total multiplied by 100.

In CY 2019, approximately 137 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 3-14). 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 2019, the total number of LLW shipments was 9,305, approximately 86 percent of the projected total.

Table 3-14. LLW Offsite Shipments during CY 2019

Offsite Treatment and Disposal Facility	Total Shipments from LANL during 2019
EnergySolutions	16
Nevada National Security Site	38
Perma-Fix Environmental Services – Washington	35
Perma-Fix Environmental Services – Florida	3
Unitech	4
Waste Control Specialists	41
TOTAL	137

3.3.3 *Mixed Low-Level Radioactive Waste*

In CY 2019, MLLW generation at Key and Non-Key Facilities was below the volumes projected in the 2008 SWEIS. Table 3-15 summarizes MLLW generation during CY 2019.

Table 3-15. MLLW Quantities from Key Facilities and Non-Key Facilities for CY 2019

Waste Generator	2008 SWEIS[a]	2019[a]
Key Facilities	68	60
Non-Key Facilities	31	3

[a] Cubic meters per year.

In CY 2019, approximately 2,065 cubic meters of MLLW was generated from N3B operations (Table 3-8). At the conclusion of 2019, the cumulated MLLW waste volume generated from N3B operations was approximately 2,129 cubic meters, which is approximately 1.5 percent of the total estimated MLLW projected in the 2008 SWEIS for N3B operations. Table 3-16 summarizes MLLW generation for N3B operations.

Table 3-16. MLLW Waste Quantities from N3B Operations CY 2019

Waste Generator	2008 SWEIS Projections Total[a]	Cumulative Total (2007–2018)[a]	2019 Cumulative Total[a]	Percentage of Total Projected Waste Generation by N3B[d]
N3B	136,197.80[b]	64.3[c]	2129.3	1.5

[a] Cubic meters.
[b] Projected total waste generation from Implementation of Consent Order, Removal Option, 2008 SWEIS (Table I-70).
[c] The total sum of the MLLW generated from EM operations from 2007 through 2018.
[d] The 2019 cumulative total divided by the 2008 SWEIS projections total and multiplied by 100.

In CY 2019, approximately 31 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 Energy Solutions (Table 3-17). 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 2019, the total number of MLLW shipments was 4,649, approximately 51 percent of the projected total.

Table 3-17. Mixed Low-Level Waste Offsite Shipments during CY 2019

Offsite Treatment and Disposal Facility	Total Shipments from LANL 2019
EnergySolutions	20
Perma-Fix Environmental Services – Washington	0
Perma-Fix Environmental Services – Florida	9
Waste Control Specialists	2
TOTAL	31

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 CY 2019 for Key Facilities and Non-Key Facilities were below the 2008 SWEIS projections. Table 3-18 summarizes the TRU and mixed TRU generation during CY 2019.

Table 3-18. TRU and Mixed TRU Quantities from Key Facilities and Non-Key Facilities for CY 2019

Waste Generator	2008 SWEIS[a]	2019 TRU and Mixed TRU[a]	2019 Mixed TRU[a]	2019 TRU[a]
Key Facilities	413[b]	115	91	24
Non-Key Facilities	23[b]	6	0	6

[a] Cubic meters.
[b] The 2008 SWEIS combines TRU and mixed TRU into one waste category because they are both managed for disposal at WIPP.

In CY 2019, no TRU or mixed TRU waste was generated from EM operations (Table 3-8). At the end of CY 2019, the cumulated TRU and mixed TRU waste volume from N3B 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 N3B operations. Table 3-19 summarizes TRU and mixed TRU generation for N3B operations.

Table 3-19. TRU and Mixed TRU Waste Quantities from N3B Operations for CY 2019

Waste Generator	2008 SWEIS Projection Total[a]	Cumulative Total (2007–2018)[a]	2019 Cumulative Total[a]	Percentage of Total Projected Waste Generation by N3B[d]
N3B	16,858.43[b]	38[c]	38	0.2

[a] Cubic meters.
[b] Projected total waste generation from Implementation of Consent Order, Removal Option, 2008 SWEIS (Table I-70).
[c] The total sum of the TRU and mixed TRU waste generated from N3B operations from 2007 through 2018.
[d] The 2019 cumulative total divided by the 2008 SWEIS projections total and multiplied by 100.

During 2019, Triad made 29 shipments of TRU and mixed TRU waste to WIPP; N3B made 13 shipments of TRU and mixed TRU waste 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 2019, approximately 1,182 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 because of growth in several mission programs.

3.4.1 *Electrical*

The Los Alamos Power Pool supplies LANL with electricity through 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).

On-site 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. Phase I of the Steam Plant Replacement Project has been initiated. This project will replace the existing central steam plant with upgrades to the combustion turbine and the addition of conventional gas-fire steam boilers. Los Alamos County is still operating a 1-megawatt solar photovoltaic power plant on the LANL TA-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. Due to reconfiguration of the lines when the Southern Technical Area Station was installed, the current transmission-line crossing configuration is not vulnerable to a single-point failure that previously could have taken both incoming transmission lines out of service. However, the transmission import capacity of 116 MVA is expected to be exceeded by the summer of 2026 by the combined demand loads of LANL and Los Alamos County. The installation of a third transmission line received Critical Decision-0 approval and would increase the import capacity from 116 to 200 MVA, thereby allowing loads to be fully served by offsite generation until CY 2048 (30 years of mission growth). LANL will need to work with the Public Service Company of New Mexico to increase import capacity as necessary. The third transmission line project—the Electric Power Capacity Upgrade—includes additional improvements to on-site transmission, upgrades for Western Technical Area Substation, and expansion of several distribution feeder circuits. Electric Power Capacity Upgrade is in the conceptual-design phase of development and beginning efforts toward an EA for NEPA consideration. On-site 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, upgrades will provide for redundant feeders to critical facilities, and upgrading the aging TA-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 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 6 years analyzed, making the new total 495,000 megawatt-hours per year. In addition, the electricity peak load under the No Action Alternative is 91,200 kilowatts per year. 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 LINAC to historic performance levels (DOE 2010). The LANL total in Table 3-20 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 per year.

Table 3-20. Electricity Peak Coincidental Demand in CY 2019[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]
2019	35,473	24,028	10,663	70,164	20,058	90,222

[a] All figures in kilowatts.
[b] Expanded Operations Alternative limit for the LANSCE Refurbishment Project. This project was approved under the DOE-approved Categorical Exclusion titled "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.

Phase 1 of the Energy Savings Performance Contract to replace the TA-03 Steam Plant is currently taking place. It is expected that Phase 2 and Phase 3 will be completed in the CY 2021 time frame, with the result of a combined heat and power plant that, centered on the Combustion Gas Turbine Generator, will provide 35 megawatts because of the combined-cycle system, with a 10-megawatt duct burner addition to the plant.

Table 3-21 shows energy consumption for CY 2019. LANL's energy consumption remains below projections in the 2008 SWEIS.

Table 3-21. Energy Consumption in CY 2019[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 2019	223,199	115,885	99,180	438,264	121,504	559,768

[a] All figures in megawatt-hours.
[b] Expanded Operations Alternative limit for the LANSCE Refurbishment Project. This project was approved under the DOE-approved Categorical Exclusion titled "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

Energy Efficiency. As in previous years, LANL invested in many energy-reduction initiatives in CY 2019. Investments include:

- building automation system upgrades,
- monitoring via energy analytics software,
- heating, ventilation, and air conditioning recommissioning
- smart labs program, and
- LED (light-emitting diode) lighting upgrades.

Based on DOE/NNSA sustainability goals, the Laboratory has worked toward an energy intensity-reduction goal of 25 percent by the end of FY 2025 from a 2015 baseline. By the end of FY 2019, the Laboratory reduced energy intensity (British thermal unit/square foot) by 0.5%—(even though an additional 2,000 employees were hired and new mission work started in non-excluded facilities) and has reduced energy intensity by more than 16 percent compared with FY 2003. High-performance sustainable building implementation includes heating, ventilation, and air conditioning recommissioning, and building automation system upgrades for night setback capability. 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

(1) expansion of the capabilities and operational levels at the Metropolis Center to support additional processors and (2) 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 CY 2012, leading to a significant decrease in Metropolis Center potable water use. In CY 2019, cooling tower water demand was 23.09 million gallons at the Metropolis Center and 20.42 million gallons for the Trinity super computer. The SERF provided more than 40 million gallons of makeup water. Because of SERF, the total potable water consumption was 2.2 million gallons at the Metropolis Center and 0.98 million gallons for Trinity. Table 3-22 shows potable water consumption for CY 2019. Under the 2008 SWEIS, water use at LANL was projected to be 459.9 million gallons per year from the No Action Alternative plus elements of the Expanded Operations Alternative. LANL consumed approximately 269 million gallons of potable water in CY 2019. Total use by LANL in 2019 was about 190 million gallons less than the 2008 SWEIS projection of 459.8 million gallons per year.

Table 3-22. Water Consumption (million gallons) in CY 2019

Category	LANL Total	Metropolis Center (SCC)	LANSCE	Los Alamos County	Total
2008 SWEIS	459.8[a]	51	119	1,241	1,621
2019	269.1	2.221	58.8	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 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 *Natural Gas*

LANL receives natural gas through the New Mexico Gas Company transmission system. A combustion gas turbine generator serves as one of LANL's on-site energy sources by producing electricity from the combustion of natural gas. The combustion gas turbine generator is capable of producing 20–27 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 CY 2019 gas usage. Approximately 82 percent of the gas used by LANL in 2019 was for heat production. The remainder was used for electricity production, mainly by the combustion gas turbine generator. LANL on-site electricity generation is primarily used for peak-load and back-up situations and for turbine operation training.

Total gas consumption for CY 2019 was less than projected in the 2008 SWEIS.

Table 3-23. Gas Consumption (decatherms[a]) at LANL in CY 2019

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
2019	947,718	94,123	853,594	228,205

[a] A decatherm is equivalent to 1,000 cubic feet of natural gas.
[b] klb = thousands of pounds.

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.

LANL has been a DOE Voluntary Protection Program (VPP) Star site since 2014. DOE-VPP promotes improved safety and health performance, which also includes coverage of radiation protection/nuclear safety and emergency management. DOE-VPP provides several benefits to participating sites, including improved labor/management relations, reduced workplace injuries and illnesses, increased employee involvement, improved morale, reduced absenteeism, and public recognition.

In February 2019, DOE Office of the Associate Under Secretary for Environment, Health, Safety and Security, the Office of Worker Safety and Health Assistance (AU-12) accepted Triad's transition into the DOE-VPP. This transition includes a recommended revised application to AU-12 by the second quarter of FY20. While in transition, Triad has invested efforts in continuing all DOE-VPP requirements such as those that were successful in retaining Star Status recognition in 2017.

In supporting one of the foundational tenets of DOE-VPP, the Laboratory's Worker, Environment, Safety and Security Team (WESST) serves as the direct link to employee engagement and involvement. Employee involvement helps drive behaviors that support the Integrated Safety Management System Core Functions and Guiding Principles and embrace the five tenets of the DOE-VPP to strengthen and sustain the Laboratory's successful safety program. The WESSTs comprise worker ambassadors within line organizations who facilitate communication and collaboration between workers and managers. WESSTs provide workers with a voice and encourage partnerships with their managers to identify and resolve safety and security issues. The teams act as pipelines for sharing safety and security improvements, lessons learned, and communicating safety- and security-related decisions.

The Laboratory has a history of strong participation in the WESSTs. In 2019, the Laboratory identified almost 320 representatives across the institution. To assist in recruiting, participation, and communication of goals and importance, a purpose statement was created: "The WESST is a worker-led volunteer organization that advocates for environmental awareness, safety, and security for Laboratory employees. Our WESSTs invite employees to connect, develop, and contribute as valued members of an impactful team to foster a safe, secure, and healthy culture at Los Alamos National Laboratory."

