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Los Alamos
NATIONAL LABORATORY

SWEIS

Site-Wide Environmental Impact Statement
Yearbook 2021

Los Alamos
NATIONAL LABORATORY

LA-UR-22-32473

SWEIS Yearbook 2021:

Comparison of 2021 Data with Projections of the 2008 Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory

Prepared for: U.S. Department of Energy/National Nuclear Security Administration, Los Alamos Field Office

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View of the Rio Grande Valley from White Rock Canyon Overlook, White Rock, New Mexico
by Alexa Verardo

The cover art is dedicated in Julia Whitworth's memory.

Los Alamos NATIONAL LABORATORY

IN MEMORY OF JULIA WHITWORTH

March 27, 1967–September 28, 2022

For anyone who had the privilege of knowing Julia Whitworth, you would have immediately recognized her compassionate heart, love for family and friends, and a pursuit of equality in the world around her. She was a dedicated daughter, wife, mother, sibling, colleague, and friend to many. As the program manager of the newly created Site-Wide Environmental Impact Statement (SWEIS) program office, Julia brought with her decades of experience in not only National Environmental Policy Act compliance but also environmental cleanup, hazardous waste management, groundwater remediation, and program management. She was a brilliant scientist, tenacious worker, staunch advocate for her programs, and a leader and mentor to many. This year's SWEIS Yearbook is dedicated to Julia.

For those of you who did not have the chance to meet Julia, we want to share a little insight into the amazing individual we were lucky to have worked alongside and who will be missed beyond words.

She was a child prodigy: Julia started kindergarten at the age of 5, but after six weeks, she was moved up to first grade because she was teaching her fellow students how to read. She also received the Dominic Savio award for her kindness and achievement in elementary school. By the time she reached high school, she was a prolific reader and writer. She took Advanced Placement and International Baccalaureate courses and graduated valedictorian of her class. She was blessed with wonderful teachers—one of whom showed up for class banged up from a plane crash in which the teacher had been the pilot. Ah, the seed for adventure was planted.

She was tough: Upon high school graduation at 16, she was gifted with a graduation present of a trip to England. Just before she left, a driver rear-ended her car as she waited in a left-turn lane. The collision was so strong that it snapped the driver's seat in two, but did that delay her trip even though she had terrible, terrible bruises? No indeed. She would later work at Yellowstone during the devastating wildfires of 1988, where she had a close encounter with a grizzly bear.

She was a scientist: Following graduation, Julia received a full-ride scholarship to Transylvania University in Lexington, Kentucky, and graduated with a double major in chemistry and math. Later she went on to earn a master's degree in Hydrogeology, which took her to the Ukraine following the Chernobyl nuclear plant incident. As part of the Intercontinental Ballistic Missile (ICBM) Dismantlement Project, Julia developed quality control sampling and soil cleanup standards at former liquid-fueled ICBM sites around Ukraine. She would later spend three years working for the International Atomic Energy

Agency, managing the disused sealed radioactive source conditioning and removal projects in the Philippines, Colombia, Cameroon, Costa Rica, and several other developing countries. She also completed internships on superconductors at Argonne National Laboratory.

She was an adventurer: Long before cell phones and the internet, Julia bought a round-the-world plane ticket to visit friends and see the world—often by herself. During this trip, she found herself camping out on a golf course with a friend who was in the Peace Corps and having to reroute her trip due to the Sudan civil war. She arrived back in the states one week overdue. She also held a great ambition to climb the tallest mountains on each continent. She succeeded in climbing Mt. Kilimanjaro in Tanzania and Mt. Popocatépetl in Mexico. While climbing Mt. Rainier (in training for Denali), she helped rescue two Army soldiers who had fallen into a crevasse during a sudden blizzard.

She was a wife and mother: Being a wife and mother were among Julia's greatest achievements and joys. She met the love of her life, Alex, when they were both wearing "Darth Vader" suits (i.e., respirators) while working at Sandia National Laboratories. Alex was singing "Maria" from West Side Story. Their daughter, Sophia Rose, was born on April 18, 2004. She shared her mother's passion for equal rights and was actively involved in dance, piano, and speech and debate. Sadly, Sophia's life was taken exactly three years before her mother's. Both lives bore great fruits of love, compassion, integrity, and achievement.

The Environmental Protection and Compliance Division and the members of Los Alamos National Laboratory as a whole lost a colleague and friend this year. Julia's legacy will live on through all of those whom she inspired.

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ACRONYMS

Acronym	Definition
AEI	Area of Environmental Interest
ALARA	as low as reasonably achievable
AOC	area of concern
ATS	Advanced Technology System
BSL	biosafety level
CGP	Construction General Permit
CMR	Chemistry and Metallurgy Research (Building)
CMRR	Chemistry and Metallurgy Research Replacement (Facility or Project)
CRMP	Cultural Resources Management Plan
CX	categorical exclusion
CY	calendar year
DARHT	Dual-Axis Radiographic Hydrodynamic Test Facility
DD&D	decontamination, decommissioning, and demolition
DNA	deoxyribonucleic acid
DOE	(U.S.) Department of Energy
DOE-EM	(U.S.) Department of Energy-Office of Environmental Management
EA	environmental assessment
EIS	environmental impact statement
EM	environmental management
EPA	(U.S.) Environmental Protection Agency
FY	fiscal year
GHG	greenhouse gas emissions
HMP	Habitat Management Plan
HVAC	heating, ventilation, and air conditioning
HWA	New Mexico Hazardous Waste Act
ICBM	Intercontinental Ballistic Missile
IVML	In Vivo Measurements Laboratory
IWESST	Institutional Worker, Environment, Safety, and Security Team
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Science Center
LINAC	linear accelerator
LLW	low-level (radioactive) waste
MeV	million electron volts
MGY	million gallons per year
MLLW	mixed low-level (radioactive) waste
MOV	management observation and verification
MPNHP	Manhattan Project National Historical Park
MSGP	multi-sector general permit

Acronyms

Acronym	Definition
MSL	Materials Science Laboratory
MVA	megavolt amperes
N3B	Newport News Nuclear BWXT-Los Alamos, LLC
NA-LA	National Nuclear Security Administration-Los Alamos Field Office
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
NPS	National Park Service
NRHP	National Register of Historic Places
OSRP	Off-Site Source Recovery Project
PCBs	polychlorinated biphenyls
POD	point of dispensing
PPE	personal protective equipment
RCRA	Resource Conservation Recovery Act
RLUOB	Radiological Laboratory/Utility/Office Building
RLWTF	Radioactive Liquid Waste Treatment Facility
ROD	Record of Decision
SEA	supplemental environmental assessment
SERF	Sanitary Effluent Reclamation Facility
SPEIS	Supplemental Programmatic Environmental Impact Statement
SRCW	Solid Radioactive and Chemical Waste (Facilities)
SSIP	safety and security improvement plan
SWEIS	Site-Wide Environmental Impact Statement
SWMU	solid waste management unit
SWWS	Sanitary Wastewater System
TA	Technical Area
TRP	TA-55 Reinvestment Project
TRU	transuranic
TSF	temporary storage facility
TWF	Transuranic Waste Facility
U.S.	United States
VPP	Voluntary Protection Program
VTR	vault-type room
WCATS	Waste Compliance and Tracking System
WESST	Worker, Environment, Safety and Security Team
WETF	Weapons Engineering Tritium Facility
WIPP	Waste Isolation Pilot Plant
WTA	Western Technical Area Substation

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) 2021. During CY 2021, 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 2021 exceeded annual waste volumes for the Non-Key Facilities because of the disposal of press filter cakes from the Sanitary Effluent Reclamation Facility (SERF), spill material from old mixing tanks, and construction and demolition debris from refurbishing projects. Although chemical waste volumes exceeded projections for CY 2021, 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. Electricity and water consumption remained within the 2008 SWEIS levels projected for utilities in CY 2021. Total gas consumption for CY 2021 was about 500,000 decatherms more than projected in the 2008 SWEIS. In 2021, on-site power was generated at the Combustion Gas Turbine Generator which resulted in the exceedance. At the end of CY 2021, LANL employed 14,380 staff.

Background

In 1999, the United States (U.S.) Department of Energy (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 2021 with the 2008 SWEIS projections approved in the RODs. It 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 2021 were compared with 2008 SWEIS projections.

The 2008 SWEIS No Action Alternative and approved elements of the Expanded Operations Alternative projected 24 facility construction and modification projects within the Key Facilities. During CY 2021, 23 construction and modification projects were undertaken. Table 1 provides details.

Table 1. CY 2021 Construction and Modification Projects

Key Facility	Construction/Modification Project
Chemistry and Metallurgy Research (CMR) Building	Continued Project: • Relocation of analytical chemistry and materials characterization to the Plutonium Facility Building (Technical Area [TA]-55-0004) and the Radiological Laboratory/Utility/Office Building
Sigma Complex	Continued Projects: • Construction of the 4,000-square-foot addition • Construction for the Large Chamber High-Voltage Electron Beam Welder • Upgrades to electrochemistry operations lab space; completed in 2021
Machine Shops	Continued Projects: • Relocation of uranium machining equipment to Sigma Building • Modification/reconfiguration of rooms in TA-03-0039 for machine shop operations
High Explosives Processing	New Projects: • Properties of inertia equipment installation in TA-16-0207 • Fire protection and electrical upgrades at TA-11 K-Site • Fire protection installations at TA-16-0301, -0305, and -0307 • Fire protection installation at TA-08-0023 • Fire protection installation at TA-11 K-Site • TA-16-0202, Room 114, heating, ventilation, and air conditioning (HVAC) installation

Key Facility	Construction/Modification Project
High Explosives Testing	New Projects: • Completed design of the TA-40 Building 0023 renovation; work began in 2021 • Installation of the TA-15-0534 HVAC replacement was completed • HVAC and Electrical Upgrades at TA-40-0023 • Installation of the TA-22-0091 Clean Room Installation
Weapons Engineering Tritium Facility (WETF)	New Project: • Replacement of the 16-450 chiller unit with two more-efficient units; replacement of the associated building automation system
Target Fabrication Facility	Continued Project: • Modifications in Room C16 for machining operations; completed in 2021 New Project: • Expansion of the vault-type room in Room B14
Bioscience Facilities	Continued Project: • Construction of the Bioscience Research Laboratory was completed • Upgrades to the Emerging Threats Laboratory continued
Los Alamos Neutron Science Center (LANSCE)	Continued Project: • Construction for a new storage building located to the north of Area C; completed in 2021
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 2021, 6 construction and modification projects were undertaken in the Non-Key Facilities. Table 2 provides details.

Table 2. CY 2021 Non-Key Facilities Construction and Modification Projects

Project Title	Construction/Modification Project
Oppenheimer Collaboration Center	Continued Project: • Construction on the basement floor began in 2018; completed in 2021
TA-03 Substation Replacement Project	Continued Project: • Construction of the substation; expected completion in 2022
Roof Assessment Management Program	Continued Project: • Re-roofed 33 facilities and repaired 15 facility roofs
Steam Plant Replacement Project	Continued Project: • Continued construction in 2021
Parking Garages in TA-03 and TA-50	Continued Projects: • Continued construction for the TA-03 parking garage; construction completed in 2021 • Continued construction for the TA-50 parking garage; construction completed in 2021
Multi-Use Office Building at TA-03	Continued Projects: • Continued construction for the TA-03 multi-use office building; completed in 2021

Project Title	Construction/Modification Project
Supplemental Environmental Project	Continued Project: Continued road improvement project

In CY 2021 at LANL's Key Facilities, 76 capabilities were active, and 14 capabilities were inactive. Table 3 provides details.

Table 3. Key Facility Inactive Capabilities

Key Facility	Inactive Capabilities
CMR	• Nonproliferation training • Fabrication and processing
High Explosives Testing Facility	• Hydrodynamic tests • High explosives pulsed-power experiments
WETF	• 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
Solid Radioactive and Chemical Waste Facilities	• Waste retrieval • Waste disposal • Decontamination operations
Plutonium Complex	• Fabrication of ceramic-based reactor fuels

During CY 2021, all Key Facility programmatic activities operation levels were within the 2008 SWEIS projections.

In CY 2021, 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 2021 Waste Exceedances

Waste Type	Key Facility	Reason for Exceedance
Chemical/ Hazardous	Sigma Complex	• Disposal of silica sediment generated from cooling tower maintenance • Disposal of used oil and polychlorinated biphenyls from machinery cleanup
	High Explosives Processing Facilities	• Disposal of construction and demolition debris, disposal of asbestos from re-roofing projects • Disposal of waste from cleaning process
	High Explosives Testing Facilities	• Disposal of fire suppression products • Disposal of an underground tank • Removal of asphalt from TA-14
	Radiochemistry Facility	• Disposal of unused/unspent laboratory waste

Waste Type	Key Facility	Reason for Exceedance
Chemical/ Hazardous (cont)	Radioactive Liquid Waste Treatment Facility (RLWTF)	• Disposal of surrogate test water from TA-50, Building 0230
	LANSCE	• Disposal of construction debris
	Plutonium Facility Complex	• Disposal of waste generated from maintenance • Disposal of snow melt/water
Low-Level Waste	RLWTF	• Disposal of a wastewater by-product of the treatment process of radioactive liquid waste evaporator bottom at TA-50
	High Explosives Processing Facilities	• Disposal of demolition debris
Mixed Low-Level Radioactive Waste	Sigma Complex	• Disposal of equipment associated with electrochemistry operations, disposal of brick tiles • Disposal of contaminated electronics
	Materials Science	• Disposal of depleted uranium and uranium hydride samples
	High Explosives Processing Facilities	• Disposal of demolition debris
	Target Fabrication Facility	• Disposal of legacy equipment from Rocky Flats • Disposal of debris associated with Ion Beam coating
	Radiochemistry Facility	• Disposal of lead-contaminated materials • Disposal of routine housekeeping and maintenance operations

In CY 2021, the Non-Key Facilities exceeded chemical waste volumes projected in the 2008 SWEIS because of the disposal of press filter cakes from the SERF and from the disposal of construction demolition debris from the Steam Plant Replacement Project.

Site-Wide Operations Data and Affected Resources

The Yearbook evaluates the effects of LANL operations during CY 2021 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 2021 totaled approximately 209 curies, less than 0.6 percent of the annual projected radiological air emissions of 34,000 curies[1]

[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.

projected in the 2008 SWEIS. The maximum off-site dose to the maximally exposed individual[2] was 0.29 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.

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 2021. These stationary combustion sources at LANL emitted approximately 53,693 metric tons of carbon dioxide equivalents in CY 2021.

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 2021, 7 of the 11 outfalls flowed, totaling an estimated 121.6 million gallons—well under the 2008 SWEIS projected volume of 279.5 million gallons per year.

During CY 2021, groundwater monitoring and groundwater investigations were performed pursuant to the 2016 State of New Mexico Environment Department Compliance Order on Consent (Consent Order) (NMED 2016a). DOE Office of Environmental Management installed two wells (R-71 and R-72) during 2021.

In 2018, responsibilities for multi-sector general permit (MSGP) compliance at the Laboratory transitioned. On May 1, 2018, Newport News Nuclear BWXT-Los Alamos, LLC (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 EPA's issuance of three new MSGP tracking numbers—two for N3B and one for Triad. On June 4, 2020, the 2015 MSGP expired and was administratively continued for existing MSGP facilities pending issuance of a new general permit. The 2021 MSGP was issued on January 15, 2021, with an effective date of March 1, 2021.

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 2021, 89 shipments (56 from Triad and 33 from N3B) containing TRU and mixed TRU waste were transported to WIPP.

In CY 2021, DOE/NNSA removed 16 structures at LANL, which eliminated 14,902 square feet of the Laboratory's footprint.

Water consumption for CY 2021 was 242.4 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 2021. In CY 2022, energy consumption was 453,078 megawatt-hours. The 2008 SWEIS projection for annual energy consumption was 651,000 megawatt-hours. Gas consumption for CY 2021 was 1.7 million decatherms, which exceeded the 2008 SWEIS projection for annual gas consumption of 1.2 million decatherms by 500,000 decatherms.

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

For LANL workers, radiological exposures were within the levels projected in the 2008 SWEIS. The total effective dose equivalent for the LANL workforce in CY 2021 was 300 person-rem. There were 227 recordable cases of occupational injury and illness in CY 2021. In addition, approximately 101 cases resulted in days away, restricted, or transferred duties.

At the end of CY 2021, there were 14,380 employees (including Triad and N3B employees). In September 2020, the DOE/NNSA issued an amended ROD 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.