Each team is employee-led and is actively supported by their line management. In addition to the WESSTs, the Institutional WESST comprises representatives from each directorate, key organizations, and subcontractors.

In 2019, the VPP Office, WESSTs, and the Institutional Worker, Environment, Safety, and Security Team (IWESST) played a critical role in providing worker-level input to three new manager-worker collaborative teams:

- The Healthy Culture Platform connected a diverse group of leaders dedicated to collective well-being through safety and security improvements, leadership and worker engagement, and continuous organizational learning.
- The Active Bystander Initiative was formed to combat incivility, disrespect, and microaggressions through awareness and empowerment to speak up as an active bystander.
- The VPP Steering Committee was restructured to include Laboratory Deputy Directors and one IWESST team representative from each Associate Laboratory Directorate. This new structure promotes worker-management collaboration to resolve safety and security issues.
- The Winter Safety Committee was formed at the end of summer 2019. This informal committee met on a regular basis to provide employees with safety tips for the winter months. The committee included program leads and management from the Deployed Environmental Safety and Health Office, the Injury/Illness Office, the Communications Office, Logistics Heavy Equipment Roads & Grounds, the IWESST, the VPP Office, and many others. The committee identified lessons learned from the previous year's winter storms and discussed hazard analysis, injury prevention, and emergency preparedness.
- The Employee Well-Being Working Group provides input on well-being initiatives, health and safety fairs, and other large-scale employee events. The IWESST and the VPP Office have aligned communications on well-being initiatives, including a focus on environment, safety, and security.

3.5.1 *Injuries and Illnesses*

In November 2011, DOE made the decision to compare the Lab's injury and illness rates to a weighted North American Industry Classification System (NAICS) comparison rate, which better reflects the variety of activities the Lab performs. The three NAICS codes used in the weighted comparison rate were as follows:

- Scientific Research and Development Services – 5417
- Facilities Support Services – 5612
- Remediation and Other Waste Management Services – 5629

In 2019, LANL's 3-year average total recordable cases (TRCs) and days away, restricted, or transferred (DART) rates were 1.33 and 0.61, respectively. These rates were evaluated against comparison industries' 3-year rates of 2.03 (TRC) and 0.85 (DART). Additionally, LANLs 3-year average TRC and DART rates fell below the comparison NAICS averages required for DOE-VPP Star status.

Analysis of LANL's CY 2019 injury and illness performance shows a rate increase of 0.46 in the TRC rate and an increase of 0.41 in the DART rate compared with CY 2018. The increase in rates can be attributed partly to several heavy winter storms with an unusual amount of snow. A new electronic system was also implemented that electronically tracks the employee restriction forms.

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 3-24. Total Recordable Cases and Days Away, Restricted, or Transferred Rates

Rate	Total 2018 Cases	CY 2018[a]	Total 2019 Cases	CY 2019[a]	Increase in Rate
TRC	89	0.87	140	1.33	0.46 Increase
DART	21	0.2	56	0.61	0.41 Increase

[a] CY 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 CY 2018 and CY 2019 are summarized in Table 3-25. The collective total effective dose for the LANL workforce during CY 2019 was 221 person-rem, an increase of 11 percent from CY 2018. Data in Table 3-25 reflect that 2 percent more workers received measurable dose in CY 2019. With more workers and relatively higher collective dose, the average non-zero dose per worker increased by 9 percent. Of the 200 person-rem collective total effective dose reported for CY 2018, 0.05 person-rem was from internal exposures to radioactive materials that resulted from low-level intakes of uranium and tritium from routine operations. Similarly, of the 221 person-rem collective total effective dose reported for CY 2019, 0.08 person-rem was from internal exposures to radioactive materials that resulted from low-level intakes of uranium and tritium from routine operations. These reported doses could change with time because, in many cases, estimates of committed effective dose from radioactive material intakes are based on several years of bioassay results. As new results are obtained, the dose estimates may be modified accordingly.

Table 3-25. Radiological Exposure to LANL Workers

Parameter	Units	2008 SWEIS	CY 2018	CY 2019
Collective total effective dose (external + internal)	person-rem	280	200	221
Number of workers with measurable dose	number	2,018	1,930	1,960
Average non-zero dose (external + internal radiation exposure)	millirem	139	104	113

The highest individual doses in CY 2018 and CY 2019 indicate continuing higher maximum doses over the last several years following a steady decrease since CY 2000. These doses were primarily associated with resumed TA-55 operations in 2018 and 2019, including stockpile stewardship and plutonium-238 work. LANL senior management and the As Low As Reasonably Achievable (ALARA) Committee set expectations and implement mechanisms to drive individual and collective doses ALARA through performance goals and other ALARA measures. For CY 2019, no worker exceeded the two-rem-per-year LANL administrative control level established for external exposures, and no worker exceeded DOE's five-rem-per-year dose limit. Table 3-26 summarizes the five highest individual dose data for CY 2018 and CY 2019 compared with 2008 when the LANL 2008 SWEIS was finalized.

Table 3-26. Highest Five Individual Annual Doses (Total Effective Dose) to LANL Workers (O'Connor et al.)

CY 2008	CY 2018	CY 2019
2.106	1.483	1.704
1.198	1.435	1.381
1.132	1.358	1.118
1.096	1.324	1.104
0.952	1.287	1.069

Comparison with the 2008 SWEIS Baseline. The collective total effective dose for CY 2018 and CY 2019 was 71 and 79 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 TA-55 Plutonium Facility, TA-53 LANSCE, and the TA-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 TA-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 TA-54 would tend to reduce worker dose for those operations.

TA-55 Plutonium Facility operations accounted for the majority of occupational dose at LANL in 2019. Occupational dose was accrued from weapons stewardship- and manufacturing-related work, Pu-238 work, repackaging materials, and providing radiological control technicians and other infrastructure support for radiological work and facility maintenance at TA-55. The top 25 doses at LANL in 2019 were accrued at TA-55. A primary contributor to dose in 2018 and 2019 was work with Pu-238—producing general-purpose heat sources for use individually and combined in radioisotope thermoelectric generators. Doses at TA-55 remain relatively high because most programmatic work was operating at normal capacity.

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

In addition, a significant portion of LANL dose was accrued by workers who were performing retrieval, repackaging, and shipping of radioactive solid waste within LANL facilities and at waste facilities TA-50 and TA-54. Some of this work was conducted under the DOE-EM prime contractor at TA-54, but dose from those operations represented less than 1 percent of the LANL total dose. Triad continues to handle significant quantities of newly generated waste, incurring commensurate dose.

LANL extremity dose increased by 19 percent from CY 2018 to CY 2019. These increases correlate with increasing worker doses, reflecting relatively more hands-on work at TA-55, as operations were at normal capacity during CY 2019. 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, work control, training, ALARA goals, performance measurement, line management engagement, and oversight by the ALARA Committee and LANL senior management. Based on established ALARA goals, dose accrued to date, and expected workload, CY 2020 collective doses are expected to increase, particularly as TA-55 operations continue at anticipated productivity and the weapons-related workforce grows. 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 TA is difficult because:

- these data are collected at the group level,
- groups are often tenants in multiple facilities, and
- members of many groups receive doses at several locations.

The fraction of a group's collective total effective dose that comes from a specific Key Facility or TA 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 TA-55 residents in CY 2019 represented the majority of the LANL collective total effective dose. Approximately 85 percent of the collective total effective dose at LANL was incurred from operations at TA-55. As discussed previously, maintenance and programmatic activities at TA-53 and solid waste operations at TA-50 and TA-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 includes Triad (NNSA's management and operations contractor) employees and subcontractors, N3B (DOE-EM) employees and subcontractors and Centerra Group (LANL's protective force). 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 CY 2019 was 6 percent greater than 2008 SWEIS projections. The 14,321 total employees at the end of CY 2019 shows an increase from the 12,649 employees reported in the CY 2018 Yearbook (LANL 2019a).

Table 3-27. LANL-Affiliated Workforce

Category	Triad Employees[a]	Triad Subcontractors	N3B Employees[b]	N3B Subcontractors	Protective Force[c]	Total
2008 SWEIS[d]	12,019	945	Not projected	Not projected	540	13,504
CY 2019	12,088	506	435	200	293	13,522

[a] Triad became the management and operations contractor for NNSA at LANL in November 2018.
[b] N3B became the management and operations contractor for EM at LANL in April 2018. A portion of the N3B employees were projected in the 2008 SWEIS in support of environmental remediation.
[c] Centerra Group (contractor for protective force services at LANL).
[d] 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.

Although the number of employees slightly exceeds the 2008 SWEIS No Action Alternative for CY 2019, the total number of employees from 2008 through 2018 was fewer than the number of employees projected in the 2008 SWEIS No Action Alternative.

LANL has a positive economic impact on northern New Mexico. For 2017 (including both direct and indirect and induced activities), a University of New Mexico report indicated that LANL was responsible for the creation of 24,169 jobs, $1.82 billion in labor income, and total revenues of $3.12 billion to businesses to the state (Mitchell and Betak 2019).

The residential distribution of the LANL-affiliated workforce reflects the housing market dynamics of three counties. As shown in Table 3-28, approximately 74 percent of employees reside in Los Alamos, Santa Fe, and Rio Arriba counties.

Table 3-28. 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 2019 Triad	4,917	1,962	2,620	1,415	10,914	1,973	12,887
N3B	197	113	126	173	609	26	635

[a] Includes both regular and temporary employees, including students who might 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

The majority of LANL remains undeveloped as grasslands, shrublands, woodlands, and forests, with the majority of development occurring on the mesa tops. The undevelopable topography serves as security and safety buffer zones that limit unauthorized access. Any undeveloped areas that are suitable for development are reserved for future programmatic growth and expansion. 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 Bureau of Land Management), the Pueblos of San Ildefonso and Santa Clara, and Los Alamos County, which includes public and private properties. The highest concentration of facilities and workers is found at TA-03, TA-53, and along the Pajarito Corridor in TA-35, -46, -48, -50, -55 and -66. Future development will likely take place in and near these areas because they have the appropriate accessibility and infrastructure acceptable for expansion.

In December, 2014, the Manhattan Project National Historical Park (Park) was established. DOE and the Department of Interior developed a Memorandum of Understanding to complete a Park Management Plan. Three Park sites now exist at LANL, and although no current public access exists to these facilities, the cultural resources staff provides public tours annually. Walking tours are also available in the town of Los Alamos. The visitor center in downtown Los Alamos is open daily.

2008 SWEIS Analysis

The 2008 SWEIS noted that LANL occupied approximately 40 square miles (25,600 acres) spread across 49 TAs. 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. To provide workspace for an additional 1,683 people, 450,000 gross square feet of space was leased within the towns of Los Alamos and White Rock. 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 decommissioned and demolished.

In 2019, LANL occupied 26,058 acres (40 square miles). Facilities comprised about 8.2 million gross square feet of space. There were a total of 897 permanent buildings and trailers. Leased space in Los Alamos and White Rock accounted for approximately 363,000 gross square feet

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 legal requirements for DOE to transfer land (Public Law 105-119,as amended ;42 USC 2391 Note). Since CY 2001, approximately 3,176 acres (5 square miles) have been transferred to other federal or local government . Approximately 2,100 acres of land have been transferred to the Secretary of Interior, to be held in trust for the Pueblo de San Ildefonso, and approximately 1,076 acres 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 the SWEIS for conveyance or transfer were later subdivided into 32 tracts (DOE 1999b). A total of 24 tracts have been conveyed or transferred: 18 to the County of Los Alamos, 3 to the Los Alamos County School District, and 3 to the Secretary of Interior. Table 3-29 provides location and size information on the land tracts remaining to be conveyed. The remaining tracts total about 1,280 acres (2 square miles), and all of these tracts would be conveyed to Los Alamos County.

In CY 2019, one tract totaling approximately one acre was conveyed to Los Alamos County: Tract A-15-2 (DP Road).

Table 3-29. Remaining Tracts Analyzed for Potential Conveyance

Land Tract	Approx. Acreage	Location
TA-21/A-16 tracts	220	Accessed by DP Road, these were delineated into smaller tracts to prepare for conveyance to the County. The remaining tracts are east of the TA-21 access gate (A-16-c, -d, and –e and the remainder of TA-21). Transfers are contingent on further clean-up actions by DOE-EM and N3B.
Rendija Canyon/ A-14a, c, d	890	North of and below Los Alamos townsite's Barranca Mesa residential subdivision. Outstanding issues require resolution before conveyance.
A-18-2	24	Located in Bayo Canyon.
C-2 and C-4	150	Highway 501 (White Rock "Y" and NM 4 south to East Jemez Road). Contingent on DOE supplemental environmental project scheduling, these two tracts comprise the White Rock "Y" and NM 4 between the "Y" and East Jemez Road.

Several previously conveyed tracts, including A-19 near White Rock, and A-13, A-9 and A-11 in the townsite, are being developed for nearly 500 housing units. These include market rate, senior and low-income apartments, and single-family homes at the White Rock location. Other tracts are being planned for commercial and light-industrial development.

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 potential for new contaminants to affect the alluvial, perched-intermediate, or regional aquifers. Material Disposal Area remediation, canyon cleanup, and other actions related to the implementation of the 2016 Consent Order in CY 2019 would not appreciably reduce or increase 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 EA (DOE 2015c) to analyze the environmental impacts associated with implementing the chromium interim measure for plume control. Groundwater extraction associated with the interim measure is occurring in the regional aquifer beneath Mortandad Canyon. The total groundwater extraction volume would not exceed 230 million gallons (871 million liters) (707 acre-feet) annually over a potential 8-year duration. The water is being treated to ensure that all constituents meet NMED Ground Water Quality Bureau permit requirements before it is reinjected into the aquifer through the injection wells. N3B does retain the ability, permissible by discharge permit DP-1793, to land apply the treated groundwater using spray irrigation/evaporation system or water trucks along unpaved access roads, and/or mechanical evaporation (DOE 2015c), though those practices have not yet been implemented at the time of this report.

In CY 2017, DOE prepared a Supplement Analysis to the 2015 EA for Chromium Plume Control Interim Measure and Plume Center Characterization (DOE 2017c). 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 that the environmental impacts of the proposed actions were bounded by analysis presented in the 2015 EA.

In CY 2019, 2016 Consent Order activities included interim measure activities and performance monitoring for chromium in groundwater were ongoing in Mortandad Canyon. To address RDX contamination in groundwater beneath the TA-16 area, groundwater characterization and monitoring was performed. No new wells were installed in CY 2019.

3.9 Cultural Resources

The following information is submitted on a fiscal-year basis to coincide with other cultural resources report requirements. LANL comprises numerous and diverse historic and prehistoric properties. As of FY 2019, archaeologists have completed surveys of prehistoric and historic cultural resources on approximately 90 percent of DOE/NNSA-administered land in Los Alamos and Santa Fe counties. There are 1,752 identified prehistoric cultural resources sites (Table 3-30). Seventy-two percent of the archaeological sites at LANL date between the thirteenth and fifteenth centuries A.D. 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, Ancestral Pueblo villages, shrines, petroglyphs, sacred springs, trails, and traditional use areas are identified by Pueblo and Athabascan[17] communities as traditional cultural properties.

Table 3-30. Acreage Surveyed, Prehistoric Cultural Resource Sites Recorded, and Cultural Resource Sites Eligible for the National Register of Historic Places (NRHP) at LANL in Fiscal Years 2008 and 2017, 2018, and 2019[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
2018	50[c]	23,135[d]	1,747[b]	1,631[b]	93.3
2019	61[c]	23,189[d]	1,752[b]	1,636[b]	93.3

[a] Source: Information on LANL provided by DOE/NNSA and Triad 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] During FY 2019, 61 new acres were surveyed, and additional linear errors in the surveyed area spatial database were also corrected.
[d] Two tracts of land, totaling 6.94 acres, were conveyed during FY 2019. Since this acreage no longer belongs to DOE it has been removed from the Total Acreage Systematically Surveyed to Date column above, resulting in the Total Acreage Systematically Surveyed to Date for FY 2019 being 23,189 acres.

To date, cultural resource staff at LANL have not identified Spanish Colonial or Mexican period sites. The 562 potential historic cultural resources include both historic archaeological sites,

[17] 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.

as well as historic buildings and structures that date from the Homestead era to the Manhattan Project and Cold War eras. Only those buildings still standing are included in the total count of 562 potential historic properties (Table 3-31). Most buildings constructed after 1990 are evaluated on a case-by-case basis when projects arise that have the potential to impact the buildings. Therefore, additional buildings could be added to the list of historic properties in the future for eligibility under the National Historic Preservation Act.

Table 3-31. 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
2018	563	469	367	196	78	230
2019	562	468	366	196	78	231

[a] Source: Information on LANL provided by DOE/NNSA and Triad 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, are NRHP eligible. Properties that have reached 50 years of age are included as Potential Properties. In addition, beginning with the CY 2002 Yearbook, historic properties that are exempt from review under the terms of the Programmatic Agreement were removed from these totals, which substantially reduced the number of potential Historic period cultural resources at LANL. During FY 2011, evaluated and demolished historic buildings were no longer included in the total number of historic "potential properties" and any other column in this table.
[c] This number represents both eligible and non-eligible sites.
[d] Eligible for the NRHP.
[e] This number 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 NRHP.

All of the 145 historic sites recorded at LANL 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 (118 sites) are structures or artifact scatters associated with the Early Historic Pajarito Plateau or Homestead periods. Of these 145 sites, 91 are eligible or potentially eligible for the NRHP. There are 417 Manhattan Project, Early Cold War, and Late Cold War period buildings.

LANL continues to demolish buildings as part of the DD&D Program. Table 3-32 indicates historic building documentation and demolition conducted under LANL's 2017 Programmatic Agreement between the DOE/NNSA Los Alamos Field Office, the State Historic Preservation Office, and the Advisory Council on Historic Preservation (DOE 2017b). Not all buildings that have been documented as part of the DD&D Program have been demolished.

Table 3-32. 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
2018	10	10
2019	8	1

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, as amended, requires federal agencies to evaluate the impact of proposed actions on historic properties. Federal agencies must also consult with the New Mexico State Historic Preservation Office and/or the Advisory Council on Historic Preservation regarding possible adverse effects to NRHP-eligible resources. LANL's Section 106 requirements are modified by the 2017 Programmatic Agreement (DOE 2017b). In 2019, cultural resources staff at LANL evaluated 950 proposed actions and conducted three field surveys to identify archaeological sites and historic buildings. In FY 2019, DOE/NNSA submitted six survey reports to the New Mexico State Historic Preservation Office for concurrence in findings of effects and determinations of eligibility for cultural resources located during survey. Additionally, one report was submitted only to the Governor and the Tribal Historic Preservation Officer of the Pueblo de San Ildefonso.

The American Indian Religious Freedom Act of 1978 (Public Law 95-341, as amended; 42 USC 1996) stipulates that it is federal policy to protect and preserve the right of American Indians to practice their traditional religions. Culturally affiliated tribes are notified of possible impacts to traditional and sacred places at LANL.

The Native American Graves Protection and Repatriation Act of 1990 (Public Law 101-601, as amended; 25 USC 3001 et seq.) states that if burials or cultural objects are inadvertently disturbed by federal activities, work must stop in that location and, within 30 days, the closest lineal descendant must be consulted for disposition of the remains. No discoveries of human remains occurred in FY 2019 during LANL activities; however, one fragment of human bone was discovered in LANL's archaeological museum collections.

The Archaeological Resources Protection Act of 1979 (Public Law 96-95, as amended; 16 USC 470aa et seq.) provides protection of cultural resources and sets penalties for their damage or removal from federal land without a permit. Triad cultural resources staff identified no violations of this Act on DOE/NNSA land in FY 2019.

3.9.2 *Compliance Activities*

During the spring and summer of 2019, Triad cultural resources staff completed the excavation of a homestead-era site (Vigil y Montoya Homestead). In July, Triad archaeologists hosted more than 35 descendants of the homestead owners, hailing from all over New Mexico. The descendants came to LANL to interact and connect with their shared past. Many descendants of the Vigil y Montoya homestead owners work or have worked for the Laboratory. Many did not know precisely where the homestead was located, and some had even driven past it on a regular basis. While at the homestead, members of the Montoya family saw excavations of structures and interacted with artifacts and personal possessions, such as a felt hat. They shared stories, memories, and family photos and provided a key oral history context for the excavation report. They were also able to pick apricots from a living tree on the homestead and regrow trees from that historical tree.

Triad archaeologists conducted a pedestrian survey for the proposed Second Fiber Optics Line project on Santa Fe National Forest, Bureau of Land Management, and DOE/NNSA lands of the Caja Del Rio Plateau. Only one fiber optics line currently serves both LANL and Los Alamos

County. This second line is to enhance and improve the service to LANL and the County. The alignment of the utility corridor spans 17.6 linear miles. Surveys were conducted on the Santa Fe National Forest and Bureau of Land Management lands in Santa Fe County (12 linear miles, 73 acres total). During archaeological reconnaissance, eight archaeological sites were located along the project corridor on the Santa Fe National Forest land; no archaeological sites were located on the Bureau of Land Management land. The alignment on DOE/NNSA land has yet to be finalized. A mitigation plan and evaluation of eligibility and treatment of cultural resources in consideration of this project will be reported during FY 2020 to the New Mexico Historic Preservation Division for concurrence on behalf of the DOE/NNSA, Santa Fe National Forest, and the Bureau of Land Management.

A pedestrian survey and archaeological monitoring for site clearing related to the Calibration Site (approximately 160-acre tract) project in TA-68 was conducted throughout 2019. The Calibration Site is located in Water Canyon. No new archaeological sites were discovered in the project area. An associated electrical line corridor is anticipated to be surveyed during FY 2020, and a report that documents the results of both surveys will be prepared for concurrence of cultural resources eligibility and mitigations to adverse effects, should those considerations arise for project implementation.

During 2019, Triad cultural resources staff also completed several historic building consultation reports. One report evaluated a Manhattan Project movable guard shack for eligibility for inclusion in the NRHP. A second report and consultation documentation was prepared for replacement of wooden wing walls on a Manhattan Project National Historical Park eligible property. Additionally, staff completed two historic building context reports for decontamination and decommissioning of register-eligible buildings TA-03-16 and TA-03-35.

Additional documentation and reporting for 14 historic buildings in TA-46 were conducted before proposed demolition and for future major remodeling of the developed area. The report documents archival photography of the 14 buildings, descriptions of the architectural designs, themes, and historical context of each building. In the previous eligibility report stages of this project, drawings of each building under evaluation were submitted. The purpose of this additional report was to conclude the documentation process to achieve concurrence with proposed demolition and future site planning of TA-46.

Nake'muu. 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 that have walls up to 6 feet high. The site is revisited annually to record changes and remove vegetation that could 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 site visits by Pueblo members were conducted in 2019.

Land Conveyance and Transfer. The Laboratory continued a multiyear program in support of the Land Conveyance and Transfer Project. In 2019, two tracts of land were conveyed to Los Alamos County. The fences surrounding three sensitive cultural areas on previously conveyed tracts were monitored. DOE and cultural resources staff from LANL conducted the annual inspection of the curation facility (Museum of Indian Arts & Culture in Santa Fe, New Mexico), where artifacts and associated records from archaeological site excavations on Laboratory property since 1949 (including the artifacts excavated in support of the Land Conveyance and Transfer project) are housed.