No tracts of DOE land were conveyed or transferred in fiscal year 2021 as part of the *Environmental Impact Statement for Land Conveyance and Transfer* (DOE 1999a). In CY 2021, LANL biological resources staff continued annual surveys under the *Threatened and Endangered Species Habitat Management Plan* (LANL 2022).

No archaeological excavations occurred on LANL property in CY 2021. 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. If expansion into Zones 4 and 6 becomes necessary, Triad would follow the National Historic Preservation Act and the LANL Cultural Resources Management Plan. Under an Interagency Agreement for preservation assistance between the National Park Service (NPS) and DOE/NNSA, LANL cultural resources staff worked with the NPS on one priority project at the Manhattan Project National Historical Park.

1 INTRODUCTION

1.1 Site-Wide Environmental Impact Statement

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

In August 2005, DOE/National Nuclear Security Administration (NNSA) issued a notice of intent to prepare a new SWEIS (DOE 2005a). The new SWEIS was 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). The 2008 SWEIS tiers from the 1999 SWEIS. Tiering is a method used in NEPA analysis that allows agencies to eliminate repetitive discussion of the same issues and to focus on the specific issues in future proposed actions.

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 2021, DOE/NNSA prepared six supplement analyses to the 2008 SWEIS and published two amended RODs. These supplement analyses and amended RODs are summarized in Table 1-1.

Table 1-1. 2008 SWEIS Supplement Analyses and Amended RODs

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 off-site 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 2011a) to assess activities of the Off-Site Source Recovery Project (OSRP) to recover and manage high-activity beta/gamma sealed sources from Uruguay and other locations.

Reference Number	Issue Date	Summary
DOE/EIS-0380, 76 FR 131	July 2011	DOE/NNSA published an amended SWEIS ROD in the Federal Register on July 20, 2011 (DOE 2011b), in response to the supplement analysis on the OSRP.
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 2016a).
DOE/EIS-0380-SA-04	October 2016	DOE/NNSA prepared a supplement analysis to the 2008 SWEIS for the proposal to treat, repackage, transport onsite, and store 89 TRU waste drums for disposition at the Waste Isolation Pilot Plant (WIPP). DOE/NNSA determined that no substantial changes would occur and that the proposed actions were bounded by analyses presented in the 2008 SWEIS (DOE 2016b).
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 to evaluate the continued adequacy of the 2008 SWEIS for the future of LANL operations [(2018 through 2022) (DOE 2018a)]. This supplement analysis indicated that the environmental impacts for the period 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).
DOE/EIS-0380-SA-06	August 2020	DOE/NNSA prepared a sixth supplement analysis to the 2008 SWEIS to re-evaluate adopting elements of the Expanded Operation Alternative for producing no fewer than 30 pits per year at LANL with additional surge capacity, if needed, to meet Nuclear Posture Review and national policy (Public Law 115-232, Section 3120) of producing up to 80 pits per year for the nuclear weapons stockpile (DOE 2020a).
DOE/EIS-0380, 85 FR 171	September 2020	DOE/NNSA announced the amendment to the September 26, 2008, ROD for the 2008 SWEIS. DOE/NNSA decided to implement elements of the Expanded Operations Alternative needed to produce a minimum of 30 war reserve pits per year during 2026 for the national pit production mission and to implement surge efforts to exceed 30 pits per year up to the analyzed limit to meet Nuclear Posture Review and national policy (DOE 2020b).

1.2 2008 SWEIS Yearbook

DOE/NNSA and LANL implemented a program to compare annually 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 (Chapter 2). These items include projected activities for which National Environmental Policy Act (NEPA) coverage was provided by the SWEIS and some post-SWEIS activities for which NEPA coverage was provided through categorical exclusions (CXs), environmental assessments (EAs), or environmental impact statements (EISs).

Site-wide effects of operations for the calendar year (Chapter 3). These include measures such as number of workers, radiation doses, workplace incidents, utility requirements, air emissions, liquid effluents, and solid wastes. These effects also include changes in the regional aquifer, ecological resources, and other resources for which the DOE has long-term stewardship responsibilities as an owner of federal lands.

Summary and conclusion (Chapter 4). 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 (Appendix A). 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.

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

Nuclear facilities list (Appendix C). This appendix provides a summary of the facilities identified as having a nuclear hazard category[3] at the time the SWEIS was issued.

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[3] DOE-STD-1027-2018, U.S. Department of Energy (DOE 2018b). Hazard Categorization of DOE Nuclear Facilities, 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-1027-2018 (DOE 2018b) 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-1027-2018 (DOE 2018b) provides the Category 3 thresholds for radionuclides.

Data for comparison come from a variety of sources, including facility records, operations reports, facility personnel, and the Annual Site Environmental Report.[4] 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 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 regarding if and when a new SWEIS is needed.

1.3 CY 2021 SWEIS Yearbook

This Yearbook represents data collected for CY 2021 compared with the 2008 SWEIS projections. The collection of data on facility operations is a unique effort. The type of information developed for the 2008 SWEIS is not routinely compiled at LANL. Nevertheless, this information is the heart of the 2008 SWEIS and the Yearbook, and the description of current operations and indications of future changes in operations are believed to be sufficiently important to warrant this effort.

DOE's Office of Environmental Management (DOE-EM) is responsible for legacy waste cleanup operations at LANL. In April 2018, Newport News Nuclear BWXT-Los Alamos, LLC (N3B) took over as the subcontractor for legacy waste cleanup management and operations. The legacy waste generation was projected in the 2008 SWEIS through fiscal year (FY) 2016, so in 2017, the Yearbook began tracking annual waste generation totals by adding them to the cumulative total (CY 2007–2021) and then comparing them with the 2008 SWEIS 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.

1.4 NEPA Documents Prepared in CY 2021

In April 2021, the DOE/NNSA issued a public notice regarding its intent to prepare an EA to upgrade the Laboratory's electrical power capacity by constructing and operating a new 115-kilovolt power transmission line and by upgrading the LANL's existing electrical infrastructure. The proposed transmission line would originate at Public Service Company of New Mexico's Norton Substation located on public lands managed by the U.S. Department of Interior, Bureau of Land Management. The proposed transmission line would proceed southwesterly—crossing the Caja del Rio public land managed by the U.S. Department of Agriculture, Santa Fe National Forest, and ultimately spanning White Rock Canyon—onto DOE/NNSA-managed lands at LANL. On May 6, 2021, a virtual public scoping meeting was held with the public comment period ending on May 21, 2021. The EA is currently being drafted, with consideration of all public scoping meeting comments received.

On December 16, 2020, the NNSA announced its notice of intent to prepare an EIS for the Surplus Plutonium Program. NNSA announced that it will prepare a Surplus Plutonium Disposition Program EIS to evaluate the dilute and dispose alternative, also known as *plutonium downblending*, and any other

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

identified reasonable alternatives for the disposition of surplus plutonium. The dilute and dispose approach would require new, modified, or existing capabilities at the Savannah River Site, LANL, the Pantex Plant, and the Waste Isolation Pilot Plant (DOE 2020c). In CY 2021, the EIS was being drafted.

Four LANL projects were categorically excluded from further DOE NEPA review in 2021. Three projects were prepared by NNSA-Los Alamos Field Office (NA-LA):

- Construction and Operation of a Light Manufacturing Facility to support the Isotope Production Program at Los Alamos National Laboratory (DOE 2021a)
- Domestic Atmospheric Radiation Measurement Campaigns (ARM) (DOE 2021b)
- Leasing Laboratory Space (DOE 2021c)

One project was prepared by DOE-EM:

- Removal, Relocation, and Examination of Remaining Transuranic (TRU) Waste at Waste Control Specialists, LLC (WCS) (DOE 2021d)

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, White Rock, and TA-57 at Fenton Hill. In CY 2021, Triad managed 897 buildings, trailers, and transportable buildings that contained 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/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 2021, Triad leased approximately 38 buildings and trailers within Los Alamos County and in Carlsbad, New Mexico. Also, in August 2021, DOE/NNSA posted a CX for leasing property. The CX announced DOE/NNSA's intent to lease previously developed property to provide laboratory space for bioscience research within a 50-mile radius of LANL, which may include existing structures located in Los Alamos, Rio Arriba, Sandoval, and Santa Fe Counties. To present a logical, comprehensive evaluation of the potential environmental impacts at LANL, the 1999 SWEIS (DOE 1999b) 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[5] and capabilities, and the locations are not necessarily confined to a single structure, building, or TA. The number of structures that comprise a Key Facility ranges from 1 (e.g., the Target Fabrication Facility) to more than 400 structures (e.g., 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.

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-

[5] As used in the 1999 and 2008 SWEISs and this Yearbook, facility operations include three categories of activities: research, production, and services to other LANL organizations. Research is both theoretical and applied. Examples include modeling (e.g., atmospheric weather patterns), 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.

than-Hazard-Category-3 Nuclear Facility (radiological facility) (LANL 2018a). Part of the Manhattan Project National Historical Park (MPNHP) at LANL is located at the northeastern boundary of TA-18.

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 2021.

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 2021 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 2018a). Appendix C provides a summary of the current nuclear facilities. In each section of Chapter 2, tables 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 DOE/NNSA 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, and
- the Sensitive Compartmented Information Facility for Global Security, officially named the Donald M. Kerr Office Building.

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)
Chemistry 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

Key Facility	TAs	Size (acres)
Radioactive Liquid Waste Treatment Facility (RLWTF)	50	62
LANSCE	53	751
Solid Radioactive and Chemical Waste (SRCW) Facilities	50, 54, 60, 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

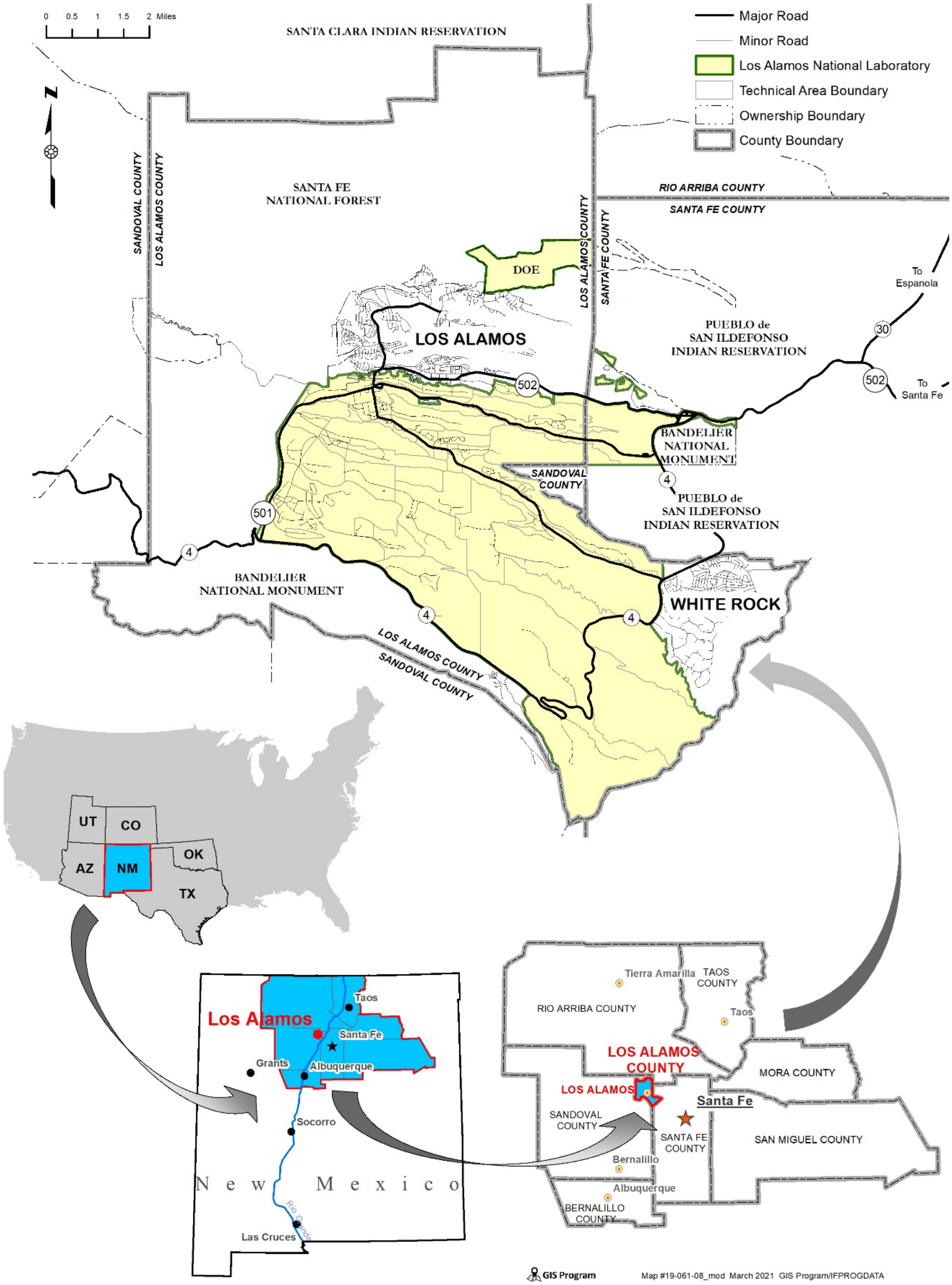

Figure 2-1. Location of Los Alamos National Laboratory.

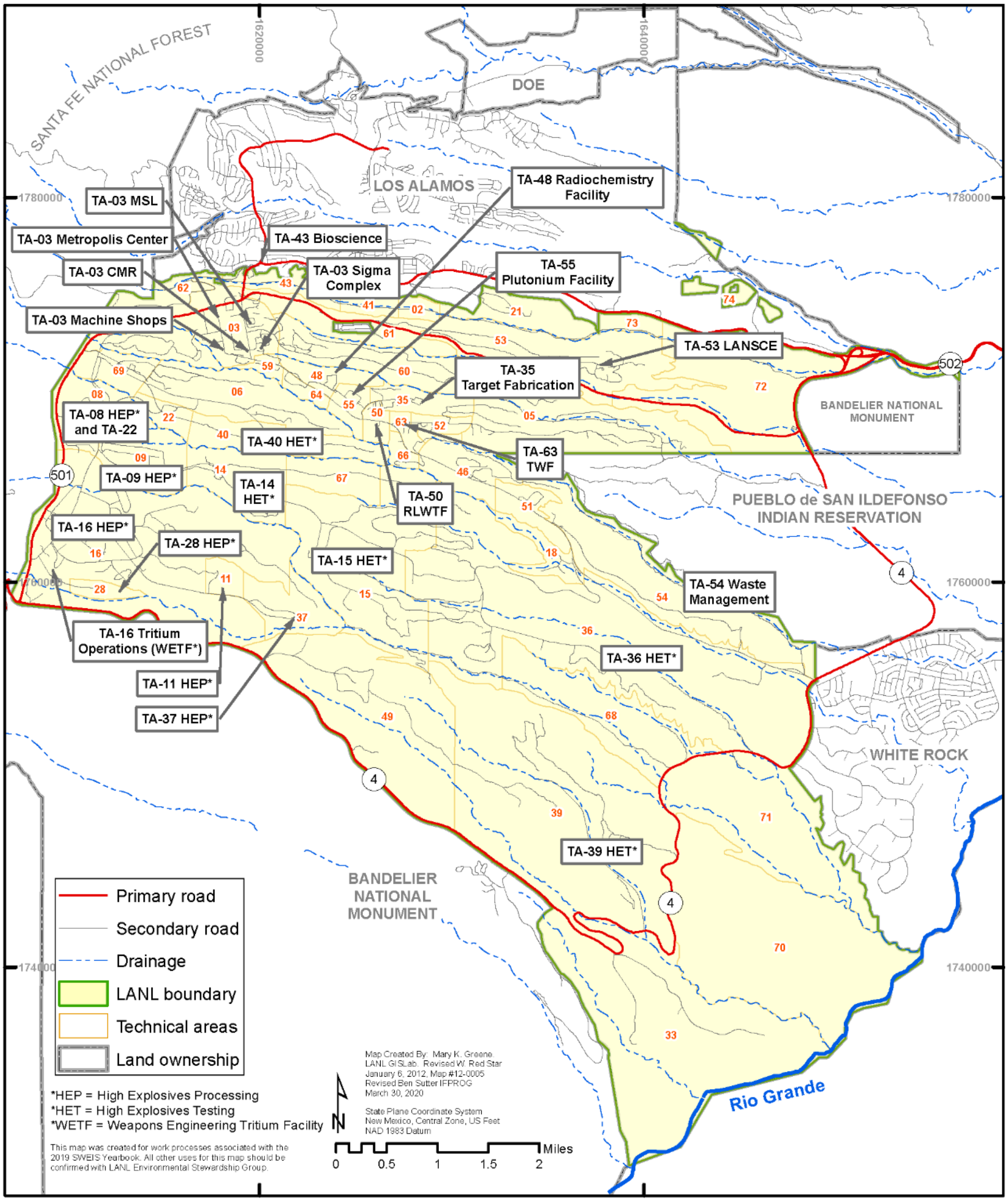

Figure 2-2. Location of Technical Areas and Key Facilities.