Manhattan Project National Historical Park. The Park is managed jointly by the National Park Service and the DOE under a Memorandum of Agreement between the Department of Interior and the DOE signed in 2015 (DOE 2015b). 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 are included in the Park or are eligible for inclusion. Located in eight separate TAs, these properties represent key events in the timeline of the Manhattan Project's scientific and engineering history. The properties 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, Japan, and the Fat Man weapon detonated over Nagasaki, Japan.

In 2019, cultural resources staff worked with National Park Service staff on one priority project at Park properties and Park-eligible properties: the stabilization, repair, and restoration of two concrete bunkers—one within the Manhattan Project National Historical Park boundaries and the other determined eligible for the NRHP in TA-18. LANL cultural resources staff provided guidance to an outside contractor, who executed the work. This project repaired degraded concrete on the building exteriors to return the buildings to their original Manhattan Project-era appearance.

Also in 2019, cultural resources staff started the following three projects:

- the stabilization repair of a concrete pad in the V-Site Park unit in TA-16;
- vegetation removal at the Concrete Bowl, a Park-eligible property in TA-06; and
- removal of a degraded concrete cap that was installed as part of repairs conducted in 2012 at Gun Site Park buildings in TA-08.

3.9.3 *Cultural Resources Management Plan*

In 2017, the Cultural Resources Management Plan (CRMP) was updated and revised (LANL 2017c). Similar to its predecessor, the CRMP provides a set of guidelines for managing and protecting cultural resources in accordance with requirements defined in:

- 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 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 the DOE/NNSA, the New Mexico State Historic Preservation Office, and the Advisory Council on Historic Preservation, signed in August 2017. The Programmatic Agreement is a legally binding document defining compliance activities and processes at LANL.

Outreach activities in 2019 included tours of historical sites at LANL (including Park properties Slotin Building, Battleship Bunker, Pond Cabin, V-Site and Gun Site). Some of these activities coincided with the Los Alamos County's Science Fest. Visitors had the opportunity to learn about the history of the Pajarito Plateau—from 10,000 years in the past through the Homesteading era and into significant events of the Manhattan Project. Triad cultural resources staff provided multiple public presentations, including the Expanding Your Horizons Science Technology, Engineering, and Mathematics Conference-Santa Fe, New Mexico, Chapter; and STEM (science, technology, engineering, and math) and Earth Days at Santa Clara Kha'p'o Community School and San Ildefonso Day School. Cultural resources staff also provided internal and external outreach presentations to the Office of Archaeological Studies-Santa Fe; the Accounting Division and the Statistics Group at LANL; new summer students at LANL; the Society for American Archaeology meeting in Albuquerque; the Albuquerque Archaeological Society; and the University of New Mexico Anthropology Job Fair. Triad cultural resources staff also provided tours to the University of New Mexico Archaeology Field School and to the Albuquerque Archaeological Society. The cultural resources staff also facilitated tours of two archaeological sites (Tsirege and Nake'muu) for the DOE/NNSA Los Alamos Field Office and several LANL organizations, including personnel from Battelle.

LANL hosted three tours of Tsirege Pueblo to members of the Pueblo de san Ildefonso and a tour of the Tsirege Pueblo for DOE/Pueblo de San Ildefonso Governor. Triad cultural resources staff also hosted several tours for Pueblo de San Ildefonso elementary school children and for Bandelier National Monument Pueblo Youth Corps. These tours provided outreach and interpretation for this culturally significant site, which is directly affiliated with the Pueblo de San Ildefonso.

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 CY 2019 support this projection. These data are reported in the 2019 Annual Site Environmental Report (LANL 2020c).

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 TA-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 LANL have undergone significant changes in the past few decades. Drought, wildfire, and insect outbreaks have impacted forest and woodland trees and have caused tree mortality in many areas.

LANL is located in a fire-prone region, which means that a high potential for wildfires exists. Due to this risk, LANL reduces forest fuels in these areas and within defensible space around buildings. The Wildland Fire Management Program mission is to protect life, infrastructure, and the environment from the devastating effects of wildfire.

Current climate modeling indicates that northern New Mexico will experience continually increasing temperatures, with stresses of severe heat, declining snowpack, and possibly increases in high-intensity rainfall events but with no concurrent increase in annual precipitation (IPCC 2014, National Climate Asessment 2014). LANL researchers predict that most mature native conifer trees will be dead by 2050 (McDowell et al. 2016). Projected climate changes and mortality of trees will lead to loss of forest cover, continued high risk of severe wildfire, and higher soil erosion rates.

In 2019, the *LANL Wildfire Mitigation and Forest Health Plan* was issued (LANL 2019b). The goals of this plan are the following:

- **Restore and maintain landscapes:** LANL landscapes are resilient to disturbances.
- **Develop a fire-adapted community:** LANL workforce, neighbors, and infrastructure can withstand a wildland fire without loss of life and property.
- **Ensure wildfire mitigation implementation:** All wildland fire mitigation working group organizations participate in making and implementing safe, effective, efficient risk-based wildland fire management decisions.

Fuels management at LANL is completed in compliance with the *Wildfire Hazard Reduction and Forest Health Environmental Assessment (DOE 2000)*. A supplemental environmental assessment (SEA) to the *2000 Environmental Assessment for the Wildfire Hazard Reduction and Forest Health Improvement Program at Los Alamos National Laboratory, Los Alamos, New Mexico* and associated *Finding of No Significant Impacts* was completed in 2019 (DOE 2019c, d). This SEA addresses changes since 2000 and environmental impacts associated with implementing the Forest Health and Wildland Fire Mitigation Plan.

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 because of habitat degradation that resulted from long-term drought and fire (LANL 2017a). LANL continued annual surveys for the Mexican Spotted Owl, the Southwestern Willow Flycatcher, and the Jemez Mountains Salamander in CY 2019, pursuant to the Threatened and Endangered Species Habitat Management Plan.

3.10.3 *Biological Assessments and Compliance Packages*

During CY 2019, the Biological Assessment for the Modernization and Development of the Weapons and Facility Operation's High Explosive Testing and Processing Facilities at Los Alamos National Laboratory (LANL 2019c) was prepared.

During CY 2019 the Biological Evaluation of the Fiber-Optic Line Installation for Improved Communication at the Los Alamos National Laboratory (LANL 2019d) was prepared.

During CY 2019, the following floodplain assessments were prepared.

- Los Alamos National Laboratory Starmer's Gulch Floodplain Assessment for the Fencing Project at Technical Area-08 (LANL 2019e)
- Lower Sandia Canyon Floodplain Assessment for the New Mexico State Route 4 and East Jemez Road Intersection and Technical Area-72 at Los Alamos National Laboratory (LANL 2019f)

3.11 Footprint Reduction

The purpose of the Footprint Reduction Program is to use institutional dollars to fund shutdown and removal of facilities and structures that have exceeded their useful lifetime. The Footprint Reduction Program strategically targets facilities and structures where their shutdown and removal benefit the institution by

- providing future building sites;
- contributing to site clean-up efforts;
- addressing the DOE mandate for new buildings where an equal number of square feet or more must be removed;
- mitigation of wildland fire risk;
- maintenance and operations cost avoidance; and
- improving space and work conditions for LANL staff, mission, and operations.

In CY 2019, DOE/NNSA removed approximately three structures, eliminating 29,588 square feet of LANL's footprint. Table 3-33 shows the total number of gross square feet of the LANL footprint eliminated since CY 2008.

Table 3-33. Reduction in Gross Square Feet at LANL since 2008

Year	Elimination (gross square feet)[a]	Cumulative (gross square feet)[a]
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

Year	Elimination (gross square feet)[a]	Cumulative (gross square feet)[a]
2015	29,025	988,216
2016	27,345	1,015,561
2017	25,925	1,041,486
2018	25,021	1,066,507
2019	29,588	1,096,095

[a] Multiply square feet by 0.092903 to get square meters.

3.11.1 *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 CY 2019, DOE/NNSA demolished several structures. Table 3-34 and Table 3-35 summarize the waste volumes for all buildings that underwent the DD&D process in CY 2019.

Table 3-34. CY 2019 DD&D Facilities Construction and Demolition Debris[a]

Building Number[b]	DD&D Completed	Waste Volumes (cubic meters)						
		Construction/ Demolition Debris[c]	Asbestos[d]	Universal Waste	Recyclable Metal	Recyclable Asphalt/ Concrete	Recyclable Wood	Equipment Salvaged
16-0374	12/10/2019	0	0	0	0.07	3	0	0
22-0118	03/26/2019	36	0	0	0	72	0	0
46-0001	08/22/2019	2,496	19	0.79	195	94	0	0
Total		**2,532**	**19**	**0.79**	**195.07**	**169**		
2008 SWEIS		246,409[a]	Not available	Not available	Not available	Not available	Not available	Not available

[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 TA-21 DD&D Option, 12,998 cubic meters from the TA-18 DD&D Option, and 41,669 cubic meters from the Waste Management Facilities Transition. Did not update.

[b] DD&D operations covered under existing EAs are not included here.

[c] Waste Volumes that are tracked in tons, cubic meters volume calculated using the conversion factors as identified in the Volume-to-Weight Conversion Factors, EPA Office of Resource Conservation and Recovery (EPA 2016).

[d] Asbestos volumes are tracked within the LANL WCATS.

Table 3-35. DD&D Waste Projections for CY 2019

Building Number	DD&D Completed	Waste Volumes			
		Chemical Waste[a]	LLW[b,c]	Mixed LLW[b]	TRU[b]
46-0001	8/22/2019	0	116	19	
Total 2019		0	116	19	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 TA-21 DD&D Option; 191,415 kilograms from the TA-18 DD&D Option; and 256,732 kilograms from the Waste Management Facilities Transition.

[e] This number represents the following numbers from the 2008 SWEIS: 29,588 cubic meters from the No Action Alternative; 7,875 cubic meters from the RLWTF Upgrade; 986 cubic meters from the Plutonium Refurbishment; 26,453 cubic meters from the TA-21 DD&D Option; 3,593 cubic meters from the TA-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 TA-21 DD&D Option; 4 cubic meters from the TA-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 meters from the RLWTF Upgrade; 260 cubic meters from the Plutonium Refurbishment; and 0.76 cubic meter from the TA-21 DD&D Option.

4 CONCLUSION

LANL operations data mostly fell within the 2008 SWEIS projections. Several Key Facilities exceeded the 2008 SWEIS levels for waste generation quantities, but the exceedances were infrequent, non-routine events that do not reflect day-to-day LANL operations. Chemical waste volumes in CY 2019 exceeded annual waste volumes for the Non-Key Facilities. This outcome was the result of the disposition of press filter cakes, reverse osmosis reject water from the SERF, and clean out of expired and unused/unspent chemicals as part of the Laboratory's effort to improve chemical management. Although chemical waste volumes exceeded projections, LANL has generated less than half of the cumulative chemical waste analyzed in the 2008 SWEIS. Gas, electricity, and water consumption remained within the 2008 SWEIS levels projected for utilities in CY 2019. At the end of CY 2019, there were 13,522 employees. Although the number of employees slightly exceeds the 2008 SWEIS No Action Alternative for CY 2019, the total number of employees from 2008 through 2018 was fewer than the number of employees projected in the 2008 SWEIS No Action Alternative. The DOE/NNSA issued an amended Record of Decision in September 2020 that selected to implement additional elements of the Expanded Operations Alternative for an increase in pit production, which includes an increase in the projected number of LANL employees to 15,400.

The purpose of the CY 2019 Yearbook is to compare LANL operations data with the 2008 SWEIS projections to determine if LANL was still operating within the environmental envelope established by the 2008 SWEIS and associated RODs. Overall, the CY 2019 data indicate that the Laboratory was operating within the SWEIS envelope.

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

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Appendix A: Capability and Operations Tables for Key and Non-Key Facilities

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

Capability	2008 SWEIS Projections	2019 Operations
Analytical Chemistry	Support actinide research and processing activities by processing approximately 7,000 samples per year	Performed fewer than 1,000 analytical processes that involved micrograms-to-gram quantities of material
Uranium Processing	Recover, process, and store LANL's highly enriched uranium inventory	Processed highly enriched uranium items 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
Actinide Research and Development	Characterize approximately 100 samples per year using microstructural and chemical metallurgical analyses	No activity
	Perform compatibility testing of actinides and other metals to study long-term aging and other material effects	No activity
	Analyze TRU waste disposal related to validation of WIPP performance assessment models	No activity
	Perform TRU waste characterization	No activity
	Analyze gas generation as could occur in TRU waste during transportation to WIPP	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 TA-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
	Process neutron sources other than sealed sources	No activity
	Stage 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 (and 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	Processed one vessel

[a] The actinide activities at the CMR Building and at TA-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 (TA-03) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2019 Operations
Radioactive Air Emissions			
Total Actinides[b]	Ci/yr	7.60E-04	1.95E-05
Krypton-85	Ci/yr	1.00E+02	Not measured[c]
Xenon-131m	Ci/yr	4.50E+01	Not measured[c]
Xenon-133	Ci/yr	1.50E+03	Not measured[c]
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	10,886	152.9
LLW	m^3/yr	1,835	10.8
MLLW	m^3/yr	19	0
TRU	m^3/yr	42[d]	3.1
Mixed TRU	m^3/yr	N/A[d]	19.4

[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 EPA regulations.
[d] The 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at WIPP.

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

Capability	2008 SWEIS Projections	2019 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	Activity performed as projected
	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

Capability	2008 SWEIS Projections	2019 Operations
Fabrication of Metallic and Ceramic Items	Fabricate stainless steel and beryllium components for up to 80 pits per year	Fabricated stainless steel and specialty alloy pit components for fewer than 80 pits
	Fabricate up to 200 reservoirs for tritium per year	Fabricated fewer than 200 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 50 secondary assemblies
	Fabricate non-nuclear components for research and development; about 100 major hydrotests and 50 joint test assemblies per year	Fabricated components for fewer than 100 hydrotests and for fewer than 50 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	Activity performed as projected
	Fabricate test storage containers for nuclear materials stabilization	No activity
Fabrication of Specialty Components*	Provide fabrication support for the dynamic experiments program and explosives research studies	Fabricated specialty components at levels projected
	Support up to 100 hydrodynamic tests per year	Supported fewer than 100 hydrodynamic tests
	Manufacture up to 50 joint test assembly sets per year	No activity
	Provide general laboratory support as requested	Activity performed as projected
Fabrication Utilizing Unique Materials*	Fabricate items using unique and unusual materials such as depleted uranium and lithium	Conducted fabrication of unique materials 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

* These Machine Shop capabilities are being combined with the Sigma Complex Key Facility capabilities since the uranium machining operations have moved into the Sigma Building.

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

Parameter	Units[a]	2008 SWEIS Projections	2019 Operations
Radioactive Air Emissions[b]			
Uranium-234	Ci/yr	6.60E-05	Not measured[b]
Uranium-238	Ci/yr	1.80E-03	Not measured[b]
NPDES Discharges			
04A022	MGY	5.8	1.6
Wastes			
Chemical	kg/yr	9,979	70,136.2[d]
LLW	m^3/yr	994	405.2
MLLW	m^3/yr	4	29.7[e]
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 CY 2018.
[d] In CY 2019, chemical waste generation at the Sigma Complex exceeded 2008 SWEIS projections because of the cleanup of legacy graphite pieces that no longer serve their intended purpose, which accounted for 74 percent (52,208 kilograms) of the total. Thirteen percent (9,688.7 kilograms) of the chemical waste total was due to the cleanup of asbestos in soil.
[e] In CY 2019, MLLW generation at the Sigma Complex exceeded 2008 SWEIS projections because of the disposal of equipment associated with electrochemistry operations and the removal of uranium contaminated electronics and copper solder, which accounted for 61 percent (18 cubic meters) and 30 percent (8 cubic meters), respectively, of the total MLLW generated at the Sigma Complex.
[f] The 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at WIPP.

Table A-5. Machine Shops (TA-03) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2019 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	2,269.6
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, which could reflect an operations focus on low-enriched uranium fuel instead of depleted uranium.
[c] The main stack at TA-03-0129, was shut down in CY 2011. Remaining radiological operations are not vented to the environment but are vented back into the workspace.
[d] The 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at WIPP.

Table A-6. Machine Shops (TA-03) Comparison of Operations

Capability	2008 SWEIS Projections	2019, 2020 Operations
Fabrication of Specialty Components	Provide fabrication support for the dynamic experiments program and explosives research studies	Fabricated specialty components at levels projected
	Support up to 100 hydrodynamic tests per year	Supported up to 10 hydrodynamic tests
	Manufacture up to 50 joint test assembly sets per year	No activity
	Conduct production work in new MQMC	Supported NNSA mark quality production work in support of the stockpile
	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	Conducted fabrication of unique materials 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-7 Materials Science Laboratory (TA-03) Comparison of Operations

Capability	2008 SWEIS Projections	2019 Operations
Materials Processing	Support development and improvement of technologies for materials formulation	Activity performed as projected
	Support development of chemical processing technologies, including recycling and reprocessing techniques to solve environmental problems	Activity 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 performed as projected
	Develop and improve techniques for these and other types of studies	Activity performed as projected
Advanced Materials Development	Synthesize and characterize single crystals and nanophase and amorphous materials	Activity 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 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 • Electroplating, surface finishing, and corrosion studies of different materials • Development of multifunctional coatings/films via electrochemistry (electro plating/electroforming, etc.)	Activity performed as projected

Capability	2008 SWEIS Projections	2019 Operations
Materials Characterization and Modeling	• Perform materials characterization activities to support materials development • Predict structure/property relationships of materials • Characterization of thermophysical properties • Measurement of the mechanical properties of metals and ceramics • Computational materials modeling	Activity 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 performed as projected

[a] This capability was not projected in the 2008 SWEIS. The Materials Science Laboratory Infill project was included in the EA for the construction of the Materials Science Laboratory building (DOE 1992).

Table A-8 Materials Science Laboratory (TA-03) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2019 Operations
Radioactive Air Emissions			
Not projected[b]	Ci/yr	Not projected[b]	Not measured[b]
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	590	314.2
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] No radiological operations occur at this site.
[c] The 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at WIPP.

Table A-9 Metropolis Center (TA-03) Comparison of Operations

Capability	2008 SWEIS Projections	2019 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 (TA-03) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2019 Operations
Radioactive Air Emissions			
Not projected[b]	Ci/yr	Not projected[b]	Not measured[b]
NPDES Discharge			
03A027[c]	MGY	17.7	10.2
Wastes			
Chemical	kg/yr	0	0
LLW	m^3/yr	0	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 radiological operations occur at this site.
[c] Discharges to Outfall 03A027 (Metropolis Center) have been directed to Outfall 001.
[d] The 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at WIPP.

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

Capability	2008 SWEIS Projections	2019 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.	Used less than 4,500 pounds (2,041 kilograms) of high explosives and less than 1,500 pounds (680 kilograms) of mock explosives materials in the fabrication of test components. Recycling mock and some high explosives materials 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	Fabricated fewer than 3,000 parts at TA-16-0260, and several parts manufactured at Pantex were modified in support of hydrotest activities.

Capability	2008 SWEIS Projections	2019 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	A total of 363 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	Performed fewer than 29 safety and mechanical tests in TA-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 • Two major product lines were completed in CY 2019

[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 (TA-08, -09, -11, -16, -22, and -37) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2019 Operations
Radioactive Air Emissions			
Uranium-238	Ci/yr	9.96E-07	Not measured[b]
Uranium-235	Ci/yr	1.89E-08	Not measured[b]
Uranium-234	Ci/yr	3.71E-07	Not measured[b]
NPDES Discharge			
05A055	MGY	0.06	0
Wastes			
Chemical	kg/yr	13,154	41,771.2[c]
LLW	m^3/yr	15	7.8
MLLW	m^3/yr	<1	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] Triad does not measure these non-point (diffuse) emissions at their source; rather, Triad uses ambient air measurements at public receptor locations to evaluate compliance from diffuse emissions.

[c] In CY 2019, chemical waste generation at the High Explosives Processing Facility exceeded 2008 SWEIS projections because of the disposal of empty drums, which accounted for 36 percent (15,131.8 kilograms); the disposal of spent chemicals from the etching machine, which accounted for 24 percent (10,293.3 kilograms); and the disposal of concrete from TA-16, which accounted for 22 percent (9,989.5 kilograms) of the chemical waste generated at the High Explosives Processing facility.

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

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

Capability	SWEIS Projections	2019 Operations
Volume of Materials Required[a]	Conduct about 1,800 experiments per year	Conducted 650 experiments
	Use up to 6,900 pounds (3,130 kilograms) of depleted uranium in experiments annually	Expended 1,657 pounds (752 kilograms) of depleted uranium
Hydrodynamic Tests	• Develop containment technology • Conduct baseline and code development tests of weapons configuration • Conduct 100 major hydrodynamic tests per year	Conducted four hydrodynamic tests
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 (TA-14, 15, 36, 39, and 40) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2019 Operations
Radioactive Air Emissions			
Depleted Uranium[b]	Ci/yr	1.5E-01	Not measured[c]
Uranium-234	Ci/yr	3.4E-02	Not measured[c]
Uranium-235	Ci/yr	1.5E-03	Not measured[c]
Uranium-238	Ci/yr	1.4E-01	Not measured[c]
Chemical Usage[d]			
Aluminum[d]	kg/yr	45,720	<800
Beryllium	kg/yr	90	<3
Copper[d]	kg/yr	45,630	<3
Depleted Uranium	kg/yr	3,931.4	<500
Iron[d]	kg/yr	30,210	<4,000
Lead	kg/yr	241.4	<1
Tantalum	kg/yr	450	<500
Tungsten	kg/yr	390	<1,000

Parameter	Units[a]	2008 SWEIS Projections	2019 Operations
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	35,380	193,216.3[e]
LLW	m^3/yr	918	63.9
MLLW	m^3/yr	8	0
TRU[f]	m^3/yr	<1[f]	0
Mixed TRU	m^3/yr	N/A[f]	

[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 isotopic composition of depleted uranium is approximately 72 percent uranium-238, approximately one 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] Triad does not measure these non-point (diffuse) emissions at their source; rather, Triad 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 CY 2019, chemical waste generation at the High Explosives Treatment Facility exceeded 2008 SWEIS projections because of concrete post-shot firing debris, which accounted for 53 percent (103,918 kilograms, and the removal of asphalt from TA-40, which accounted for 15 percent (20,859 kilograms) of the chemical waste generated at the High Explosives Treatment facility.

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

Table A-15 Tritium Facilities (TA-16) Comparison of Operations

Capability	2008 SWEIS Projections	2019 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	Performed 3 gas boost system tests (all below 100 grams) and 10 associated gas analyses and processing operations
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 (TA-16) Operations Data

Parameter	Units[a]	2008 SWEIS	2019 Operations
Radioactive Air Emissions			
TA-16/WETF, Elemental tritium	Ci/yr	300	10.5
TA-16/WETF, Tritium in water vapor	Ci/yr	500	28.1
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	1,724	7.7
LLW	m^3/yr	482	32.8
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] The 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at WIPP.

Table A-17 Target Fabrication Facility (TA-35) Comparison of Operations

Capability	2008 SWEIS Projections	2019 Operations
Precision Machining and Target Fabrication	Provide targets and specialized components for laser and physics	Activity performed as projected
	Perform high-energy-density physics tests	Activity performed as projected
Polymer Synthesis	Produce polymers for targets and specialized components laser and physics tests	Performed characterization using computed tomography, optical, structural, and chemical methods
	Perform high-energy-density physics	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 laser and physics tests	Activity performed as projected
	Support plutonium pit rebuild operations	Supported plutonium pit rebuild operations

Table A-18 Target Fabrication Facility (TA-35) Operations Data

Parameter	Units[a]	2008 SWEIS	2019 Operations
Radioactive Air Emissions			
Not projected[b]	Ci/yr	Not projected[b]	Not measured[b]
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	3,810	12,233.8[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] No radiological operations occur at this site.
[c] In CY 2019, chemical waste generation at the Target Fabrication Facility exceeded 2008 SWEIS projections because of fire alarm and chiller construction debris, which accounted for 60 percent (7,366.3 kilograms) and beryllium-contaminated lab trash (30 percent 3,664.1 kilograms).