2.1 Chemistry 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 2021[a]
TA-03-0029	CMR	2	2

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

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

In November 2003, DOE/NNSA published an EIS for the Chemistry and Metallurgy Research Replacement (CMRR) Project (DOE 2003). The EIS 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 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 2011c).	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 2011d).
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 2018c).	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 2018d).

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 that involved various actinides. 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. The vessel processing is complete.

In CY 2021, 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 2021, and all three were below operational levels projected in the 2008 SWEIS (Table A-1). As mentioned previously, the vessel processing capability is complete.

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.

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 performed at the Sigma Complex are 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, several new construction and major modifications have occurred over the last 5 years. These efforts are expected to continue, driven by the need for refurbishment and/or recapitalization of essential capabilities and improvement in waste and/or radiological operations. In CY 2016, a 4,000-square-foot addition was proposed for the northeast corner of the main Sigma Building (TA-03-0066). In 2017, DOE/NNSA issued a CX 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 will 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. Uranium-machining equipment is planned to be relocated from the Radiological Hazardous Machine Shops at TA-03-0102 into the new addition at the Sigma Building during CY 2022. Significant laboratory space upgrades to support electrochemistry operations were underway in CY 2020 and were completed in CY 2021.

2.2.2 Operations at the Sigma Complex

The 2008 SWEIS identified three capabilities (research and development on materials fabrication, coating, joining, and processing, characterization of materials, and fabrication of metallic and ceramic items) for the Sigma Complex. All three of the capabilities were active in CY 2021 and performed as projected in the 2008 SWEIS.

2.2.3 Operations Data for the Sigma Complex

In CY 2021, operations data levels at the Sigma Complex were below levels projected in the 2008 SWEIS with two exceptions:

- Chemical waste generation at the Sigma Complex exceeded 2008 SWEIS projections mostly because of
  - disposal of silica sediment generated from cooling tower maintenance, which accounted for 54 percent (13,767 kilograms) of the total chemical waste generated; and
  - disposal of used oil and polychlorinated biphenyls (PCBs) from machinery cleanup operations, which accounted for 19 percent (4,952 kilograms) of the chemical waste generated.
- Mixed low-level waste (MLLW) generation exceeded 2008 SWEIS projections at the Sigma Complex because of
  - disposal of material associated with electrochemistry operations, which accounted for 51 percent (12.7 cubic meters) of the total MLLW generated;
  - disposal of brick tiles removed during an upgrade project, which accounted for 20 percent (5 cubic meters) of the total MLLW generated; and
  - disposal of electronics contaminated with uranium and beryllium, which accounted for 20 percent (5 cubic meters) of the total MLLW generated at the Sigma Complex (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, fabrication, inspection, and assembly of various materials in support of many LANL Weapons programs and Global Security 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 were initiated to relocate uranium machining equipment and operations to the Sigma Building (TA-03-0066), and planning is ongoing. In CY 2021, modification and reconfiguration of rooms in TA-03-0039 for machine shop operations continued, including construction of a modular inspection lab. The project received full Beneficial Occupancy in March 2021.

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 2021 and performed as projected in the 2008 SWEIS. The workload at the Machine Shops is directly linked to research and development and production requirements. Operations data levels at the Machine Shops remained below levels projected in the 2008 SWEIS. Table A-6 provides operations data details.

2.4 Materials Science Laboratory Complex (TA-03)

The Materials Science Laboratory (MSL) 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, ~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.[6] In CY 2021, all five of the capabilities were active and performed as projected in the 2008 SWEIS (Table A-7).

2.4.3 Operations Data for the Materials Science Laboratory

Operations data levels at the Materials Science Laboratory remained below levels projected in the 2008 SWEIS with one exception: In CY 2021, MLLW generation at the MSL exceeded 2008 SWEIS projections because of the disposal of depleted uranium and uranium hydride samples, which accounted for 100 percent (0.1 cubic meter) of the total. Table A-8 provides operations data details.

2.5 Nicholas C. Metropolis Center for Modeling and Simulation

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 impacts associated with operating the Metropolis Center at an initial capacity of a 50-teraflop[7] platform were analyzed in the “Environmental Assessment for the Proposed Strategic Computing Complex," Los Alamos National Laboratory, Los Alamos, New Mexico (DOE 1998). 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).

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

[7] A teraflop is a measure of a computer’s speed and can be expressed as a trillion floating-point operations per second, 10 to the 12th power floating-point operations per second, 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 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.

A new high-performance computer system called Crossroads will be the next supercomputer to serve the mission of national security science and will run some of the largest and most demanding simulations for stockpile stewardship. The Crossroads system will improve efficiency in three key areas: application performance, workflow, and application development. Crossroads received the first cabinets and racks in CY 2022 and is expected be fully operational by CY 2023. The second generation of Commodity Technology Systems is expected to be operational by CY 2023. Both systems 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.[8]

A final design for a minor construction electrical upgrade project needed for the Advanced Technology System (ATS)-5 computer is expected to be complete in CY 2022. The upgrade is expected to increase computing power with an electrical power load up to approximately 50 megawatts. Long-lead equipment is being procured in 2023, and construction is expected to commence in 2024. Due to investments in operational efficiency for mechanical cooling, the ATS-5 computer is not expected to require any significant 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 2021 and was performed at operational levels projected in the 2008 SWEIS (Table A-9).

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[8] 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 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.

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 per 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. The Metropolis Center water consumption is currently metered. Water usage is monitored daily and reported monthly. In CY 2021, the Metropolis Center used approximately 14.3 peak megawatts of electricity and 1 million gallons of groundwater for the Metropolis Center, and the Sanitary Effluent Reclamation Facility (SERF) provided approximately 40.5 million gallons of reclaimed water. An additional 3.1 million gallons of groundwater was used for Trinity. Operations data levels at the Metropolis Center remained below levels projected in the 2008 SWEIS. (Table A-10 provides operations data details).

2.6 High Explosives Processing 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.

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 from multiple directorates, divisions, and groups. One of the facilities that supports the majority of the high explosives processing facilities is TA-16-0260, where high explosives materials are pressed into shapes and then machined to meet customer specifications. 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 has not been pursued. The following construction and modifications to buildings in the High Explosives Processing area were completed in CY 2021:

- Properties-of-inertia equipment installation in TA-16-0207
- Fire protection and electrical upgrades at TA-11 K-Site
- Fire protection system installation at TA-16-0301, -0305, and -0307
- Fire protection system installation at TA-08-0023
- Fire protection system installation at TA-11 K-Site
- Heating, ventilation, and air conditioning (HVAC) installation at TA-16-0202, Room 114

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 2021 and were performed as 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 2021, less than 8,000 pounds (3,628 kilograms) of high explosives and less than 1,500 pounds (680 kilograms) of mock explosives material were used in the fabrication of test components for internal and external customers. In CY 2021, 375 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 2021, high explosives processing and high explosives laboratory operations generated approximately 12,785 gallons (58,121 liters) of explosives-contaminated water, which was treated at the High Explosives Wastewater Treatment Facility. All high explosives burning operations are conducted at TA-16-0388. Approximately 2,208 pounds (1,001 kilograms) of water-saturated high explosives and 4,640 pounds (2,104 kilograms) of high-explosives-contaminated scrap metal were treated annually. No explosives-contaminated solvents were treated. Approximately 5,151 gallons (23,416 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 2021, efforts continued to

- develop protocols for obtaining stockpile-returned materials,
- develop new test methods, and
- procure new equipment to support requirements for science-based studies on stockpile and energetic materials.

Completion of one detonator lot typically takes 18 months from start to finish. Two major product lines were manufactured in CY 2021.

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 three exceptions:

- In CY 2021, chemical waste generation at the High Explosives Processing Facility exceeded 2008 SWEIS projections because of disposal of
  - asbestos from re-roofing projects at TA-16, which accounted for 14 percent (26,481 kilograms);
  - demolition debris from the remodel of TA-16-0969, which accounted for 8 percent (14,329 kilograms) of the total waste;
  - construction and demolition debris generated from the TA-22-0090 conference room upgrade project, which accounted for 8 percent (14,379 kilograms) of the total waste;
  - waste generated from a cleaning process to remove oils from aluminum parts at TA-22, which accounted for 6 percent (10,788 kilograms) of the total chemical waste generated, and
  - construction debris generated from TA-08-0022 upgrades, which accounted for 6 percent (10,541 kilograms) at the High Explosives Processing facility.
- In CY 2021, LLW waste generation at the High Explosives Processing Facility exceeded 2008 SWEIS projections because of the disposal of demolition debris from the demolition of TA-16-0460, -0462, and -0463, which accounted for 100 percent (65 cubic meters) of the LLW.
- MLLW generation at the High Explosives Processing Facility also exceeded 2008 SWEIS projections because of the disposal of demolition debris from the demolition of TA-16-0460, -0462, and -0463, which accounted for 100 percent (17 cubic meters) of the MLLW. See Table A-12 for details.

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

High Explosives Testing Facilities, located in five TAs (TA-14, -15, -36, -39, and -40), 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 facilities that support this Key Facility are located at TA-15 and include the Dual-Axis Radiographic Hydrodynamic Test Facility (DARHT; 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 2021; however, the following modifications and upgrades to existing facilities were completed in CY 2021:

- Design of the TA-40-0023 renovation; work began in CY 2021
- Installation of the TA-15-0534 HVAC replacement
- Upgrade of HVAC and Electrical at TA-40-0023
- Installation of the TA-22-0091 Clean Room

2.7.2 Operations at the High Explosives Testing Facilities

The 2008 SWEIS identified six capabilities at this Key Facility. Three hydrodynamic tests were conducted in CY 2021. All capabilities were active in CY 2021 and were performed as 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 2021, 275 pounds (125 kilograms) of depleted uranium was expended. The quantity of expended depleted uranium includes the quantity of depleted uranium expended during material sanitization. Three hydrotests were performed at the DARHT Facility in CY 2021.

2.7.3 Operations Data for the High Explosives Testing Facilities

Operations data levels at the High Explosives Testing Facilities remained below levels projected in the 2008 SWEIS with one exception: In CY 2021, chemical waste generation at the High Explosives Treatment Facility exceeded 2008 SWEIS projections because of

- disposal of fire suppression products, which accounted for 39 percent (69,724 kilograms);
- disposal of an underground tank, which accounted for 14 percent (25,809 kilograms); and
- removal of asphalt from TA-14, which accounted for 6 percent (12,682 kilograms) of the chemical waste generated at the High Explosives Treatment Facility.

2.8 Tritium Facility (TA-16)

The Weapons Engineering Tritium Facility (WETF) in 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. Most tritium operations are conducted in Building 205. Building 450 is physically connected to but radiologically separated from Building 205 and is not currently operational with tritium. Buildings 329 and 824 are office buildings.

WETF is listed as a Hazard Category 2 Nuclear Facility (see Table 2-4). In CY 2021, the tritium inventory at WETF was greater than 30 grams.

Table 2-4. WETF Buildings with Nuclear Hazard Classification

Building	Description	2008 SWEIS Hazard Category	LANL 2021[a] Hazard Category
TA-16-0205	WETF	2	2
TA-16-0450	WETF	2	2

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

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. The following major modification was completed in CY 2021:

- Replacement of the TA-16-0450 chiller unit with two more efficient units; replacement of the associated building automation system.

2.8.2 Operations at the Tritium Facilities

The 2008 SWEIS identified eight capabilities for this Key Facility.[9] Five of the eight capabilities were active in CY 2021. All capabilities were performed as projected in the 2008 SWEIS. Gas processing operations were conducted in CY 2021. Table A-15 provides details.

Flanged tritium waste containers are used for disposal of tritium-contaminated materials from WETF. The Nevada National Security Site (NNSS) has approved a waste stream profile that allows for the disposal of classified tritium-containing items from WETF. Two containers were shipped to NNSS for disposal in 2021. Three more containers will be loaded and shipped to NNSS in the near term.

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 2021, modifications continued for Room C16 machining operations and were completed in 2021. Construction

[9] 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.

on room B14 was started to expanded as a vault-type room. Other minor modifications were completed to add additional equipment to the facility.

2.9.2 Operations at the Target Fabrication Facility

The primary measurement of activity for this facility is production of targets for research and testing (laser and physics testing). The 2008 SWEIS identified three capabilities at the Target Fabrication Facility. All three of the capabilities were active in CY 2021, and all were performed as projected in the 2008 SWEIS. Table A-17 provides operations details.

2.9.3 Operations Data for the Target Fabrication Facility

Operations data levels at the Target Fabrication Facility remained below levels projected in the 2008 SWEIS with one exception: In CY 2021, MLLW generation at the Target Fabrication Facility exceeded 2008 SWEIS projections because of the disposal of legacy equipment from Rocky Flats, which accounted for 92 percent (46 cubic meters), and because of the disposal of debris associated with ion beam coating, which accounted for 8 percent (4 cubic meters) of the waste generated.

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 CX for a new modular BSL-2 facility. This facility—previously referred to as the Commercial Engineered Facility Construction 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 2018e). In CY 2019, the site was prepared for the construction of the new Bioscience Research Laboratory. The module arrived, and building construction continued into 2020. The building is undergoing startup and commissioning and received full Beneficial Occupancy in 2022.

During CY 2004, construction was finalized on a BSL-3 facility (TA-03-1076), 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 was undergoing readiness work to enable BSL-2 and chemical operations under the new Emerging Threats Laboratory. 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 with additional upgrades. The building is expected to receive full Beneficial Occupancy in 2023.

2.10.2 Operations at the Bioscience Facilities

The 2008 SWEIS identified 12 capabilities for this Key Facility. Eleven capabilities were active in CY 2021, 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 that involve 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.

2.10.3 Operations Data at the Bioscience Facilities

In CY 2021, 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 that deal primarily with radiological and chemical analyses of samples. TA-48 contains six major research buildings: TA-48-0001, -0017, -0028, -0045, -0107, and -0008.

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 2021.

2.11.2 Operations at the Radiochemistry Facility

The 2008 SWEIS identified 10 capabilities at the Radiochemistry Facility.[10] All 10 capabilities were active in CY 2021, and the capabilities were at or below projections. Table A-21 provides details on operations.

2.11.3 Operations Data for the Radiochemistry Facility

Operations data levels at the Radiochemistry Facility remained mostly below levels projected in the 2008 SWEIS with two exceptions:

- In CY 2021, chemical waste exceeded the 2008 SWEIS projections at the Radiochemistry Facility because of the disposal of unused/unspent laboratory waste, which accounted for 94 percent (12,170 kilograms) of total chemical waste generated.
- In CY 2021, MLLW exceeded the 2008 SWEIS projections at the Radiochemistry Facility because of the disposal of lead-contaminated materials from routine housekeeping and maintenance operations, which accounted for 86 percent (5.4 cubic meters) of total MLLW generated.

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).

TA-50-0250 has the capacity to store 300,000 gallons of low-level radioactive influent during an emergency, such as a wildfire. Five of the six structures are listed as Hazard Category 3 Nuclear Facilities (see 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.

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

Table 2-5. RLWTF Buildings with Nuclear Hazard Classification

TA-50 Building	Description	2008 SWEIS Hazard Category	LANL 2021[a] Hazard Category
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

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

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 activities took place during CY 2021:

- 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 6 years because of needed post-project modifications.
- Design of the replacement TRU Liquid Waste Facility was completed during CY 2017; a re-design began in 2019 and continued into CY 2021.

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 2021 and were at or below operational levels projected in the 2008 SWEIS. Table A-23 provides operations data details.

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 2021, the RLWTF received approximately 1,154,812 liters of LLW influent. Approximately 172,060 liters of treated water was discharged to the environment via the effluent evaporator. Approximately 892,991 liters of treated water was discharged to Mortandad Canyon. Little TRU radioactive liquid waste activity occurred during CY 2021. Four waste transfers (1,021 liters) were received from TA-55; no treatment or solidification occurred.

Operations data levels at the RLWTF remained mostly below levels projected in the 2008 SWEIS with two exceptions:

- In CY 2021, chemical waste generation exceeded 2008 SWEIS projections because of disposal of surrogate test water from TA-50-0230, which accounted for 96 percent (3,773 kilograms) of the total chemical waste generated at the RLWTF.
- In CY 2021, 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 93 percent (609 cubic meters) of the LLW generated.

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), encompasses 315,000 square feet. Activities consist of

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

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

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

Experimental Area A, formerly used for nuclear physics experiments using pi mesons[11] (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 (RF) system development. LANSCE is classified as an Accelerator Facility, regulated under DOE Order 420.2C, and currently operates under two main Safety Basis documents: *Safety Assessment Document* (SAD-TA53-003-R0.2) and *LANSCE Accelerator Safety* Envelope (ASE-TA53-0004-R0.2).

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. This project has been cancelled and replaced with plans for similar high-power tungsten spallation target neutron source designed for fusion reactor materials testing rather than next-generation fission reactor material testing. This target station is now being called the Fusion Prototypic Neutron Source.
- Construction of the Neutron Spectroscopy Facility within existing buildings (under the High-Powered Microwaves and Advanced Accelerators Capability).

In 2021, construction of a new storage building located to the north of Area C concluded. Early work, including surveys and geotechnical evaluations, for the new TA-53 radiological facility began during 2020 but were put on hold due to COVID-19. Field work on this facility remained on hold through 2021.

2.13.2 Operations at LANSCE

The 2008 SWEIS identified eight capabilities at this Key Facility. Seven of the eight capabilities were active in CY 2021, and all seven fell at or below operational levels projected in the 2008 SWEIS. During

[11] Pi mesons are any of three subatomic particles: π^0, π^+, and π^-.

CY 2021, 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 micro amps 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 two exceptions: In CY 2021, chemical waste generated at LANSCE exceeded 2008 SWEIS projections because of disposal of

- material associated with scheduled maintenance work at LANSCE, which accounted for (13,865 kilograms);
- items during facility-wide cleanup, which accounted for (9,163 kilograms); and
- asbestos from the Rosen Auditorium upgrade project, which accounted (7,448 kilograms) of the chemical waste generated at LANSCE.

In CY 2021, MLLW generated at LANSCE exceeded the 2008 SWEIS projections because of the disposal of legacy material during cleanup activities, which accounted for 31 percent (5 cubic meters); and the disposal of de-ionized water from the beam line, which accounted for 68 percent (11 cubic meters) of the MLLW generated. 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 90-day storage area—in accordance with its hazardous waste permit—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 MLLW. Area L at TA-54 is 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. If approved, a Class 2 Permit Modification to the LANL Hazardous Waste Permit to add TA-60-0017 as a temporary storage facility would allow for additional storage of enduring mission hazardous and mixed wastes up to 1 year and would allow Triad to manage waste more efficiently and effectively.

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 Hazard Category	LANL 2021[a] Hazard Category
50-0069	Triad - Waste Characterization, Reduction, and Repackaging Facility	2	2
50-0069 Outside	Triad - Nondestructive Analysis Mobile Activities	N/A[b]	2
50-0069 Outside[c]	Triad - Drum Storage	2	2
54-Area G[d]	N3B - LLW Storage/Disposal	2	2[e]
54-0002	N3B - TRU Storage Building	N/A	2[e]
54-0008	N3B - MLLW/LLW Storage Building	2	2[e]
54-0033	N3B - TRU Waste Management Dome	2	2[e]
54-0038	Triad - Radioassay and Nondestructive Testing Facility	2	2[e]
54-0048	N3B - TRU Waste Management Dome	2	2[e]
54-0049	N3B - TRU Waste Management Dome	2	2[e]
54-0153	N3B - TRU Waste Management Dome	2	2[e]
54-0224	N3B - Mixed/LLW Storage Dome	N/A	2[e]
54-0229	N3B - TRU Waste Management Dome	2	2[e]
54-0230	N3B - TRU Waste Management Dome	2	2[e]
54-0231	N3B - TRU Waste Management Building	2	2[e]
54-0232	N3B - TRU Waste Management Dome	2	2[e]
54-0283	N3B - TRU Waste Management Dome	2	2[e]
54-0375	N3B - TRU Waste Management Building	2	3[e]
54-0412	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]
63-0144	Triad - Transuranic Waste Facility (TWF)	N/A	2

[a] List of LANL nuclear facilities (LANL 2018a).
[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; and TRU waste storage.
[e] Hazard Category Nuclear Facilities at TA-54 that are now under N3B operational control and 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.

The Waste Compliance and Tracking System (WCATS) was specifically designed to manage LANL's waste from generation to disposition. Waste tracking includes information about

- 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 2005 State of New Mexico Environment Department Compliance Order (The 2016 State of New Mexico Environment Department Compliance Order on Consent [Consent Order] supersedes the 2005 order.)

These waste management facilities were scheduled to replace LANL's existing facilities for solid waste management. In CY 2017, construction was completed on the TWF (TA-63-0144). The TWF was 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).

As discussed earlier, in 2019, Triad began using TA-60-0017 as a central accumulation area for mission-essential waste generated from sites across LANL. Triad's TRU and mixed TRU waste are managed at the TRU Waste Facility.

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 2021, and activities were performed as 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

Due to the change in management operational areas between N3B and Triad, waste generation numbers for this Key Facility will no longer be published in Table A-28. All site-wide waste generation numbers are captured in Chapter 3.2.

2.15 Plutonium Facility Complex (TA-55)

The Plutonium Facility Complex consists of six primary buildings and 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. 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 2018a) 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 Hazard Category	LANL 2021[a] Hazard Category
Plutonium Facility (TA-55-0004)	Plutonium Processing	2	2

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

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 2021, TRP II activities were completed. The TRP III planning stage continued in 2021.

The TA-55 Radiography Facility Project has not been pursued. 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 2021.

The following construction and modification projects were initiated and continued in CY 2021:

- 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 accredited safety functions, as defended in the Documented Safety Analysis (LANL 2016b). Project planning and construction activities continued through CY 2021.
- As mentioned 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 2015a).
- 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 2021. For all six active capabilities, activity levels were at or 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 2015b). When program funding was available, 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. The Critical Decision-0 for the dilute and dispose program was achieved in CY 2021. Critical Decision-1 package is under development.

The Plutonium Sustainment Program at LANL continues to prepare to meet the requirement of re-establishing War Reserve pit production by the end of FY 2023 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 2019a). A supplement analysis to the 2008 SWEIS was prepared in CY 2019 into CY 2020 for producing no fewer than 30 pits per year with additional surge capacity, if needed, to meet Nuclear Posture Review and national policy (Public Law 115-232, Section 3120) of producing up to 80 pits per year for the nuclear weapons stockpile (DOE 2020a). The DOE/NNSA issued an amended ROD in September 2020, selecting to implement elements of the Expanded Operations Alternative for an increase in pit production (DOE 2020b).

2.15.3 Operations Data for the Plutonium Facility Complex

Operations data levels at the Plutonium Facility Complex remained below levels projected in the 2008 SWEIS with two exceptions:

- In CY 2021, chemical waste at the Plutonium Facility Complex exceeded 2008 SWEIS projections because of waste generated as a result of maintenance of equipment at RLUOB, which accounted for 76 percent (23,586 kilograms) of the chemical waste; and disposal of water drained from equipment at the TA-55 gate, which accounted for 34 percent (10,649 kilograms) of the total chemical waste generated at the Plutonium Complex.
- In CY 2021, MLLW at the Plutonium Facility Complex exceeded 2008 SWEIS projections because of disposal of TRU waste containers recategorized as MLLW, which accounted for 24 percent (14 cubic meters) of MLLW waste generated; and disposal of routine maintenance and housekeeping, which accounted for 22 percent (13 cubic meters) of the MLLW generated at the Plutonium Complex.

Table A-30 provides operations data detail.

2.15.4 Off-Site Source Recovery Program

The OSRP is a U.S. government activity sponsored by the DOE/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[12] (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 U.S. 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 DOE/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 DOE/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 CXs, 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 CXs 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*.

Of the planned countries slated for source repatriation in CY 2021, the OSRP repatriated 6 sources from Japan, 9 sources from Germany, 56 sources from Malaysia, and 737 sources from U.S. domestic locations.

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

2.16 Non-Key Facilities Construction and Modifications

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 49 TAs and comprise approximately 14,218 of LANL's 26,058 acres.

The 2008 SWEIS projected no major modifications to the Non-Key Facilities under the No Action Alternative. Major projects that have been completed since 2008 are listed in Table 2-8. A complete description of these projects can be found in previous Yearbooks.

Table 2-8. Non-Key Facilities Completed Construction Projects

Description	Year Completed
Los Alamos Site Office Building	2008
Protective Force Running Track	2010
Expansion of the Sanitary Effluent Reclamation Facility (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
Supplemental Environmental Projects: Road Improvement Project	2019
Supplemental Environmental Projects: Potable Water Line Replacement Project	2020
TA-72 Outdoor Range Upgrade Project	2020
Sensitive Compartmented Information Facility Modular Office Building	2020

New projects that were still under construction or were completed in CY 2021 are discussed in the following paragraphs.

Oppenheimer Collaboration Center Renovation

Description: The Oppenheimer Collaboration Center, also known as the 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 was 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; construction began in CY 2018 and was completed in 2021.

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 2016c). Construction began in CY 2018 after design was completed. Construction was completed during 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 lives. 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 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 2021 saw the roofs of 33 facilities replaced and the roofs of 15 facilities repaired within the Weapons Facilities Operations, TA-55, and TA-50.

Supplemental Environmental Projects

Description: In 2014, the State of New Mexico Hazardous Waste Bureau issued compliance orders for New Mexico Hazardous Waste Act (HWA) violations. One of the orders stemmed from the improper treatment of TRU waste shipped from LANL to WIPP. A settlement agreement (NMED 2016b) between DOE/NNSA and the New Mexico Environment Department (NMED) includes five supplemental environmental projects that NNSA and the Laboratory implemented. Surface Water Sampling and Potable Water Line Replacement projects (see Table 2-8) have been finalized. The Triennial Review project to conduct an independent, external triennial review of environmental regulatory compliance and operations is an ongoing commitment for which no activities occurred in 2021. The 2021 activities on the remaining supplemental environmental projects are described as follows.

Status: The following Supplemental Environmental Project was ongoing in CY 2021:

- Road Improvement Project – Improve routes at the Laboratory used for the transportation of TRU 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 DOE/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. On September 8, 2020, DOE/NNSA categorically excluded this project (DOE 2020d). The design was completed in August 2019. Funding for the intersection construction is being pursued.

Steam Plant Replacement Project

Description: DOE/NNSA is replacing 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 using 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 2018f). Construction work began in August 2019.

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 2018a). Construction work began in November 2019. This project was completed during 2021.

New Parking Garages in TA-03 and TA-50

Description: To alleviate a severe parking shortage at LANL, DOE/NNSA constructed two, three-story parking garages; one in TA-03 and the other in TA-50.

Status: In October 2019, DOE/NNSA categorically excluded this project from further NEPA analysis (DOE 2019b). Construction for the TA-03 parking garage began in January 2020 and was completed in July 2021. Construction for the TA-50 parking garage began in March 2020 and is expected to be completed during 2022. The new parking garages have three levels with 450 spaces, along with the Smart Parking feature that indicates availability. Extra electric vehicle charging spots have been added.

2.16.1 Operations at the Non-Key Facilities

The Non-Key Facilities occupy more than half of LANL's 26,058 acres. Non-Key Facilities are host to seven of the eight categories of activities at LANL, as shown in Table A-31. During CY 2021, no new capabilities were added to the Non-Key Facilities, and none of the seven existing capabilities were deleted.

2.16.2 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: The total chemical waste for CY 2021 exceeded 2008 SWEIS projections for Non-Key facilities because of disposal of

- press filter cakes from SERF, which accounted for 31 percent (265,280 kilograms);
- spill material from an old mixing tanks, which accounted for 12 percent (98,629 kilograms); and
- construction and demolition debris from refurbishing projects, which accounted for 9 percent (77,317 kilograms) of the chemical waste generated.

Improvements made at SERF have decreased the amount of waste generated since CY 2019 (see Table A-32 for details).

In CY 2021, the Non-Key Facilities generated about 35 percent of the total LANL chemical waste volume, about 1 percent of the total LLW volume, 1 percent of the total MLLW volume, and 0 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 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 detail 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; however, some properties that contain 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 (NMSA 1978, § 74-4-10) and the New Mexico Act (NMSA 1978, §74-9-36([D)) and by DOE/NNSA for radionuclides under the Atomic Energy Act implemented through DOE Order 458.1, *Radiation Protection of the Public and the Environment*, and DOE Order 435.1, *Radioactive Waste Management*.

On March 1, 2005, NMED, DOE, and the University of California entered into the Consent Order, which superseded Module VIII of the Laboratory's 1994 Hazardous Waste Facility Permit. Under the Consent Order, all 2,123 original corrective action sites, 6 newly identified sites, an additional site that resulted 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 U.S. Environmental

Protection Agency (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 superseded the March 2005 Consent Order. Changes from the 2005 Consent Order included removal of many of the detailed technical requirements and instead, focused on the cleanup process itself. 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 to be met 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 2021, NMED issued 375 Certificates of Completion; 288 Certificates of Completion without Controls and 87 Certificate of Completion with Controls. The total number of corrective action sites remaining in the investigation process at LANL is 1,030.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, 134 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 of the 2016 Consent Order 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 conducted field investigations and site cleanups at Lower Water/Indio Canyon, Chaquehui Canyon, and South Ancho Canyon Aggregate Areas in CY 2021. These efforts were documented in the Investigation Reports for Chaquehui Canyon, Lower Water/Indio Canyon, and South Ancho Canyon Aggregate Areas Investigation Reports. All three reports were Consent Order Appendix B milestones, delivered to NMED on or before September 30, 2021. 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.

Table 2-9 provides summaries of the site, aggregate area, and canyon investigations conducted and/or reported in CY 2021.

Table 2-9. Summary of Site, Aggregate Area, and Canyon Investigations Conducted and/or Reported in CY 2021 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
Supplemental Investigation Report for Lower Sandia Canyon, Revision 1	20, 53	17	No samples collected in 2021	No site cleanups conducted in 2021	13/4
Conclusions/Recommendations: Corrective action complete without controls is recommended for 13 sites for which extent is defined and that pose no potential unacceptable human health risk or dose under any scenario and no unacceptable ecological risk. Additional sampling is recommended for four sites for which extent is not defined but which pose no potential unacceptable human health risk or dose under the industrial, construction worker, and residential scenarios and no unacceptable ecological risk. A Phase II investigation work plan will be developed based on the conclusions and recommendation presented in this supplemental investigation report.					
Phase II Investigation Report for Chaquehui Canyon Aggregate Area	33	16	693	8	3/13
Conclusions/Recommendations: Corrective action complete without controls is recommended for three sites for which extent is defined and that pose no potential unacceptable human health risk or dose under any scenario and no unacceptable ecological risk. Additional sampling and analyses are recommended for 13 sites for which extent is not defined. A Phase III investigation work plan will be developed based on the conclusions and recommendation presented in this supplemental investigation report.					
Investigation Report for Lower Water/Indio Canyon Aggregate Area	15	6	480	1	6/0
Conclusions/Recommendations: Corrective action complete without controls is recommended for four sites for which extent is defined and that pose no potential unacceptable human health risk or dose under the residential and industrial scenarios and no unacceptable ecological risk. Corrective action complete with controls is recommended for two sites for which extent is defined and that pose no potential unacceptable human health risk or dose under the construction worker and industrial scenarios and no unacceptable ecological risk.					
Investigation Report for South Ancho Canyon	33	11	785	1	11/0
Conclusions/Recommendations: Corrective action complete without controls is recommended for 11 sites for which extent is defined and that pose no potential unacceptable human health risk or dose under all scenarios and no unacceptable ecological risk.					

2.17.3 Site/Facility Categorization

No new nuclear environmental sites were added to or removed from the LANL nuclear facilities list during CY 2021 (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 Hazard Category	LANL 2021[a] Hazard Category
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 2021 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 2021 totaled approximately 209 curies, about 0.6 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 WETF Key Facility totaled about 36 curies in CY 2021. The total point source emissions from LANSCE was approximately 172 curies in CY 2021.

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 2021, non-point emissions totaled approximately 28 curies.

Maximum off-site dose to the maximally exposed individual was 0.29 millirem in 2021. 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 off-site 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 2021a).

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. Besides sulfur oxides, CY 2021 emissions for all four categories (listed in Table 3-1) were within the 2008 SWEIS projection.