Table A-19 Bioscience Facilities (Technical Areas 03, 16, 35, 43, and 46) Comparison of Operations

Capabilities	2008 SWEIS Projection	2019 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
	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	All operations have been terminated, and equipment was removed during CY 2019; shields remain in place

*This is not a Bioscience Division capability; however, it is located at TA-43-0001 and is included as a capability within this Key Facility.

Table A-20 Bioscience Facilities (TA-03, -16, -35, -43, and -46) Operations Data

Parameter	Units[a]	2008 SWEIS	2019 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	2,264.8
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] The 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at WIPP.

Table A-21 Radiochemistry Facility (TA-48) Comparison of Operations

Capability	2008 SWEIS Projections	2019 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 preparation, irradiation and processing to produce isotopes for medical, industrial, and research applications, resulting in ~100 offsite product shipments • Increased diversity of isotopes produced • Produced isotopes with Z >86
Actinide and TRU Chemistry	Perform radiochemical operations involving alpha-emitting radionuclides	Activity performed as projected

Capability	2008 SWEIS Projections	2019 Operations
Data Analysis	Re-examine archive data and measure nuclear process parameters of interest to weapons radiochemists	Activity performed as projected
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 CY 2016, DOE/NNSA determined that 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 (TA-48) Operations Data

Parameter	Units[a]	2008 SWEISProjections	2019 Operations
Radioactive Air Emissions			
Mixed Fission Products[b]	Ci/yr	1.5E-04	Not measured[b]
Plutonium-239	Ci/yr	1.2E-05	No emissions[c]
Uranium isotopes	Ci/yr	4.8E-07	No emissions[c]
Arsenic-72	Ci/yr	1.2E-04	No emissions[c]
Arsenic-73	Ci/yr	2.5E-03	1.25E-06
Arsenic-74	Ci/yr	1.3E-03	No emissions[c]
Beryllium-7	Ci/yr	1.6E-05	No emissions[c]
Bromine isotopes[d]	Ci/yr	9.3E-04	6.01E-06
Germanium-68[e]	Ci/yr	8.9E-03	1.31E-04
Rubidium-86	Ci/yr	3.0E-07	No emissions[c]
Selenium-75	Ci/yr	3.8E-04	8.69E-05
Other Activation Products[f]	Ci/yr	5.5E-06	5.16E-04
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls

Parameter	Units[a]	2008 SWEISProjections	2019 Operations
Wastes			
Chemical	kg/yr	3,311	832.6
LLW	m^3/yr	268	80.3
MLLW	m^3/yr	4	8.4[g]
TRU	m^3/yr	0[h]	0
Mixed TRU	m^3/yr	0[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] The emission category of "mixed fission products" is no longer used for EPA compliance reporting; individual nuclides are called out instead. However, for this table, 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 EPA compliance reporting; individual radionuclides are called out instead. The measured value in this table includes activation products not included in specific line items.

[g] In CY 2019, MLLW exceeded the 2008 SWEIS projections at the Radiochemistry Facility because of lead-contaminated materials from routine housekeeping and maintenance operations, which accounted for 64 percent (5.4 cubic meters) of total MLLW generated.

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

Table A-23 Radioactive Liquid Waste Treatment Facility (TA-50) Comparison of Operations

Capability	2008 SWEIS Projections[a]	2019 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.)	Shipped 612,000 liters of radioactive liquid waste bottoms 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 treatment
	Solidify, characterize, and package 17 cubic meters per year of TRU waste sludge	No solidification
	Treat 20 million liters per year of liquid LLW	Processed 26 million liters of liquid LLW
	Dewater, characterize, and package 60 cubic meters per year of LLW sludge	Packaged 18.14 cubic meters of LLW sludge (96 drums)
	Process 1,200,000 million liters per year of secondary liquid waste generated by the RLWTF treatment processes through the RLWTF evaporator	No activity
	Discharge treated liquids through an NPDES outfall	Discharged 80,798 liters of treated water through the NPDES outfall; evaporated 25 million liters of treated water

[a] The 2008 SWEIS Projections updated to the Expanded Operations Alternative.

[b] All waste is sent off-site for disposal because TA-54 is now operated by N3B.

Table A-24 Radioactive Liquid Waste Treatment Facility (TA-50) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2019 Operations
Radioactive Air Emissions			
Americium-241	Ci/yr	Negligible	No emissions[b]
Plutonium-238	Ci/yr	Negligible	2.02E-08
Plutonium-239	Ci/yr	Negligible	5.07E-09
Thorium-228	Ci/yr	Negligible	No emissions[b]
Thorium-230	Ci/yr	Negligible	2.53E-08
Thorium-232	Ci/yr	Negligible	No emissions[b]
Uranium isotopes	Ci/yr	Negligible	No emissions[b]
NPDES Discharge			
051	MGY	4.0	0.021
Wastes			
Chemical	kg/yr	499	3,932.2[c]
LLW	m^3/yr	298	799.3[d]
MLLW	m^3/yr	2.2	0
TRU	m^3/yr	13.7[e]	0
Mixed TRU	m^3/yr	N/A[e]	

[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 CY 2019, chemical waste generated at RLWTF exceeded 2008 SWEIS projections because of a roof replacement and asbestos removal at TA-50, which accounted for 57 percent (2,249.8 kilograms) of the chemical waste generated; and from the disposal of empty drums, which accounted for an additional 10 percent of the total chemical waste generated.

[d] In CY 2019, LLW generation at RLWTF exceeded 2008 SWEIS projections because of a wastewater byproduct of the treatment process of Radioactive Liquid Waste evaporator bottoms at TA-50, which accounted for approximately 98 percent (786.2 cubic meters) of the LLW generated at RLWTF

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

Table A-25 LANSCE (TA-53) Comparison of Operations

Capability	2008 SWEIS Projections	2019 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 • Delivered H+ at a nominal 265 microamperes to the Isotope Production Facility • Delivered H-beam as follows: - to the Lujan Center at a nominal 100 microamperes - to Weapons Neutron Research Facility at 6 microamperes - on demand was available to Areas B and C • Beam was available 7 months of 2019 (up to approximately 2,800 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	Performed remote handling and packaging of radioactive material at the Isotope Production Facility

Capability	2008 SWEIS Projections	2019 Operations
Neutron Research and Technology*	Conduct 1,000 to 2,000 experiments/year using neutrons from the Lujan Center and Weapons Neutron Research Facility	Conducted 101 neutron beam experiments at the Lujan Center and Weapons Neutron Research Facility
	Support contained weapons-related experiments using small to moderate quantities of high explosives, including: • Approximately 200 experiments per year using nonhazardous materials and small quantities of high explosives • Approximately 60 experiments per year using up to 10 pounds (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 10 pounds (4.5 kilograms) of high explosives and 45 kilograms of depleted uranium • Dynamic experiments in powder launcher with up to 10 ounces (300 grams) of gun powder Contained experiments using small to moderate quantities of high explosives similar to those discussed under Neutron Research and Technology*	Conducted 32 high explosive shots and ~10 static experiments • Dynamic experiments in containment vessels with up to 10 pounds of TNT-E high explosives and 45 kilograms of depleted uranium; no depleted uranium was used in CY 2019
	Conduct research using ultracold neutrons; operate up to 10 microamperes per year of negative beam current	Ultracold neutrons collected data and performed experimental setup for the Spallation Neutron Source's Neutron Electric Dipole Moment Experiment, the LANL Electric Dipole Moment Laboratory Directed Research and Development, and the Ultra Cold Neutron Tau experiment

Capability	2008 SWEIS Projections	2019 Operations
Medical, Industrial, and Research Isotope Production	Irradiate up to 120 targets per year for medical isotope production at the Isotope Production Facility	• A total of 31 targets were irradiated in 2019: - 2 rubidium chloride targets and 10 rubidium targets for strontium-82; - 2 large-diameter rubidium chloride targets and 1 large diameter gallium target for high current beam testing - 11 gallium targets for gallium-68; - 1 magnesium target for sodium-22; - 1 germanium target for arsenic-73 - 1 scandium target for titanium-44 - 2 thorium targets for production of actinium-225 • In addition, irradiated 14 research samples for production scoping, 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	• Enduring diacrode radiofrequency (RF) test stand operation • Installation, setup, and conditioning of C-Band RF source for Dynamic Mesoscale Materials Science Capability-related research
Radioactive Liquid Waste Treatment (Solar Evaporation at TA-53)	Treat about 520,000 liters per year of radioactive liquid waste	In CY 2019, LANSCE received 163,056 liters of radioactive liquid waste into its holding tanks, including 19,558 liters from WETF. Discharged 104,036 liters to/in the evaporation tanks in CY 2019. The discrepancy in the total is due to liquid that was already in the evaporation tanks before the beginning of CY19.

* 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 (TA-53) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2019 Operations
Radioactive Air Emissions			
Argon-41	Ci/yr	8.87E+02	1.57E+01
Particulate and Vapor Activation Products	Ci/yr	Not projected[a]	2.57E-03
Carbon-10	Ci/yr	2.65E+00	3.21E-01
Carbon-11	Ci/yr	2.25E+04	1.18E+02
Nitrogen-13	Ci/yr	3.10E+03	4.17E+01
Oxygen-15	Ci/yr	3.88E+03	1.04E+02
Tritium as Water	Ci/yr	Not projected[b]	8.77E+00
NPDES Discharge			
Total Discharges	MGY	29.5[c]	26.0
03A048	MGY	Not projected[d]	25.8
03A113	MGY	Not projected[d]	0.2
Wastes			

Parameter	Units[a]	2008 SWEIS Projections	2019 Operations
Chemical	kg/yr	16,783	15,037.0
LLW	m^3/yr	1,070	26.6
MLLW	m^3/yr	1	18.5[e]
TRU	m^3/yr	0[f]	0
Mixed TRU	m^3/yr	0[f]	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] This 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 282. The total discharge projected for all LANSCE outfalls into both Los Alamos and Sandia canyons is 295 million gallons, which is the combined total of 282 and 13 million gallons, respectively.
[d] The 2008 SWEIS did not calculate individual flow per outfall.
[e] In CY 2019, MLLW generated at LANSCE exceeded 2008 SWEIS projections because of mercury-contaminated waste from the Flight Path Shutter System, which contributed to 82 percent (15.3 cubic meters) of MLLW generated.
[f] The 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at WIPP.