Table 3-1. Emissions of Criteria Pollutants as Reported on the Annual Emissions Inventory[a]

Pollutants	2008 SWEIS (tons/year)	CY 2021 Operations (tons/year)
Carbon monoxide	58.0	15.3
Nitrogen oxides	201.0	39.7
Particulate matter	11.0	5.2
Sulfur oxides	0.98	1.9[b]

[a] Emissions included on the annual Emissions Inventory Report do not include small boilers.
[b] In 2021, on-site power was generated at the Combustion Gas Turbine Generator which resulted in the exceedance.

Criteria pollutant emissions from fuel-burning equipment at LANL 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 2021 (LANL 2021b). In CY 2021, more than one-third 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. NMED delayed issuing the permit, and LANL continues to operate under Title V Permit P100-R2M4.

Table 3-2 summarizes the facility-wide emission limits in the Title V Operating Permit, the 2008 SWEIS emission projections, and CY 2021 actual emissions from all sources included in the permit. Emissions from small boilers and heaters are included in these totals. In 2021, 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, the chemical management database for LANL. The quantities presented here represent all chemicals procured or brought onsite in CY 2021. 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 2021b).

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

Pollutants	2008 SWEIS (tons/year)	Title V Facility-Wide Emission Limits (tons/year)	2021 Emissions (tons/year)
Carbon monoxide	58.0	225	29.0
Nitrogen oxides	201.0	245	54.3
Particulate matter	11.0	120	6.4
Sulfur oxides	0.98	150	1.9

[a] The Title V Operating Permit Emissions Report includes two categories of sources not required in the annual Emissions 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. Emissions estimates (expressed as kilograms per year) were performed in the same manner as those reported in previous SWEIS Yearbooks. Listed chemicals usage 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 1 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 2021, 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	2021
Hazardous air pollutants	24	5.7
Volatile organic compounds	200	6.8

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 2021, these stationary combustion sources emitted 91,824.6 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 stationary combustion sources by emission type in metric tons per year.

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

Gas	Units	2008 SWEIS[b]	2021 Emissions
Methane	metric tons/year	–	1.72
Nitrous oxide	metric tons/year	–	0.173
Carbon dioxide	metric tons/year	–	91,730
Total Emissions	metric tons carbon dioxide equivalents/year	–	91,824.6

[a] LANL GHG Emissions Electronically Submitted to the EPA (LANL 2021b).
[b] 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, 2021, through December 31, 2021, 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, seven permitted outfalls recorded flows in CY 2021, totaling approximately 113.4 million gallons. This amount is approximately 8.2 million gallons less in CY 2020 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 2021 are provided in 2021 Annual Site Environmental Reports (LANL 2021c). CY 2021 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 2021	Discharge 2008 SWEIS (million gallons)	Discharge 2021 (million gallons)
Guaje	0	0	0	0
Los Alamos	5	1	45.6	31.8
Mortandad	5	4	44.3	6.2
Pajarito	0	0	0	0
Pueblo	0	0	0	0
Sandia	6[a]	5[a]	187.3	65.1
Water[b]	5	1	2.26	0
Totals	21	11	279.5	113.4

[a] Includes Outfall 13S from the Sanitary Wastewater Systems Plant, which is permitted 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 2021, the bulk of the discharges came from Non-Key Facilities. Key Facilities accounted for approximately 80 million gallons of the total in CY 2021. LANSCE discharged approximately 31.8 million gallons in CY 2021—about 0.4 thousand gallons less than CY 2020—accounting for about 60 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 2021	Discharge 2008 SWEIS (million gallons)	Discharge CY 2021 (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	0.73[a]
High Explosives Processing (05A055)	3	1	0.06	0
High Explosives Testing	2	None	2.2	0

Key Facility	No. of Outfalls 2008 SWEIS	No. of Permitted Outfalls in CY 2021	Discharge 2008 SWEIS (million gallons)	Discharge CY 2021 (million gallons)
LANSCE (03A113, 03A048)	4	2	29.5[b]	32.
Metropolis Center (001)	1	1	17.7[c]	12.1[d]
Biosciences	None	None	0	0
Radiochemistry Facility	None	None	0	0
RLWTF (051)	1	1	4.0	0.24
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]	48.07
Subtotal, Non-Key Facilities (001, 13S, 03A160, 03A199)	4	4	200.9	65.1[f]
Totals	21[g]	11	283.5[e]	113.4

[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 Explosives Wastewater Treatment Facility at TA-16 (both Key Facilities). The RLWTF (Outfall 051) discharges into Mortandad Canyon. The High Explosives Wastewater Treatment Facility (Outfall 05A055) is permitted to discharge into Cañon de Valle.

As previously stated, discharges from the Non-Key Facilities made up the majority of the total CY 2021 discharge from LANL. The total for CY 2021—65 million gallons—was about 135 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 84.1 percent of the total discharge from Non-Key Facilities and about 55.7 percent of all water discharged by LANL in CY 2021.

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 that collectively disturbs one or more acres of land. The NPDES CGP applies to all eligible construction projects throughout New Mexico.

Triad and external subcontractors apply individually for NPDES CGP coverage and are co-permittees at most construction sites. N3B seeks NPDES CGP coverage as the sole permittee for applicable construction projects for which they are responsible. 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 2021, Triad was responsible for 35 storm water pollution prevention plans and performed 8,305 inspections, with 95.3 percent of the sites fully compliant. During the same period, N3B implemented five construction projects under the CGP in 2021 and performed 324 CGP inspections. The non-compliant items were successfully addressed with 73 corrective actions that rehabilitated storm water pollution prevention measures.

Multi-Sector General Permit. The NPDES MSGP for Storm Water Discharges Associated with Industrial Activities 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.

On June 4, 2020, the 2015 MSGP expired and was administratively continued for existing MSGP facilities pending issuance of a new general permit. The 2021 MSGP was issued on January 15, 2021, with an effective date of March 1, 2021. To maintain permit coverage under the administratively continued 2015 Permit, existing MSGP facilities were required to submit a notice of intent to discharge under the 2021 MSGP by May 30, 2021. Active MSGP tracking numbers for LANL facilities are 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	EM Legacy Cleanup	A notice to discharge under the 2021 MSGP was submitted for this facility on 5/10/2021; authorization to discharge under the 2021 MSGP was issued by EPA on 6/9/2021.
NMR050012	Hazardous waste treatment, storage, or disposal facilities (Sector K) at TA-54, Areas G and L	N3B	EM Legacy Cleanup	A notice to discharge under the 2021 MSGP was submitted for this facility on 4/20/2021. Authorization to discharge under the 2021 MSGP is currently pending from EPA.
NMR050013	Wood product fabrication, vehicle and equipment maintenance, recycling activities, electricity generation, warehousing activities, and asphalt manufacturing	Triad	DOE/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 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. Monitoring results are compared with values dictated by the 2021 MSGP and New Mexico water quality standards. Exceedances of regulatory standards do not constitute an MSGP violation; however, unless an exceedance is determined solely attributable to natural background sources, corrective action—such as evaluation for potential sources—and implementation of follow-up action and documentation are required.

In 2021, Triad staff completed the following tasks as part of the MSGP compliance:

- 92 inspections of storm water controls at the 9 active permitted facilities,
- 1 annual inspection at each of 38 sites having "no exposure" status,
- collection of 65 samples,
- 274 inspections of automated sampler equipment,
- 51 inspections of single-stage samplers at substantially identical discharge points (discharge points that discharge storm water from the same source and with the same control measures and amount of storm water runoff per unit area),
- 10 visual inspections at 9 monitored discharge points,
- 20 visual inspections at 10 substantially identical discharge points, and
- 123 corrective actions, including
  - 18 corrective actions to mitigate exceedances,
  - 69 actions to remedy control measures inadequate to meet non-numeric effluent limits,
  - one corrective action from change in facility operations that required change in control measures, and
  - 35 corrective actions to address unauthorized releases (spills) or discharges.

By meeting permit-defined criteria under Triad's Permit Tracking Number NMR050013, LANL was able to discontinue monitoring for three types of pollutants at two active permitted sites for 2021. Two pollutants (nitrate plus nitrite nitrogen and aluminum) registered below the benchmark value at one site (MSGP07601), so monitoring for these pollutants was discontinued. Also, monitoring for one other pollutant (total aroclor) was discontinued at two sites (MSGP01201 and MSGP07701) because this constituent was not detected in storm water samples obtained at the monitored outfalls.

During CY 2021, each of N3B's MSGP-covered facilities at Area G, Area L, and the Maintenance Facility West were subject to four routine quarterly inspections and monitoring of storm water. A total of nine corrective actions were initiated at TA-54 Areas G and L during 2021, including two due to exceedances of regulatory standards for impairment parameters of receiving waters and seven due to needed maintenance of one or more storm water control features. No corrective actions were initiated at Maintenance Facility West during 2021.

All corrective actions initiated during 2021 were documented upon discovery and tracked to completion in N3B's electronic database, Maintenance Connection. All corrective actions initiated in 2021 were successfully closed in accordance with permit requirements.

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 EPA issued the original Permit in 2010, and it has been administratively continued until a new Permit is issued. A draft Permit was issued by the EPA in November 2019, for which the public comment period ended on November 2, 2020. The State of New Mexico issued their State Certification of the draft Permit on November 30, 2020. The Permittees submitted a Petition for Review of the State Certification to the New Mexico Secretary of the Environment on December 30, 2020, and submitted comments on the State Certification to the EPA and the NMED on January 12, 2021. The Permittees entered discussions with the NMED regarding the State Certification, and on December 30, 2021, a settlement agreement was signed by the NMED and the Permittees. The final Permit has not been issued by the EPA.

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, which 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; the controls were installed and certified to the EPA during 2010 and 2011. When target action levels, based on New Mexico surface water quality standards, are exceeded, additional corrective actions are required. In summary, the process of complying with the Individual Permit can be broken down into five categories:

- 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 2021:

- Published the 2021 update to the Site Discharge Pollution Prevention Plan, 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, 2021,” which presents the compliance status for all permitted sites, activities conducted, and milestones accomplished to comply with the Individual Permit.
- Completed 1,424 inspections of storm water controls at the 250 site-monitoring areas.
- Completed 884 sampling equipment inspections.
- Conducted storm water monitoring at 138 site-monitoring areas.
- Collected extended baseline control confirmation samples at 2 site-monitoring areas.

- Collected corrective action confirmation monitoring samples at 17 site-monitoring areas.
- Installed 22 additional control measures at 16 site-monitoring areas.
- Installed and/or certified 24 enhanced control measures at 7 site-monitoring areas.
- Held two public meetings as required by the Individual Permit.
- Submitted analytical results following certification of enhanced controls at 34 site/site-monitoring area combinations.
- Submitted analytical results following certification of a no-exposure condition at 4 site/site-monitoring area combinations.
- Submitted certification of corrective action complete following a certificate of completion from the NMED to the EPA for 1 site/site-monitoring area combination.
- Submitted certification of installation of enhanced control measures at 20 site/site-monitoring area combinations to EPA.
- Collaborated with NMED on a Settlement Agreement regarding the State Certification of the Individual Permit.
- Updated the Individual Permit website and notified the public of submittals of permit-required documents to the Electronic Public Reading Room.
- Continued to support the Individual Permit re-application effort.

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, LLW, TRU, 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 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.

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

Although a variety of waste types exist, the 2008 SWEIS categorizes wastes as chemical, LLW, MLLW, 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 2021.

Table 3-8. LANL Waste Types and Generation for CY 2021

Waste Type	Units	LANL Waste Generators			Total CY
		Key Facility Total	Non-Key Facility	N3B	
Chemical	10^3 kilograms per year[a]	538	848	0.825	2,444
LLW	cubic meters per year[b]	2,586	45	1633.9	4449
MLLW	cubic meters per year[b]	135	2	120	199
TRU[c]	cubic meters per year[b]	213	0	0	213
Mixed TRU[c]	cubic meters per year[b]	66	0	0	66

[a] The 2008 SWEIS lists chemical waste projections in kilograms per year. Waste numbers are recorded here as 10^3 kilograms per year for readability.
[b] The 2008 SWEIS lists waste projections as cubic yards. Waste numbers were converted to cubic meters because those are the units tracked in 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 sites 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 (DOE 2008a). 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 2021 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 DOE-EM 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.

Previously, the N3B annual waste generation total was compared with the FY projection identified in 2008 SWEIS Table I-70; however, no FY projections exist 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. Most of the 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, 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 off-site shipments from the 2008 SWEIS continue through 2022 (DOE 2018a). 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 (page K-24) in the 2008 SWEIS. From the time that the 2008 SWEIS was published through 2021, the approximate total number of radiological shipments was 28,106, 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 2021, the total number of chemical (hazardous) waste shipments is approximately 1,830; approximately 38 percent of the projected total.

In CY 2021, approximately 127 radiological waste shipments and 125 chemical waste shipments were made to off-site permitted treatment, disposal, or storage facilities.

The 2008 SWEIS defined chemical wastes as hazardous waste (designated RCRA regulations), toxic waste (PCBs and asbestos designated under the Toxic Substances Control Act), and special waste (designated under the New Mexico Solid Waste Regulations). The 2008 SWEIS projected chemical waste to decline for normal operations at LANL; however, the 2018 Supplement Analysis of the 2008 SWEIS projects that waste generation will continue, and current generation projections will continue through 2022.

Chemical waste includes construction and demolition debris and 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 off-site 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 2020 are tracked in Section 3.11.2 of this Yearbook.

In CY 2021, 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 2021 exceeded 2008 SWEIS annual projections because of the disposal of press filter cakes. This number has decreased since CY 2019 because of improvements made at SERF. Table 3-9 summarizes chemical waste generation at Key Facilities and Non-Key Facilities during CY 2021. Although chemical waste volumes exceeded projections for CY 2021, 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 2021

Waste Generator	2008 SWEIS[a]	CY 2021[a]
Key Facilities	596	538
Non-Key Facilities	651	848

[a] 10^3 kilograms per year.

At the conclusion of 2021, chemical waste from N3B operations was approximately 21.8 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 2021

Waste Generator	2008 SWEIS Projection Total[a]	Cumulative Total (2007–2020)[a]	2021 Generated Waste	2021 Cumulative Total[a]	Percentage of Total Projected Waste Generation by N3B[e]
N3B	41,209.78[b,c]	9,023.5[d]	0.825	9,024.3	21.8

[a] 10^3 kilograms.
[b] Used conversion 1,100 kilograms per cubic meter. The 1,100 kilograms was derived from adding all of the EM chemical waste for CY 2008.
[c] Projected total chemical waste generation from Implementation of Consent Order, Removal Option, 2008 SWEIS (Table I-70).
[d] The total sum of the chemical waste generated from EM operations from CY 2007 through CY 2020.
[e] The 2021 cumulative total divided by the 2008 SWEIS projection; total multiplied by 100.

In CY 2021, approximately 125 shipments of chemical waste were shipped offsite from Triad and N3B operations to permitted treatment and disposal facilities. Treatment and disposal facilities varied, but the majority of chemical waste was shipped to Waste Management-Colorado (Colorado Springs) and Veolia-Colorado (Table 3-11 and Table 3-12).

Table 3-11. Triad Chemical Waste Shipped Offsite during CY 2021

Off-Site Treatment and Disposal Facility	2021 Trucks from LANL
U.S. Ecology-Nevada	6
Waste Management-New Mexico	10
Waste Management-Colorado (Midway Landfill)	11
Waste Management-Colorado (Colorado Springs)	36
Veolia-Arizona	1
Veolia-Colorado	35
Solid Waste Disposal	1
Clean Harbors-Colorado	19
Stericycle-New Mexico	2
Lighting Resources-Texas	3
TOTAL	125

Table 3-12. N3B Chemical Waste Shipped Offsite during CY 2021

Off-Site Treatment and Disposal Facility	2021 Trucks from LANL
Waste Management-Colorado, Midway Landfill	3
Veolia-Colorado	6
Clean Harbors-Utah	2
TOTAL	11

3.3.1 Low-Level Radioactive Wastes

In CY 2021, Non-Key Facilities LLW volumes remained below the projected volume for Key Facilities. Table 3-13 summarizes LLW generation during CY 2021.

Table 3-13. LLW Quantities from Key Facilities and Non-Key Facilities for CY 2021

Waste Generator	2008 SWEIS[a]	2021[a]
Key Facilities	7,646	2,586
Non-Key Facilities	1,529	45

[a] Cubic meters per year.

In CY 2021, 1,633.9 cubic meters of LLW was generated from N3B operations (Table 3-8). At the conclusion of 2021, the cumulated LLW volume from N3B operations was 69,283.9 cubic meters, which is approximately 8.5 percent of the total estimated LLW projected in the 2008 SWEIS for EM operations. Table 3-14 summarizes LLW generation for N3B operations.

Table 3-14. LLW Waste Quantities from N3B Operations

Waste Generator	2008 SWEIS Projection Total[a]	Cumulative Total (2007–2020)[a]	2021 Generated Waste	2021 Cumulative Total[a]	Percentage of Total Projected Waste Generation by N3B[b]
N3B	811,346[c]	67,650[d]	1,633.9	69,283.9	8.5

[a] Cubic meters.
[b] The 2021 cumulative total divided by the 2008 SWEIS projection and total multiplied by 100.
[c] Projected total waste generation from Implementation of Consent Order, Removal Option, 2008 SWEIS (Table I-70) consisting of LLW, alpha LLW, and remote-handled LLW.
[d] The total sum of the LLW generated from N3B operations from 2007 through 2020.

In CY 2021, approximately 909 shipments of LLW were transported offsite from Triad and N3B operations to permitted treatment and disposal facilities. Treatment and disposal facilities varied, but the majority of LLW was shipped to the Nevada National Security Site (Table 3-15 and Table 3-16). 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) in the 2008 SWEIS. From the time the 2008 SWEIS was issued through 2021, the total number of LLW shipments was10,366, approximately 96.2percent of the projected total.

Table 3-15. Triad LLW Off-Site Shipments during CY 2021

Off-Site Treatment and Disposal Facility	Total Shipments from LANL during 2021
EnergySolutions	148
Nevada National Security Site	562
Perma-Fix Environmental Services-Washington	68
Perma-Fix Environmental Services-Florida	8
Waste Control Specialists	14
TOTAL	800

Table 3-16. N3B LLW Off-Site Shipments during CY 2021

Off-Site Treatment and Disposal Facility	Total Shipments from LANL during 2021
EnergySolutions	52
Perma-Fix Environmental Services-Washington	12
Waste Control Specialists	45
TOTAL	109

3.3.2 Mixed Low-Level Radioactive Waste

In CY 2021, MLLW generation at Key and Non-Key Facilities was below the volumes projected in the 2008 SWEIS. Table 3-17 summarizes MLLW generation during CY 2021.

Table 3-17. MLLW Quantities from Key Facilities and Non-Key Facilities for CY 2021

Waste Generator	2008 SWEIS[a]	2021[a]
Key Facilities	69	135
Non-Key Facilities	31	2

[a] Cubic meters per year.

In CY 2021 approximately 120 cubic meters of MLLW was generated from N3B operations (Table 3-8). At the conclusion of 2021, the cumulated MLLW waste volume generated from N3B operations was approximately 2,253.3 cubic meters, which is approximately 1.6 percent of the total estimated MLLW projected in the 2008 SWEIS for N3B operations. Table 3-18 summarizes MLLW generation for N3B operations.

Table 3-18. MLLW Waste Quantities from N3B Operations

Waste Generator	2008 SWEIS Projections Total[a]	Cumulative Total (2007–2020)[a]	2021 Generated Waste	2021 Cumulative Total[a]	Percentage of Total Projected Waste Generation by N3B[d]
N3B	136,197.80[b]	2,133.3[c]	120	2,253.3	1.6

[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 2020.
[d] The 2021 cumulative total divided by the 2008 SWEIS projections total and multiplied by 100.

In CY 2021, approximately 128 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 Energy Solutions (Table 3-19 and Table 3-20). 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) in the 2008 SWEIS. From the time the 2008 SWEIS was issued through 2021, the total number of MLLW shipments was 4,835, approximately 53.6 percent of the projected total.

Table 3-19. Triad Mixed LLW Off-Site Shipments during CY 2021

Off-Site Treatment and Disposal Facility	Total Shipments from LANL 2021
Divisified Scientific Solutions Incorporated	31
EnergySolutions	67
Perma-Fix Environmental Services-Washington	4
Waste Control Specialists	10
TOTAL	112

Table 3-20. N3B MLLW Off-Site Shipments during CY 2021

Off-Site Treatment and Disposal Facility	Total Shipments from LANL 2021
EnergySolutions	10
Perma-Fix Environmental Services-Washington	5
Veolia	1
TOTAL	16

3.3.3 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 2021 for Key Facilities and Non-Key Facilities were below the 2008 SWEIS projections. Table 3-21 summarizes the TRU and mixed TRU generation during CY 2021.

Table 3-21. TRU and Mixed TRU Quantities from Key Facilities and Non-Key Facilities for CY 2021

Waste Generator	2008 SWEIS[a]	2021 TRU and Mixed TRU[a]	2021 Mixed TRU[a]	2021 TRU[a]
Key Facilities	413[b]	279	213	66
Non-Key Facilities	23[b]	0	0	0

[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 2021, 0 cubic meters of mixed TRU waste were generated from N3B operations (Table 3-8). At the end of CY 2021, the cumulated TRU and mixed TRU waste volume from N3B operations was 460 cubic meters, which is approximately 2.7 percent of the total estimated TRU or mixed TRU projected in the 2008 SWEIS for N3B operations. Table 3-22 summarizes TRU and mixed TRU generation for N3B operations.

Table 3-22. TRU and Mixed TRU Waste Quantities from N3B Operations

Waste Generator	2008 SWEIS Projection Total[a]	Cumulative Total (2007–2020)[a]	2021 Generated Waste	2021 Cumulative Total[a]	Percentage of Total Projected Waste Generation by N3B[d]
N3B	16,858.43[b]	460[c]	0	460	2.7

[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 2020.
[d] The 2021 cumulative total divided by the 2008 SWEIS projections total and multiplied by 100.

During 2021, Triad made 56 shipments of TRU and mixed TRU waste to WIPP; N3B made 33 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 2021, approximately 1,347 shipments of TRU and mixed TRU waste were made from LANL, which is approximately 26.7 percent of the maximum number of shipments.

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.

Over the next 10 years, the Laboratory could double its energy use in high-performance computing facilities, significantly increasing its water use in cooling towers. To support this mission growth and maintain efficient operations, major infrastructure and utility investments are required (LANL 2018b).

3.4.1 Electrical

The Los Alamos Power Pool supplies LANL with electricity through agreements with generators using a variety of sources, including hydroelectric, coal, natural gas, wind, and solar. 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 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 have been out of service for several years and are likely to be demolished in the future. Phase I of the Steam Plant Replacement Project (DOE 2018f) was initiated and will be completed in FY 2023. This project replaces the existing central steam plant with upgrades to the combustion turbine and the addition of conventional gas-fired 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. Planning is also underway for a 10-megawatt solar array at TA-16, with an expected completion by the end of FY 2024. LANL will design and install a new power line to connect the array to the Western Technical Area Substation (WTA), and a third-party developer will build and operate the array itself.

The installation of a proposed 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 off-site generation until CY 2048 (30 years of mission growth). LANL would work with the Public Service Company of New Mexico to increase import capacity as necessary. The proposed third transmission line project, the Electric Power Capacity Upgrade, would include additional improvements to on-site transmission, upgrades for the WTA, and expansion of several distribution feeder circuits. The Electric Power Capacity Upgrade is in the conceptual-design phase of development. On April 19, 2021, DOE/NNSA announced its intent to prepare an EA for the project, and public scoping was held from April 19–May 21, 2021. If necessary, on-site generation and seasonal transmission line rating increases can be used to supplement import capacity to meet LANL's power needs while LANL pursues increases in transmission import capability.

Within the existing underground ducts, the 13.8-kilovolt distribution system must be upgraded to fully realize the capabilities of the WTA and the upgraded Eastern Technical Area Substation. As discussed in Section 2.16, upgrades 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, total electricity consumption was 495,000 megawatt-hours per year. In addition, the electricity peak load under the No Action Alternative was 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 impacts 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 were approved by DOE/NNSA in 2010. The scope of this project encompassed the restoration of the LANSCE 800-MeV LINAC to historic performance levels (DOE 2010a). The LANL total in Table 3-23 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 3-23. Electricity Peak Coincidental Demand in CY 2021[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]
2021	35,010	23,755	14,372	73,137	17,450	90,587

[a] All figures in kilowatts.

[b] Expanded Operations Alternative limit for the LANSCE Refurbishment Project. This project was approved under the DOE-approved CX titled "Categorical Exclusion for Replacement of LANSCE Operational Equipment" (DOE 2010a).

[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.

Table 3-24 shows energy consumption for CY 2021, which remains below projections in the 2008 SWEIS.

Table 3-24. Energy Consumption in CY 2021[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 2021	237,553	115,142	100,383	453,078	118,732	571,810

[a] All figures in megawatt-hours.

[b] Expanded Operations Alternative limit for the LANSCE Refurbishment Project. This project was approved under the DOE-approved CX titled "Categorical Exclusion for Replacement of LANSCE Operational Equipment" (DOE 2010a).

[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 and carbon reduction initiatives in CY 2021. Investments include

- building automation system upgrades,
- monitoring via energy analytics software,
- HVAC recommissioning,
- insulation of LANL steam pits,
- electrical vehicle charging station installation,
- smart labs program, and
- LED 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 2021, the Laboratory reduced energy intensity (British thermal unit/square foot) by 22.4 percent from the baseline. This reduction was partially due to continuing impacts of COVID-19 and telework. Other efficiency measures include HVAC recommissioning and building automation system upgrades for night setback capability. Footprint-reduction efforts continue to contribute toward energy, water, and GHG reduction goals.

In response to national goals and policies and DOE directives pertaining to climate change, the Laboratory is developing a broad approach to sustainability. In 2021, the Biden-Harris Administration's EO 14008, *Tackling the Climate Crisis at Home and Abroad,* and EO 14057, *Catalyzing America's Clean Energy Economy Through Federal Sustainability*, established climate considerations as an essential element of national security and initiated multiple sustainability and net-zero emissions goals that will be addressed across the site.

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.

LANL has worked to install water meters on high-consumption 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. Triad 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 could 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 2021, cooling tower water demand was 21 million gallons at the Metropolis Center and 20 million gallons for the Trinity supercomputer. The SERF provided more than 40.5 million gallons of makeup water. Because of the SERF, the total potable water consumption was 1 million gallons at the Metropolis Center and 3.1 thousand gallons for Trinity. Table 3-25 shows potable water consumption for CY 2021. Under the 2008 SWEIS, water use at LANL was projected to be 459.8 million gallons per year from the No Action Alternative plus elements of the Expanded Operations Alternative. LANL consumed approximately 243 million gallons of potable water in CY 2021. Total use by LANL in 2021 was about 216.5 million gallons less than the 2008 SWEIS projection of 459.8 million gallons per year.

Table 3-25. Potable Water Consumption (million gallons) in CY 2021

Category	LANL Total	Metropolis Center (SCC)	LANSCE	Los Alamos County	Total
2008 SWEIS	459.8[a]	51	119	1,241	1,621
2021	243.4	1.0	72.9	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 the on-site energy sources by producing electricity from the combustion of natural gas. The combustion gas turbine generator can produce 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 3-26 presents CY 2021 gas usage. Approximately 45 percent of the gas used by LANL in 2021 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 2021 was about 500,000 decatherms more than projected in the 2008 SWEIS. In 2021, on-site power was generated at the Combustion Gas Turbine Generator. The generator ran for 3,459.00 hours at a usage of ~743,336.34 decatherms.

Table 3-26. Gas Consumption (decatherms[a]) at LANL in CY 2021

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
2021	1,742,808	962,206	780,603	209,470

[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 on-site personnel. We protect the health, safety, and welfare of the general public. We do not compromise safety for personal, programmatic, or operational reasons.

LANL earned DOE Voluntary Protection Program (VPP) Star site recognition in 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 proven 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 July 2020, the Office of Worker Safety and Health Assistance received and accepted Triad's transition application into DOE-VPP. The application incorporated all revised content and application materials regarding management leadership, employee involvement, worksite analysis, hazard prevention and control, and health and safety training. While in transition, Triad has invested efforts in continuing all DOE-VPP requirements, with a focus on simultaneous excellence and organizational culture change. During transitional star site status, LANL has invested efforts and made various improvements in health, safety, security, and culture.

Safety Culture Survey Results

The Laboratory conducted a Safety Culture Survey in October 2020. The survey was open to all employees and generated approximately 3,900 responses, including responses from the craft worker population.

Highlights from 2020 Safety Culture Survey responses are listed as follows:

- Managers listen when safety concerns are raised.
- Workers are comfortable pausing work when procedures cannot be followed or when instructions are unclear.
- Workers expressed confidence that they can depend on coworkers to identify hazards, follow procedures, and prevent accidents.
- Two areas identified for improvement are listed as follows:
  - Increasing the timeline management spends in the field and engaging with workers.
  - Increasing the use of Learning Teams to identify the right things to fix.

In 2021, LANL secured a contract with a third-party vendor, DuPont Sustainable Solutions, to administer and evaluate the next Lab-wide Safety Culture Survey, with a target to launch in 2022.

Safety and Security Improvement Plans

Safety and security improvement plans (SSIPs) demonstrate employee engagement and management commitment in the safety and security improvement process. Each year, LANL organizations identify improvement goals and actions by reviewing past safety data, I/I performance, the Annual Safety Culture Survey, the Annual VPP Self- Evaluation, and other relevant internal and external assessment reports.

The VPP Office collaborates with the Worker, Environment, Safety and Security Teams (WESSTs) to track progress quarterly on organizational SSIP goal completion. In 2021, SSIPs were developed by 11 ALDs and the Director's Office. The average SSIP goal completion at the end of December 2021 was 94 percent. ALDs that did not reach their 100 percent goal are encouraged to incorporate those goals into the following year.

Top institutional themes in 2021 SSIP goal development surrounded security and safety communications and/or awareness, worker engagement and/or ownership, and organizational learning (including lessons learned).

Voluntary Protection Program Self-Evaluation

The VPP Office facilitated self-evaluation activities during 2021. To accommodate a mixture of on-site and teleworking workforce, in 2020 and 2021, the VPP Self-Evaluation guidance included a newly created method in creating and leading virtual focus groups to obtain feedback from organizations. To conduct the evaluations, the VPP Office provided guidance to organizational teams, including a detailed self-evaluation profile that covers all VPP elements. The evaluation provides each directorate team (employees, management, and WESSTs) an opportunity to find both successes and opportunities that will assist in the development of their annual SSIP goals.

Results of the 2021 self-evaluations included areas of strength and OFIs. Areas of strength included the following:

- Hazard Prevention and Control: Access to Certified Professionals. Employees stated that supporting resources and SMEs are accessible and appreciated.
- Management Leadership: Visible Management Involvement. Managers are approachable and involved in the workspace.
- Health and Safety Training: Training. Employees stated that they receive appropriate, adequate, and effective safety and security training in their organizations.

Opportunity for improvement themes included the following:

- Management Leadership: LANL Safety and Security Goal and Objectives and Directorate SSIPs. SSIPs and WESST information can be communicated more widely with employees and encourage further employee involvement in developing SSIPs.
- Management Leadership: Visible Management Involvement. Management Observations and Verifications (MOVs) were impacted by the pandemic, and sustained engagement between management and their employees could be improved.

Institutional Worker Environment, Safety, and Security Teams

The mission of WESSTs is to work with the VPP Office and senior leaders to improve safety and security through direct engagement of all employees. The Institutional Worker, Environment, Safety, and Security Team (IWESST) represents all workers and collaborates with the ALDs and the Laboratory Director's Office—via the VPP Steering Committee—to enhance and support a healthy culture.

During 2021, two demonstrated accomplishments were led by efforts of the IWESST Leadership subcommittee. The first was a delivery of a WESST orientation 2-day workshop that provided incoming WESSTs with an orientation to the WESST role, including tools and templates to help drive success in the WESST roles. This orientation was well-attended, with more than 156 attendees over the 2-day workshop offerings. The second accomplishment from the subcommittee included a collaborative effort with Human Resources Professional and Organizational Development to offer SCoR integration training to all WESSTs.

Currently, 465 workers across the institution are identified as environment, safety, and security representatives. The representatives are encouraged to participate in monthly IWESST meetings. In 2021, the IWESST leadership set goals to increase management participation and assistance in facilitating IWESST meetings, gain management support across all organizations for WESST, and continue efforts in the leadership and teamwork subcommittees. Through October 2021, management attendance efforts at each IWESST meeting resulted in increased participation, with an average participation of 100 workers and managers at each monthly meeting.