Table A-27 Solid Radioactive and Chemical Waste Facilities (TA-50, TA-54, TA-60 and TA-63)

Capability	2008 SWEIS Projections	2019 Triad Operations	2019 N3B Operations
Waste Characterization, Packaging, and Labeling	Characterize 640 cubic meters of newly generated TRU waste	347 cubic meters	No activity
	Characterize 8,400 cubic meters of legacy TRU waste	No activity	Characterized 410 cubic meters
	• Characterize LLW, MLLW, and chemical waste, including waste from DD&D and remediation activities • Characterize additional LLW, MLLW, and chemical waste, including waste from DD&D and remediation activities	Activity performed as projected	Activity performed as projected
	Ventilate TRU waste retrieved from below-ground storage	No activity	No activity
	Perform coring and visual inspection of a percentage of TRU waste packages	No activity	No activity
	Overpack and bulk small waste, as required	No activity	Activity performed as projected
	Support, certify, and audit generator characterization programs	Activity performed as projected	Activity performed as projected
	Maintain waste acceptance criteria for LANL waste management facilities	Activity performed as projected	Activity performed as projected
	Maintain waste acceptance criteria for offsite treatment, storage, and disposal facilities	Activity performed as projected	Activity performed as projected
	Maintain WIPP waste acceptance criteria compliance and liaison with WIPP operations	Activity performed as projected	Activity performed as projected
	Characterize approximately 2,400 cubic meters of contact-handled and 100 cubic meters of remote-handled legacy TRU waste retrieved from below-ground storage	No activity	No activity

Capability	2008 SWEIS Projections	2019 Triad Operations	2019 N3B Operations
Waste Transport, Receipt, and Acceptance	Ship 540 cubic meters per year of newly generated TRU waste to WIPP	125 cubic meters shipped	No activity
	Ship 8,400 cubic meters per year of legacy TRU waste to WIPP	No activity	Shipped approximately 19.2 cubic meters of legacy TRU to WIPP for disposal
	Ship LLW to offsite disposal facilities	Shipped approximately 2,326 cubic meters of LLW for offsite disposal	Shipped approximately 1,293 cubic meters of LLW for offsite disposal
	Ship 55 cubic meters of MLLW for offsite treatment and disposal in accordance with EPA land disposal restrictions	Shipped approximately 13 cubic meters of MLLW for offsite disposal	Shipped approximately 1,720 cubic meters of MLLW for offsite disposal
	Ship 6,400 metric tons of chemical wastes for offsite treatment and disposal in accordance with EPA land disposal restrictions	Shipped approximately 2,500 metric tons of chemical waste for offsite disposal	Shipped approximately 17.5 cubic meters of chemical waste for offsite disposal
	• Ship LLW, MLLW, and chemical waste from DD&D and remediation activities • Ship additional LLW, MLLW, and chemical waste from DD&D and remediation activities	Activity performed as projected	Activity performed as projected
	Collect chemical and mixed wastes from LANL generators and transport to Consolidated Remote Storage Sites and TA-54	Activity performed as projected with following exception: waste was transported to TA-60-0017 and not to TA-54	Activity performed as projected
	Receive, on average, five to ten shipments per year of LLW and TRU waste from offsite locations	No activity	No activity
	Ship approximately 2,340 cubic meters of remote-handled legacy TRU waste to WIPP	No activity	No activity
Waste Storage	Stage chemical and mixed wastes before shipment for offsite treatment, storage, and disposal	Activity performed as projected	Activity performed as projected
	Store TRU waste until it is shipped to WIPP	Activity performed as projected	Activity performed as projected
	Store MLLW pending shipment to a treatment facility	Activity performed as projected	Activity performed as projected
	Store LLW uranium chips until sufficient quantities are accumulated for stabilization campaigns	Activity performed as projected	No activity
	Store TRU waste generated by DD&D and remediation activities	Activity performed as projected	No activity
	Manage and store sealed sources for the OSRP at increased types and quantities	Activity performed as projected	Activity performed as projected

Capability	2008 SWEIS Projections	2019 Triad Operations	2019 N3B Operations
Waste Retrieval	Retrieve remaining legacy TRU waste 2,400 cubic meters of contact-handled and 100 cubic meters of remote-handled legacy TRU waste from below-ground storage in TA-54, Area G, including: Pit 9, above Pit 29, Trenches A–D, and Shafts 200–232, 235–243, 246–253, 262–266, and 302–306	No activity	No activity
Waste Treatment	Compact up to 2,300 cubic meters per year of LLW	No activity*	No activity
	Process 2,300 cubic meters of TRU waste through size reduction at the Decontamination and Volume Reduction System	No activity	No activity
	Demonstrate treatment (e.g., electrochemical) of liquid MLLW	No activity	No activity
	Stabilize 870 cubic meters of uranium chips	No activity	No activity
	Process newly generated TRU waste through new TRU Waste Facility	Receipt of TRU waste at TWF commenced in October 2017	No activity
Waste Disposal	Dispose 84 cubic meters of LLW in shafts, 23,000 cubic meters of LLW in pits, and small quantities of radioactively contaminated PCBs in shafts in Area G per year	No activity	No activity
	Dispose additional LLW generated by DD&D and remediation activities	No activity	No activity
	Migrate operations in Area G to Zones 4 and 6, as necessary, to allow continued onsite disposal of LLW	No activity	No activity
Decontamination Operations	Decontaminate approximately 700 personnel respirators and 300 air-proportional probes for reuse per month	No activity	No activity
	Decontaminate vehicles and portable instruments for reuse (as required)	No activity	No activity
	Decontaminate precious metals for resale using an acid bath	No activity	No activity
	Decontaminate scrap metals for resale by sandblasting the metals	No activity	No activity
	Decontaminate 200 cubic meters of lead for reuse by grit blasting	No activity	No activity

* LANL does not perform compaction anymore.

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

Parameter	Units[a]	2008 SWEIS Projections	2019 Operations
Radioactive Air Emissions[b]			
Tritium	Ci/yr	6.09E+01	Not measured[b]
Americium-241	Ci/yr	2.87E-06	No emissions[c]
Plutonium-238	Ci/yr	2.24E-05	No emissions[c]
Plutonium-239	Ci/yr	8.46E-06	No emissions[c]
Uranium-234	Ci/yr	8.00E-06	1.03E-08
Uranium-235	Ci/yr	4.10E-07	No emissions[c]
Uranium-238	Ci/yr	4.00E-06	No emissions[c]
Other Radionuclides	Ci/yr	Negligible	5.97E-09
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes[d]			
Chemical	kg/yr	907	108.9
LLW	m^3/yr	229	0
MLLW	m^3/yr	8	0
TRU	m^3/yr	27[e]	0
Mixed TRU	m^3/yr	N/A[e]	

[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 TA-50; and TA-54-0412, Dome 231, and Dome 375 at TA-54. All non-point sources at TA-50 and TA-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, personal protective clothing and equipment, and process wastes from size reduction and compaction.
[e] The 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at WIPP.

Table A-29 Plutonium Facility Complex (TA-55) Comparison of Operations

Capability	2008 SWEIS Projection	2019 Operations
Plutonium Stabilization	Recover, process, and store existing plutonium inventory	Activity performed as projected
Manufacturing Plutonium Components	Produce nominally 20 plutonium pits per year	Produced fewer than 20 qualified pits
	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 has not restarted
Surveillance and Disassembly of Weapons Components	Disassemble, survey, and examine up to 65 plutonium pits per year	• Disassembled fewer than 65 pits • Destructively examined fewer than 40 pits as part of the stockpile evaluation program (pit surveillance)

Capability	2008 SWEIS Projection	2019 Operations
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	Disassembled/converted fewer than 200 pits
	Process up to 5,000 curies of neutron sources (including plutonium, 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 TA-55 and the CMR Building*	Processed less than 400 kilograms of actinides
	Process pits through the Special Recovery Line (tritium separation)	Activity performed as projected
	Perform alloy decontamination of 28 to 48 uranium components per month	Decontaminated fewer than 48 uranium components per month
	Conduct research in support of DOE actinide cleanup activities and on actinide processing and waste activities at DOE sites	Activity performed as projected
	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	Processed, evaluated, and/or tested less than 25 kilograms of plutonium-238
	Recover, recycle and blend up to 18 kilograms per year plutonium-238	Recovered, recycled, and blended less than 18 kilograms of plutonium-238

Capability	2008 SWEIS Projection	2019 Operations
Storage, Shipping, and Receiving	Provide interim storage of up to 66 metric tons of the LANL special nuclear material inventory, mainly plutonium	Activity performed as projected
	Store working inventory in the vault in TA-55-0004; 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 TA-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 OSRP	Activity performed as projected
	Store mixed oxide fuel rods and fuel rods containing archive and scrap metals from mixed oxide fuel lead assembly fabrication	Activity performed as projected

* The actinide activities at the CMR Building and at TA-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 (TA-55) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2019 Operations
Radioactive Air Emissions			
Plutonium isotopes[b]	Ci/yr	1.95E-05	1.42E-08
Tritium in Water Vapor	Ci/yr	7.50E+02	4.54E-01
Tritium as a Gas	Ci/yr	2.50E+02	2.06E-01
NPDES Discharge			
03A181	MGY	4.1	3.0
Wastes			
Chemical	kg/yr	8,618	21,935.5[c]
LLW	m^3/yr	757	260.9
MLLW	m^3/yr	15	2.9
TRU	m^3/yr	336[d]	20.6
Mixed TRU	m^3/yr	N/A[d]	71.8

[a] Ci/yr = curies per year; MGY = million gallons per year; kg/yr = kilograms per year; m^3/yr = cubic meters per year
[b] Projections for the SWEIS were reported as plutonium or plutonium-239, the primary material at TA-55.
[c] In CY 2019, chemical waste at the Plutonium Facility Complex exceeded 2008 SWEIS projections because of waste from a hydraulic oil spill at TA-55 construction site, which accounted for 39 percent of the total waste (8,607.8 kilograms) and concrete removal from TA-55 silo, which accounted for 17 percent of the total chemical waste (3,803.8 kilograms).
[d] The 2008 SWEIS combined TRU and mixed TRU waste. Both waste categories are managed for disposal at WIPP.

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, and 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 Projections	2019 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	74.6
001	MGY	N/A[c]	61.9[d]
13S	MGY	N/A[c]	0
03A160	MGY	28.5	0[e]
03A199	MGY	N/A[c]	12.7
Wastes			
Chemical	kg/yr	651,000	1,965,971.76[f]
LLW	m^3/yr	1,529	141.9
MLLW	m^3/yr	31	2.8
TRU	m^3/yr	23[g]	5.8
Mixed TRU	m^3/yr	N/A[g]	

[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 (TA-33 and TA-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 1,724 million gallons per year.

[d] Discharges to Outfall 03A027 (Metropolis Center) were directed to Outfall 001 beginning September 9, 2016, and are not included in this table.

[e] Discharges to Outfall 03A160 (National High Magnetic Field Laboratory) have been directed to the SWWS beginning on May 3, 2018.

[f] The total chemical waste for 2019 exceeded 2008 SWEIS projections because of press filter cakes from Sanitary Effluent Reclamation Facility, which accounted for 37% (426,937 kilograms) of the total chemical waste generated and reverse osmosis water, which accounted for 58% (1,149,585 kilograms).

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

Appendix B: Chemical Usage and Estimated Emissions

Chemical Usage and Estimated Emissions (kg/year)				
Key Facility	Toxic Air Pollutants*	CAS Number	2019 Usage	2019 Estimated Air Emissions
High Explosives Processing Facilities	Acetone	67-64-1	47.461	16.611
	Isopropyl Alcohol	67-63-0	405.342	141.870
	Methyl Alcohol	67-56-1	3.168	1.109
	Potassium Hydroxide	1310-58-3	1.000	0.350
	Propane	74-98-6	143.419	0.000
	Propylene Glycol Monomethyl Ether	107-98-2	0.924	0.323
	Zinc Oxide Fume	1314-13-2	0.331	0.003
High Explosives Testing Facilities	Acetylene	74-86-2	11.843	0.000
	Chlorodifluoromethane	75-45-6	2.502	0.876
	Diethylene Triamine	111-40-0	17.172	6.010
	Isopropyl Alcohol	67-63-0	14.523	5.083
	Propane	74-98-6	119.053	0.000
Bioscience Facilities	Acetic Acid	64-19-7	3.153	1.104
	Acetone	67-64-1	25.312	8.859
	Acetonitrile	75-05-8	86.574	30.301
	Ammonium Chloride (Fume)	12125-02-9	1.500	0.525
	Benzene	71-43-2	1.758	0.615
	Chloroform	67-66-3	4.333	1.517
	Dimethyl Amine	124-40-3	0.317	0.111
	Ethanol	64-17-5	194.763	68.167
	Ethyl Acetate	141-78-6	158.754	55.564
	Ethyl Ether	60-29-7	1.428	0.500
	Formamide	75-12-7	0.567	0.198
	Formic Acid	64-18-6	9.835	3.442
	Hexane (other isomers)* or n-Hexane	110-54-3	127.518	44.631
	Hydrogen Chloride	7647-01-0	7.560	2.646
	Hydrogen Peroxide	7722-84-1	22.200	7.770
	Isobutane	75-28-5	9.072	3.175
	Isopropyl Alcohol	67-63-0	16.093	5.632
	Methyl Acrylate	96-33-3	0.239	0.084
	Methyl Alcohol	67-56-1	26.928	9.425
	Methylene Chloride	75-09-2	119.643	41.875
	n,n-Dimethyl Acetamide or Dimethyl Acetamide	127-19-5	3.772	1.320
	n,n-Dimethylformamide	68-12-2	173.140	60.599
	Phenol	108-95-2	1.608	0.563
	Phosphoric Acid	7664-38-2	1.608	0.563
	Propane	74-98-6	22.680	0.000
	Pyridine	110-86-1	0.983	0.344
	Sulfuric Acid	7664-93-9	6.444	2.255
	Tetrahydrofuran	109-99-9	7.992	2.797
	Tetrasodium Pyrophosphate	7722-88-5	0.250	0.088
	Thionyl Chloride	7719-09-7	4.100	1.435
	Toluene	108-88-3	1.734	0.607
	Triethylamine	121-44-8	1.458	0.510

Chemical Usage and Estimated Emissions (kg/year)				
Key Facility	Toxic Air Pollutants*	CAS Number	2019 Usage	2019 Estimated Air Emissions
LANSCE	Acetone	67-64-1	73.505	25.727
	Acetylene	74-86-2	40.462	0.000
	Carbon Black	1333-86-4	0.454	0.159
	Chlorodifluoromethane	75-45-6	2.002	0.701
	Diacetone Alcohol	123-42-2	0.444	0.155
	Ethanol	64-17-5	6.151	2.153
	Isopropyl Alcohol	67-63-0	44.072	15.425
	Propane	74-98-6	391.469	0.000
	Triphenylphosphate	115-86-6	3.672	1.285
	Xylene (o-,m-,p-Isomers)	1330-20-7	1.835	0.642
Plutonium Facility Complex	Acetone	67-64-1	3.955	1.384
	Acetylene	74-86-2	42.867	0.000
	Aluminum numerous forms	7429-90-5	0.250	0.003
	Ethanol	64-17-5	135.533	47.437
	Hydrogen Chloride	7647-01-0	180.078	63.027
	Hydrogen Fluoride, as F	7664-39-3	8.919	3.122
	Hydrogen Peroxide	7722-84-1	9.514	3.330
	Indium & compounds, as In	7440-74-6	0.300	0.105
	Lead, el&inorgcompounds, as Pb	7439-92-1	0.250	0.003
	Methyl 2-Cyanoacrylate	137-05-3	3.005	1.052
	Methyl Alcohol	67-56-1	3.247	1.137
	Nickel, metal (dust) or Soluble & Inorganic Comp.	7440-02-0	0.500	0.175
	Nitric Acid	7697-37-2	279.134	97.697
	Phosphoric Acid	7664-38-2	9.460	3.311
	Potassium Hydroxide	1310-58-3	58.001	20.300
	Propane	74-98-6	122.402	0.000
	Sulfuric Acid	7664-93-9	244.857	85.700
	Tributyl Phosphate	126-73-8	0.982	0.344
Radiochemistry Facility	1,4-Dioxane	123-91-1	3.108	1.088
	Acetic Acid	64-19-7	3.943	1.380
	Acetone	67-64-1	171.650	60.077
	Acetonitrile	75-05-8	40.374	14.131
	Ammonium Chloride (Fume)	12125-02-9	1.000	0.350
	Benzene	71-43-2	1.758	0.615
	Beryllium	7440-41-7	0.231	0.081
	Cadmium, el.&compounds, as Cd	7440-43-9	3.500	1.225
	Chlorobenzene	108-90-7	0.555	0.194
	Chloroform	67-66-3	3.115	1.090
	Copper	7440-50-8	0.500	0.005
	Cyclohexene	110-83-8	0.810	0.284
	Ethanol	64-17-5	11.850	4.148
	Ethyl Acetate	141-78-6	12.628	4.420
	Ethyl Ether	60-29-7	22.134	7.747
	Formic Acid	64-18-6	0.305	0.107
	Hexane (other isomers)* or n-Hexane	110-54-3	24.252	8.488
	Hydrogen Bromide	10035-10-6	14.980	5.243
	Hydrogen Chloride	7647-01-0	561.864	196.652

Chemical Usage and Estimated Emissions (kg/year)				
Key Facility	Toxic Air Pollutants*	CAS Number	2019 Usage	2019 Estimated Air Emissions
Radiochemistry Facility (continued)	Hydrogen Fluoride, as F	7664-39-3	23.289	8.151
	Hydrogen Peroxide	7722-84-1	64.103	22.436
	Isobutyl Alcohol	78-83-1	2.000	0.700
	Isopropyl Alcohol	67-63-0	29.438	10.303
	Mercury numerous forms	7439-97-6	6.412	0.064
	Methyl Alcohol	67-56-1	34.849	12.197
	Methylene Chloride	75-09-2	0.793	0.278
	n,n-Dimethylformamide	68-12-2	1.900	0.665
	n-Butyl Alcohol	71-36-3	0.810	0.284
	n-Heptane	142-82-5	4.923	1.723
	Nitric Acid	7697-37-2	2088.893	731.113
	Nitromethane	75-52-5	0.570	0.199
	Pentane (all isomers)	109-66-0	3.756	1.315
	Phosphoric Acid	7664-38-2	45.598	15.959
	Propane	74-98-6	690.363	0.000
	Pyridine	110-86-1	5.898	2.064
	Sulfuric Acid	7664-93-9	3.682	1.289
	Tetrahydrofuran	109-99-9	14.608	5.113
	Toluene	108-88-3	11.445	4.006
	Tributyl Phosphate	126-73-8	3.437	1.203
	Triethylamine	121-44-8	0.365	0.128
	Xylene (o-,m-,p-Isomers)	1330-20-7	43.181	15.113
RLWTF	Hydrogen Chloride	7647-01-0	2.100	0.735
	Potassium Hydroxide	1310-58-3	6.000	2.100
	Sulfuric Acid	7664-93-9	421.848	147.647
Target Fabrication Facility	Acetic Anhydride	108-24-7	0.540	0.189
	Acetone	67-64-1	87.011	30.454
	Acetonitrile	75-05-8	3.148	1.102
	Acrylamide	79-06-1	1.000	0.350
	Acrylic Acid	79-10-7	6.000	2.100
	Aluminum numerous forms	7429-90-5	5.000	0.050
	Ammonium Chloride (Fume)	12125-02-9	2.000	0.700
	Catechol	120-80-9	0.500	0.175
	Copper	7440-50-8	2.000	0.020
	Cyclohexane	110-82-7	38.172	13.360
	Dicyclopentadiene	77-73-6	0.500	0.175
	Divinyl Benzene	1321-74-0	0.930	0.326
	Ethanol	64-17-5	92.335	32.317
	Ethyl Acetate	141-78-6	86.593	30.308
	Ethyl Ether	60-29-7	3.570	1.250
	Ethylene Dichloride	107-06-2	2.506	0.877
	Hexane (other isomers)* or n-Hexane	110-54-3	63.265	22.143
	Hydrogen Chloride	7647-01-0	2.625	0.919
	Hydrogen Fluoride, as F	7664-39-3	1.000	0.350
	Hydrogen Peroxide	7722-84-1	0.555	0.194
	Iodine	7553-56-2	0.500	0.175
	Isopropyl Alcohol	67-63-0	130.312	45.609

Chemical Usage and Estimated Emissions (kg/year)				
Key Facility	Toxic Air Pollutants*	CAS Number	2019 Usage	2019 Estimated Air Emissions
Target Fabrication Facility (continued)	Methacrylic Acid	79-41-4	3.500	1.225
	Methyl Alcohol	67-56-1	38.017	13.306
	Methyl Silicate	681-84-5	1.200	0.420
	Methylene Chloride	75-09-2	43.627	15.269
	n,n-Dimethylformamide	68-12-2	54.151	18.953
	n-Butyl Alcohol	71-36-3	0.810	0.284
	n-Heptane	142-82-5	10.941	3.829
	Nitric Acid	7697-37-2	8.321	2.912
	Pentane (all isomers)	109-66-0	1.252	0.438
	Phosphorus Oxychloride	10025-87-3	0.250	0.088
	Propane	74-98-6	68.040	0.000
	Silica, Quartz	14808-60-7	30003.000	1.050
	Styrene	100-42-5	3.624	1.268
	tert-Butyl Alcohol	75-65-0	1.560	0.546
	Tetrahydrofuran	109-99-9	28.416	9.946
	Thionyl Chloride	7719-09-7	1.640	0.574
	Toluene	108-88-3	16.473	5.766
	Toluene-2,4-diisocyanate (TDI)	584-84-9	0.250	0.088
	VM & P Naphtha	8032-32-4	16.000	5.600
	Acetylene	74-86-2	63.244	0.000
	Isopropyl Alcohol	67-63-0	27.755	9.714

Appendix C: Nuclear Facilities List

List of Los Alamos National Laboratory Nuclear Facilities

LIST–SBD-503-R1.1

Prepared by:

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Date: 1/2/19

☒ Unclassified ☐ UCNI ☐ Classified ☐ OUO	Derivative Classifier Name: KAREN J McHugh Signature: [signature]	Date: 12/19/18

Revision Log

Document Number	Revision	Date	Description of Change
LIST-SBD-503	1.1	December 2018	Correction to Table 1
LIST-SBD-503	1	November 2018	Removed Area G and the NES sites per DOE EM-LA awarded N3B the Los Alamos Legacy Cleanup Contract per memo DIR-18-084.
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

Revision Log

Document Number	Revision	Date	Description of Change
	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, 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

Revision Log

Document Number	Revision	Date	Description of Change
			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 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

Changes in Nuclear Facility Status

Date	Description
November 2018	Removed TA-54 Waste Storage and Disposal Facility (Area G) Removed TA-21 MDA A NES (General's Tanks) Removed TA-21 MDA T NES Removed TA-35 MDA W NES Removed TA-49 MDA AB NES Removed TA-54 MDA H NES

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
EM-LA	Environmental Management - Los Alamos Site Office
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
N3B	Stoller Newport News Nuclear Inc. and BWNT Technical Services Group
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

Acronym	Definition
SM	South Mesa
SST	Safe-Secure Trailer
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 as defined by the Prime Contract No. 89233218CNA000001 to Triad National Security, LLC for the Management and Operation of Los Alamos National Laboratory.

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 Radioactive Assay Nondestructive Testing (RANT) Facility
2	TA-63 Transuranic Waste Facility (TWF)

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/ddops/aldeshqss/nuclear-safety/safety-basis/safety-basis-document-list.shtml

Table 2. Nuclear Facility Categorization Information

TA	Bldg	Haz Cat	Facility Name	Description
Site Wide		2	Site Wide Transportation	Laboratory nuclear materials transportation
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
3	0029	2	Chemistry and Metallurgy Research Facility CMR	Actinide chemistry research and analysis
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.
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.
50	0069	2	TA-50 Waste Characterization Reduction and Repackaging Facility (WCRRF)	Waste characterization, reduction, and repackaging facility
	External	2		Drum staging activities outside TA-50-69

TA	Bldg	Haz Cat	Facility Name	Description
54	0038	2	TA-54 Radioactive Assay Nondestructive Testing (RANT) Facility	TRUPACT-II and HalfPACT loading of drums for shipment to WIPP
63	Multiple	2	TA-63 Transuranic Waste Facility	A facility for storage, characterization, and intra-site shipping of transuranic (TRU) waste.