In addition, the VPP Office and WESSTs played a critical role in providing worker-level input to manager-worker collaborative teams:

- The Active Bystander Initiative combats incivility, disrespect, and microaggressions through awareness and empowerment to speak up as an active bystander.
- The VPP Steering Committee is in the process of being restructured to include senior leadership, oversight, and participation. This new structure promotes management leadership efforts in providing strategic vision and resources necessary to support VPP tenets and program elements.
- IWESST representation is also a crucial committee member on the new restructure.
- The LANL Culture Alliance includes IWESST Chair representation in collaboration with senior-level managers in evolving opportunities in culture transformation focused on leadership, employee engagement, and organizational learning.
- 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.

Site-Wide 2021 Operations Data and Affected Resources

In addition to providing input to manager-worker collaborative teams, in 2021, LANL, the IWESST, and WESSTs spearheaded many environment, safety, and security initiatives that led to the awareness, education, and resolution of concerns, including the following:

- ALDESHQSS WESST created a series of personal protective equipment (PPE) posters to increase awareness of appropriate PPE for the job.
- ALDWP WESST sponsored a presentation in Northern New Mexico to communicate concerns and resources regarding childcare during COVID.
- IWESST sponsored a tag line contest to increase appropriate employee utilization for the Emergency Operations Support Center call line.
- IWESST provided input and hosted virtual booth content for outdoor safety during LANL's 2021 Earth Week.
- LANL partnered with N3B to create the Commuter Safety Task Force, which increased communications and awareness to positively influence safety driving to, from, and around Los Alamos.
- Los Alamos Explosives Safety sponsored a virtual 2021 High Explosives Safety Days event to communicate awareness of high explosives safety, history, program updates, and lessons learned.
- ALDPS WESST worked to increase worker and manager field interactions.
- The Director's Office WESST developed an MOV guidance card specific to office environment safety and security for onsite and telework.
- ALDBUS WESST increased employee and management engagement in monthly meetings amongst a worker population that is highly reliant on teleworking.
- ALDGS WESST created and offered a safety and security summit for directorate employees that focused on electrical safety in the R&D Environment, off-site work (Lessons Learned from Seattle), and recent Lab operational experiences.
- ALDFO WESST increased learning from experience using safety conversation cards and WESST member engagement in use of the cards.
- ALDESHQSS WESST initiated increased management engagement with implementation of a competition across ALDs by tracking management engagement in MOVs, thus increasing management presence in the field.
- ALDX WESST improved and increased communication of safety and security issues while partnering management and employees in these efforts. Communications focused on COVID-19 and vaccination efforts geared toward employees working onsite and remotely.
- ALDCELS WESST increased ergonomic and hand safety awareness through communication and participation.
- ALDSC WESST educated and provided resources for their Directorate population on home ergonomics equipment, stretches, schemes, and procedures.
- ALDCP WESST encouraged active workforce engagement through support of the Human Performance Improvement working group to expand hazard analysis to the worker level.
- ALDW WESST leveraged learning from experience by emphasizing operational excellence and encouraging management to exercise active communications of lessons learned in daily operations.
- During monthly IWESST meetings, attendees used the WESST Action Log to identify, track, distribute, and communicate worker concerns for investigation and resolution.

- Attendees of monthly IWESST meetings displayed and discussed IWESST quad charts to encourage communications across ALDs regarding I/I rates, challenges, successes, and Safety and Security Improvement Plan completion status.
- The IWESST partnered with Occupational Health to distribute winter safety items at scheduled flu vaccination clinics for the workforce.
- The IWESST partnered with a communication campaign to reduce instances of portable electronic devices in unauthorized areas.

Other Notable Events & Achievements

- Virtual WESST Fest: The 12th Annual WESST Fest—a celebration of worker environment, safety, and security successes—was held in the second-annual virtual format in July 2021 to accommodate COVID-19 barriers. Close to 14,000 page-view booth visits to the 36 virtual booths occurred over the 3-day event. A WESST appreciation video was featured from Laboratory Director Thom Mason. Booths included various content that was organized by VPP Tenet categories within Safety & Health training, Site Analysis, Hazard Prevention and Control, Management Leadership, and Employee Engagement.
- 2021 Jane Hall Award: The COVID-19 Closed POD Working Group was the winner of the fourth annual Jane Hall Award, which recognizes a team or organization that has demonstrated continued improvement in safety and security processes or performance. The group was established to develop and implement a closed point of dispensing (POD) with a goal to vaccinate the Laboratory's workforce efficiently and expediently against COVID-19. Becoming a closed POD directly benefited the Laboratory and its workforce by improving protection against contracting COVID-19 and allowing the workforce to continue working or return to work more quickly than if workers were required to get vaccinated in the community.
- Annual DOE-VPP Participants Virtual Meeting: LANL participated in the annual DOE-VPP Participants Meeting virtually in October 2021. In addition to participation, LANL shared experiences and knowledge with other DOE-VPP sites by providing a presentation led by Laboratory Associate Director for ESHQSS about LANL's Cultural Alliance Journey. The presentation shared LANL's approach to culture and its many facets. Discussed during this presentation was the need to advance the approach and set identified outcomes to workforce culture.
- Health and Safety Outreach Events and Fairs: The VPP Office, IWESST, and WESSTs collaborated with the Institutional Employee Well-Being and Health team to provide outreach and information on employee well-being and safety throughout events during FY 2021. Eleven health and safety events reached more than 7,279 employees. Eighty-three classes that included topical areas in wellness, health promotion, safety, Virgin Pulse, benefits and Fidelity, Ombuds, Active Bystander, Team Psychological Safety, and Focused Injury Training provided outreach to more than 5,297 employees during FY21.
- WESST Star Awards: More than 80 LANL employees were nominated for various environment, safety, and security good catches, enhancements, and initiatives.
- Provided outreach and benchmarking for VPP resources to Mission Support and Test Services in May 2021.

3.5.1 Injuries and Illnesses

Table 3-27 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 3-27. Total Recordable Cases and Days Away, Restricted, or Transferred Rates

Rate	Total 2020 Cases	CY 2020[a]	Total 2021 Cases	CY 2020[a]	Percent Change in Rate
TRC[b]	138	1.24	227	1.93	56%
DART[c]	67	0.55	101	0.86	56%

[a] CY rates reflect the rolling average rate at the end of December of each year.
[b] Total Recordable Cases
[c] Days Away, Restricted, or Transferred

In 2021, the North American Industry Classification System data were not published or available to be included in this publication. There will be no comparison to industries' rates.

Figure 3-1 shows the breakdown of recordable injuries by category for CY 2021. These data are based on 227 cases.

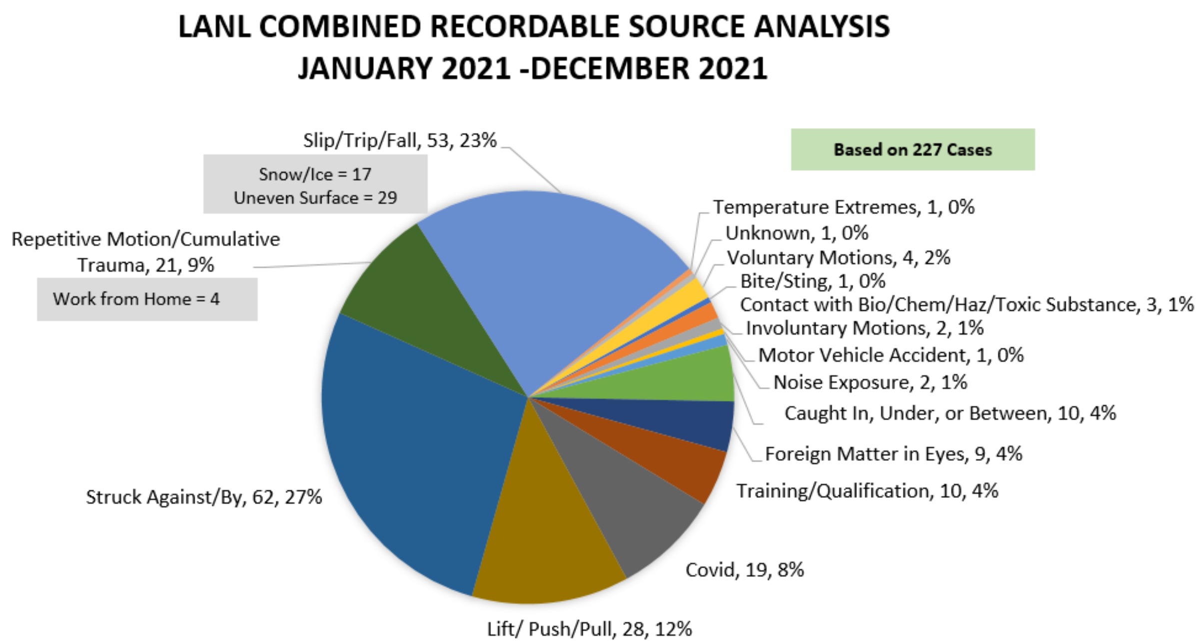

Figure 3-1. LANL recordable injury data for 2021.

3.5.2 Ionizing Radiation and Worker Exposures

Occupational radiation exposures for workers at LANL during CY 2020 and CY 2021 are summarized in Table 3-28. The collective total effective dose for the LANL workforce during CY 2021 was 300 person-rem, an increase of 29 percent from CY 2020. Data in Table 3-28 reflect that 62 percent more workers received measurable dose in CY 2021. With more workers and relatively higher collective dose, the average non-zero dose per worker decreased by 22 percent. In CY 2020, 2.64 of the 232 person-rem collective total effective dose was from internal exposures to radioactive materials. The majority (2.59 rem, 98 percent) resulted from an event occurring June 8, 2020 (detailed in Occurrence Reporting and Processing System report NA--LASO-LANL-TA55-2020-0012). In CY 2021, 0.198 of the 300 person-rem collective total effective dose was from internal exposures to radioactive materials. These exposures primarily resulted from low-level uranium and low-level tritium intakes consistent with routine operations. There were two low-level plutonium intakes—one associated with a contamination event in March 2021 and the other identified through routine monitoring. 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 3-28. Radiological Exposure to LANL Workers

Parameter	Units	2008 SWEIS	CY 2020	CY 2021
Collective total effective dose (external + internal)	person-rem	543[a]	232	300
Number of workers with measurable dose	number	2,018	2,488	4,026
Average non-zero dose (external + internal radiation exposure)	millirem	139	94	73

[a] In September 2020, the United States (U.S.) Department of Energy (DOE) National Nuclear Security Administration (NNSA) issued an amended Record of Decision (ROD) that selected to implement additional elements of the Expanded Operations Alternative for an increase in pit production, which includes an increase in the Collective total effective dose (external + internal) to 543.

After an uptick observed in CY 2019 and CY 2020, the highest individual doses decreased in CY 2021. These doses were primarily associated with continued TA-55 operations in 2020 and 2021, 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 2021, no worker exceeded the two-rem-per-year LANL administrative control level established for external exposures. No worker exceeded DOE's five-rem-per-year dose limit. Table 3-29 summarizes the five highest individual dose data for CY 2020 and CY 2021 compared with 2008 when the LANL 2008 SWEIS was finalized.

Table 3-29. Highest Five Individual Annual Doses (Total Effective Dose) to LANL Workers[a]

CY 2008	CY 2020	CY 2021
2.106	3.021	1.375
1.198	1.819	1.295
1.132	1.727	1.218
1.096	1.668	1.214
0.952	1.401	1.177

[a] Source: O'Connor et al.

The collective total effective dose for CY 2020 and CY 2021 was 83 and 107 percent, respectively, of the 543-person-rem-per-year projection in the 2008 SWEIS.

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 2021. 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 2021 were accrued at TA-55. A primary contributor to dose in 2020 and 2021 was work with Pu-238—producing general-purpose heat sources for use individually and combined in radioisotope thermoelectric generators. Doses at TA-55 were slightly higher for 2021, reflecting the resumption of mission-essential work following the COVID-19 pandemic.

In addition to TA-55 operations, a significant portion of LANL dose was accrued by workers commensurate with programmatic and maintenance work at LANSCE (TA-53). A reduction in this segment of the overall dose in 2021 can be attributed to extended cool-down time resulting from LANL's COVID-19 posture. 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 7 percent from CY 2020 to CY 2021. Extremity doses remain commensurate with handling significant quantities of radioactive material.

3.5.3 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 2022 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.

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 Logistics (craft workers) organizations are distributed across the Laboratory, and these 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 2021 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 (DOE/NNSA's management and operations contractor) employees and subcontractors, N3B (DOE-EM) employees and subcontractors and Centerra Group (protective force at LANL). Under the 2008 SWEIS No Action Alternative, the 2005 levels of employment were assumed to remain steady at 13,504 employees. In September 2020, the DOE/NNSA issued an amended ROD 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. As shown in Table 3-30, the total number of employees in CY 2021 was approximately 4.3 percent greater than the 13,792 employees reported in the CY 2021 Yearbook.

Table 3-30. LANL-Affiliated Workforce

Category	Triad Employees[a]	Triad Subcontractors	N3B Employees[b]	N3B Subcontractors	Protective Force[c]	Total
2008 SWEIS[d]	13,706[e]	1,078	Not projected	Not projected	616	15,400
CY 2021	12, 809	605	422	189	355	14,380

[a] Triad became the management and operations contractor for DOE/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.
[e] In September 2020, DOE/NNSA issued an amended ROD that selected to implement elements of the Expanded Operations Alternative for an increase in pit production. The Expanded Operations Alternative number is 15,400 employees.

The number of employees at the end of CY 2021 was approximately 93 percent of the total employees projected in the Expanded Operations 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 in 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 3-31, approximately 77 percent of employees reside in Los Alamos, Santa Fe, and Rio Arriba counties.

Table 3-31. 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]	7,854	3,080	2,926	1,078	14,938	462	15,400
CY 2021 Triad	5,015	2,039	3,129	1,858	12,041	768	12,809
CY 2021 N3B	172	152	110	146	580	27	607

[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.
[c] In September 2020, DOE/NNSA issued an amended ROD that selected to implement elements of the Expanded Operations Alternative for an increase in pit production. The Expanded Operations Alternative number is 15,400 employees.

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 (the National Park Service [NPS], the U.S. Forest Service, and the Bureau of Land Management), the Pueblos of San Ildefonso and Santa Clara, and Los Alamos County, which includes public and private properties. The highest concentration of facilities and workers is found in 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.

A special resource study/EA was completed in 2010 (DOI 2010) to study the preservation and interpretation of historic sites of the Manhattan Project for inclusion in the NPS. DOE adopted the EA and the Finding of No Significant Impact in 2010 (DOE 2010b). In December 2014, the MPNHP 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, public tours are conducted 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 LANL 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 2021, LANL occupied 26,058 acres (approximately 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 (within the Department of Interior) 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), and approximately 3,176 acres (5 square miles) has been transferred to other federal or local government. Approximately 2,100 acres of land has been transferred to the Secretary of Interior, to be held in trust for the Pueblo de San Ildefonso, and approximately 1,076 acres has been conveyed to Los Alamos County and the Los Alamos School District. Ten original tracts identified in the *Environmental Impact Statement for Land Conveyance and Transfer* 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 the Interior. Table 3-32 provides location and size information on the land tracts remaining to be conveyed, which total about 1,280 acres (2 square miles), and all of these tracts would be conveyed to Los Alamos County.

Table 3-32. Remaining Tracts Analyzed for Potential Conveyance

Land Tract	Approx. Acreage	Location
TA-21/A-16 tracts	220	Accessed by DP Road, these tracts were delineated into smaller tracts to prepare for conveyance to the County. The remaining tracts are located 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 New Mexico 4 south to East Jemez Road); contingent on DOE supplemental environmental project scheduling, these two tracts comprise the White Rock "Y" and New Mexico 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 units 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.

In February 2020, unknown materials and debris were discovered by Los Alamos County Department of Public Utilities subcontractors while installing a utility line on former DOE property. This material and subsequent discoveries during trenching were located on DP Road within former land conveyance tracts A-16-a, A-8-a and A-8-b. Response to the event included DOE's Radiological Assistance Program team, NA-LA, DOE-EM, Triad, and N3B staff. Initial response and continued project support activities allowed successful installation of the county lift station in 2020. These activities included waste characterization, sampling and monitoring (including air emissions), site stabilization, historical research, and heavy equipment operation and excavation.

DOE's Office of Enterprise Assessments conducted an assessment in 2020 that specifically examined the processes used to convey DOE land on DP Road to Los Alamos County, where buried waste related to LANL operations during the Manhattan Project was discovered. The waste had not been identified during land characterization activities. The results of this assessment are available to the public (DOE 2021e).

3.8 Groundwater

Under the 2008 SWEIS No Action Alternative, 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 2021 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 and injection being conducted as the interim measure is occurring in the regional aquifer beneath Mortandad Canyon. 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 implemented only on a very limited basis to date.

In CY 2017, DOE prepared a Supplement Analysis to the 2015 EA for Chromium Plume Control Interim Measure and Plume Center Characterization (DOE 2017b). 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 2021, 2016 Consent Order activities included interim measures activities and performance monitoring for chromium in groundwater in Mortandad Canyon. New groundwater monitoring wells that were installed in CY 2021 include R-71 and R-72. Additional activities associated with the chromium project included the redevelopment of R-28 and R-42 after completion of the supplemental pilot-scale testing conducted at these two wells. Activities associated with the groundwater underlying the TA-16 area included

- continued groundwater characterization and monitoring,
- responding to NMED's comments on the Fate and Transport Modeling and Risk Assessment Report that was submitted to NMED in May 2020,
- preparing for and conducting five technical team meetings with NMED to discuss the comment responses, and
- scoping of the revision to the Fate and Transport Modeling and Risk Assessment Report.

3.9 Cultural Resources

LANL lands comprise numerous and diverse historic and prehispanic properties. As of FY 2021, archaeologists have completed surveys of prehispanic and historic cultural resources on 90 percent of DOE/NNSA-administered land in Los Alamos and Santa Fe counties. There are 1,757 identified prehispanic cultural resources sites (Table 3-33). Seventy-nine percent of the archaeological sites at LANL date between the thirteenth and fifteenth centuries anno Domini (A.D.) and are Ancestral Puebloan. 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 located on mesa tops. Within LANL's limited access boundaries, Pueblo and Athabaskan[13] communities have identified Ancestral Pueblo villages, shrines, petroglyphs, sacred springs, trails, and traditional use areas as traditional cultural properties.

Table 3-33. Acreage Surveyed, Prehispanic Cultural Resource Sites Recorded, and Cultural Resource Sites Eligible for the National Register of Historic Places (NRHP) at LANL in Fiscal Years 2008 and 2019, 2020, and 2021[a]

Fiscal Year	Total Acreage Surveyed by Fiscal Year	Total Acreage Systematically Surveyed to Date	Total Identified Prehispanic Cultural Resource Sites to Date (Cumulative)	Total Number of Eligible and Potentially Eligible NRHP Sites	Percentage of Total Prehispanic Sites Eligible and Potentially Eligible
2008	0	23,130	1,727	1,625	94
2019	61	23,188	1,752	1,636	93.3
2020	20.05[b]	23,208[c]	1,752[d]	1,635[c]	93.3
2021	50.83[b]	23,259[c]	1,757[d]	1,641[c]	93.3

[a] Source: Information on LANL provided by DOE/NNSA and Triad
[b] During FY 2021, 50.83 new acres was surveyed.
[c] No tracts of land were conveyed during FY 2021.
[d] This number includes prehispanic sites that have not been evaluated and, therefore, could be NRHP eligible. 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.

To date, cultural resource staff at LANL have not identified Spanish Colonial or Mexican period sites. The 556 historic cultural resources include both historic archaeological sites, 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 556 potential historic properties (Table 3-34).

[13] Athabaskan 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.

Table 3-34. Historic Period Cultural Resource Properties at LANL[a]

Fiscal Year	Total Identified Historic Cultural Resource Properties to Date (Cumulative)	Total Number of Eligible and Potentially Eligible Properties	Percentage of Total Historic Properties Eligible and Potentially Eligible	Evaluated Buildings Demolished
2008	758	346	55	144
2019	562	366	78	231
2020	564[b]	365[b]	64.7[c]	231[d]
2021	556[b]	358[b]	64.3[c]	235[d]

[a] Source: Information on LANL provided by DOE/NNSA and 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 "Identified Properties" or other columns in this table.

[c] The reduction in the data numbers in this column are in response to the realignment of this table to more closely match the prehispanic resources table. This column was updated during FY 2020, and it now indicates the percentage of total historic properties (building and archaeological sites) that are eligible or that are considered eligible until such time that they are formally recorded and evaluations consulted on with the State Historic Preservation Office. This column formerly indicated only the percentage of eligible properties of the formally recorded properties.

[d] This number represents the total number of evaluated buildings demolished to date. Numbers for 2019 and 2020 inadvertently included the D&D of an exempt structure.

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 inclusion under the National Historic Preservation Act. 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 146 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. Most (119 sites) are structures or artifact scatters associated with the Early Historic Pajarito Plateau or Homestead periods. Of the 146 sites, 92 are eligible or potentially eligible for inclusion in the NRHP. There are 410 Manhattan Project–, Early Cold War–, and Late Cold War–period buildings.

LANL continues to demolish buildings as part of the DD&D Program. Table 3-35 indicates historic building documentation and demolition conducted under the 2017 Programmatic Agreement between the DOE/NNSA Los Alamos Field Office, the State Historic Preservation Office, and the Advisory Council on Historic Preservation (DOE 2017c). Not all buildings that have been documented as part of the DD&D Program have been demolished.

Table 3-35. 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
2019	8	1
2020	10	0
2021	0	5

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. Triad meets Section 106 requirements through a process outlined in the 2017[14] Programmatic Agreement between the DOE/NNSA, the New Mexico State Historic Preservation Office, and the Advisory Council on Historic Preservation (DOE 2017b) and the 2017 Cultural Resources Management Plan (CRMP) (LANL 2017). The Programmatic Agreement is a legally binding document that defines compliance activities and processes at LANL and is scheduled to be updated during FY 2022. The CRMP is implemented through the Programmatic Agreement and provides a process 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 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 culturally affiliated groups and organizations in identifying traditional cultural properties and sacred sites.

In FY 2021, cultural resources staff at LANL evaluated 787 proposed actions and conducted three field surveys to identify archaeological sites and historic buildings. Also in FY 2021, DOE/NNSA submitted four survey reports to the New Mexico State Historic Preservation Office for concurrence in findings of effects and determinations of eligibility for cultural resources. 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 2021 during LANL activities.

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

[14] The Programmatic Agreement was updated during FY 2022; the update will be reflected in the FY 2022 Yearbook.

land without a permit. Triad cultural resources staff identified no violations of this Act on DOE/NNSA land in FY 2021.

3.9.2 Compliance Activities

During FY 2021, Triad cultural resources staff began support for the DARHT vessel inspection and staging facility and continued support for the DARHT vessel repair facility at TA-15, which included the updating the recordings of two archaeological sites eligible for inclusion in the National Register of Historic Places.

Staff continued support for the photovoltaic project in TA-16 as well, including updating the archaeological site boundary of the Anchor Ranch homestead site to include several sections of historic fence line and telephone line route.

Survey and site recording was begun and consultation initiated on the Energetic Materials Characterization project in TA-06.

During FY 2021, Triad cultural resources staff completed the detailed updated recording of a large cavate zone (more than 100 cavates) adjacent to the northeastern boundary of the Pajarito Site (TA-18) unit of the MPNHP unit at LANL. Additionally staff updated site recordings for four other nearby archaeological sites that are within the viewshed of the Park. The updated site recording results will be documented in a report to be submitted to the New Mexico State Historic Preservation Office for updated eligibility status concurrence.

A pedestrian survey was completed for a new Calibration Site in Water Canyon in TA-68 and the associated electrical line project in Fence and Water Canyons in TA-36 and TA-68. During FY 2021, 50.83 acres was surveyed. Upon survey completion, a report that documents the results of both associated surveys and related cultural resources will be prepared and submitted to the New Mexico State Historic Preservation Office for review and concurrence on site eligibility status for inclusion in the NRHP.

The final documentation of the excavation of the Vigil y Montoya Homestead was completed and submitted to the State Historic Preservation Office during FY 2021.

During 2021, Triad cultural resources staff also completed several historic building consultation reports. One report and consultation documentation was prepared for roof replacement to TA-16-0054, a Manhattan Project building. Two additional reports and consultation documentation was prepared for phase 2 of the rehabilitation, restoration, and adaptive reuse of TA-22-0001 (the Fat Man Quonset Hut) and for the installation of ramps and a utility cabinet at TA-18-0001 (the Slotin Building). Also during FY 2021, the fieldwork associated with the eligibility evaluations of 104 historic buildings was completed by a subcontractor in conjunction with Triad cultural resources staff.

3.9.3 Land Conveyance and Transfer

The Laboratory continued a multiyear program in support of the Land Conveyance and Transfer Project. In 2021, no tracts of land were transferred or conveyed. Due to the COVID-19 pandemic, DOE and cultural resource staff from LANL were not able to conduct the FY 2021 annual inspection of the cultural facility (Museum of Indian Arts & Cultural 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.

3.10 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 2021, in support of the preparation of the National Park Services' Cultural Landscape Report (which is being prepared by the University of Oregon [under contract with NPS]), Triad archaeologists completed updating the site recordings for the five archaeological sites that are within the viewshed of the Pajarito Site (TA-18 Park unit). These updates will be documented in a report to be submitted to the New Mexico State Historic Preservation Office for updated eligibility status concurrence.

In 2021, cultural resources staff worked with National Park Service staff on three priority projects at Park properties and Park-eligible properties:

- the asbestos shingle replacement with non-asbestos shingles on all Manhattan Project buildings,
- the roof replacement on the Slotin Building (TA-18-0001), and
- the repair and stabilization of the door on Battleship Bunker TA-18-0005.

Also in 2021, cultural resources staff and Bradbury Science Museum staff saw the donation of a Manhattan Project–era bomb hauler truck that was used at Los Alamos. It currently sits at V-Site, awaiting restoration work to return it to service. The truck will be used for interpretation of Park sites.

All public tours to the TA-18 unit of the MPNHP were cancelled. Triad cultural resources staff provided multiple public presentations, including

- a presentation to Picuris Pueblo's science, technology, engineering and math program;
- a presentation to LANL's Environmental Management System core team;
- a presentation to LANL's Subcontractor Forum;
- a lecture to anthropology students at University of Oklahoma;
- several in-reach tours for Triad weapons personnel and Triad biologists; and
- a presentation during the annual Pecos archaeological conference.

3.11 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 2021 support this projection. These data are reported in the "2021 Annual Site Environmental Report" (LANL 2021c).

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 were completed as needed (see 3.11.20).

3.11.1 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 high-risk 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 2022). 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 2021, implementation of the LANL Wildfire Mitigation and Forest Health Plan (LANL 2019) continued with hiring and mitigation project implementation. An annual operating plan outlines planned mitigation projects and progress toward the following goals:

- 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.

In February 2021, LANL hired a forest health program manager to integrate forest health objectives into wildland fire mitigations. This effort was a significant accomplishment and milestone to ensure that LANL wildland fire mitigation and forest health initiatives are executed collaboratively. Forest health initiatives include open space thinning, invasive species removal, and development of a monitoring program. Mitigation projects that reduce the risk of high-severity crown fire that would impact forest resources included King, Sled, and Omega fire road improvements; annual maintenance activities, including fire break and evacuation route roadside fuel mitigations; an oak shrub thinning treatment; and power line fuel mitigations.

Fuels management at LANL is completed annually 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, NM, and associated Finding of No Significant Impact was completed in 2019 (DOE 2019c, 2019d). This SEA addresses changes since 2000 and environmental impacts associated with implementing the Forest Health and Wildland Fire Mitigation Plan.

3.11.2 Threatened and Endangered Species Habitat Management Plan

DOE/NNSA started an administrative update of the Threatened and Endangered Species Habitat Management Plan (HMP). The update addressed the current development status in buffer habitat for all Mexican spotted owl Area of Environmental Interests (AEIs). All AEIs except Three-mile have exceeded the allowable development levels of the initial HMP and now require consultation for additional development in buffer habitat (LANL 2022).

LANL continued annual surveys for the Mexican spotted owl, the Southwestern willow flycatcher, and the Jemez Mountains salamander in CY 2021, pursuant to the HMP, and prepared biological assessments and compliance packages.

During CY 2021, LANL prepared a biological assessment for the Request to Amend the Consultation for the Modernization and Development of the Weapons and Facility Operation's High Explosive Testing and Processing Facilities at Los Alamos National Laboratory (LANL 2021d). Ten ecological reviews for Storm Water Pollution Prevention Plans were also prepared in CY 2021 for compliance with the CGP.

During CY 2021, the following floodplain assessments were prepared.

- "Los Alamos National Laboratory Floodplain Assessment for the Heating, Ventilation, and Air Conditioning Project at Technical Area 39" (LANL 2021e)
- "Los Alamos National Laboratory Floodplain Assessment for Fire Risk Mitigations at the Lower Slobbovia Explosives Testing Site in Technical Area 36" (LANL 2021f)
- "Los Alamos National Laboratory Floodplain Assessment for the West Road Maintenance Project" (LANL 2021g)
- "Los Alamos National Laboratory Floodplain Assessment for High Explosive Transfer Facility Blast Radius Fence Project at Technical Area 08" (LANL 2021h)

3.12 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 2021, DOE/NNSA removed 16 structures, eliminating 14,902 square feet of the LANL footprint. Table 3-36 shows the total number of gross square feet of the LANL footprint eliminated since CY 2008.

Table 3-36. 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
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
2020	513	1,096,608
2021	14,902	1,111,510

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

3.12.1 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 that DD&D actions would produce large quantities of demolition debris and bulk LLW and smaller quantities of TRU, MLLW, sanitary, asbestos, and hazardous wastes. In CY 2021, DOE/NNSA demolished 16 structures. Table 3-37 summarizes the waste volumes for all buildings that underwent the DD&D process in CY 2021.

Table 3-37. CY 2021 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
16-0460	10/18/2021	5663.4	114.6	0	326	0	0	0
16-0462	09/03/2021	487	7.6	0	11.3	0	0	0
16-0463	08/27/2021	852.3	11.4	0	28.3	0	0	0
22-0011	08/30/2021	0	0	0	2.27	88.2	0	0
22-0012	09/01/2021	0.62	0	0	2.27	88.2	0	0
22-0014	10/21/2021	0	0	0	2.27	88.2	0	0
22-0015	09/27/2021	0.80	0	0	2.27	88.2	0	0
22-0016	09/07/2021	1.7	0	0	2.27	88.2	0	0
22-0017	10/18/2021	0	4.7	0	2.27	88.2	0	0
22-0019	10/07/2021	0	0	0	2.27	88.2	0	0
22-0021	10/12/2021	0	0	0	2.27	88.2	0	0
22-0022	12/02/2021	0	4.7	0	2.27	88.2	0	0
22-0023	10/15/2021	3.54	0	0	2.27	88.2	0	0
22-0024	12/14/2021	0	0	0	2.27	88.2	0	0
22-0025	12/23/2021	5.24	4.7	0	2.27	88.2	0	0
22-0035	11/22/2021	0	0	0	2.27	88.2	0	0
Total		7,015	148	0	395.11	1,146.6	0	0
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.

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

[c] For waste volumes that are tracked in tons, cubic meters volume was 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 3-38. DD&D Waste Projections for CY 2021

Building Number	DD&D Completed	Waste Volumes			
		Chemical Waste[a]	LLW[b,c]	Mixed LLW[b]	TRU[b]
16-0460	10/18/2021	0	41.2	9.2	0
Totals	-	0	41.2	9.2	0
2008 SWEIS	-	1,417,000[d]	91,891[e]	649[f]	437[g]

[a] Units = kilograms per year.
[b] Units = cubic meters per year.
[c] LLW, both bulk and packaged.
[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 meter from the RLWTF Upgrade; 260 cubic meters from the Plutonium Refurbishment; and 0.76 cubic meters 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 2021 exceeded annual waste volumes for the Non-Key Facilities because of the disposal of press filter cakes from the SERF, disposal of spill material from old mixing tanks, and disposal of construction and demolition debris from refurbishing projects. Although chemical waste volumes exceeded projections for CY 2021, 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. Electricity and water consumption remained within the 2008 SWEIS levels projected for utilities in CY 2021. Total gas consumption for CY 2021 was about 500,000 decatherms more than projected in the 2008 SWEIS. In 2021, on-site power was generated at the Combustion Gas Turbine Generator which resulted in the exceedance. At the end of CY 2021, LANL employed 14,380 staff.

The purpose of the CY 2021 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 2021 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

Capability and Operations Tables for Key and Non-Key Facilities

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

Capability	2008 SWEIS Projections	2021 Operations
Analytical Chemistry	Support actinide research and processing activities by processing approximately 7,000 samples per year	Performed chemical analyses on 150 samples in support of Plutonium Facility and CMR operations
Uranium Processing	Recover, process, and store LANL's highly enriched uranium inventory	Processed U-233 and U-235 materials for disposal or long term storage at off-site facilities
Destructive and Nondestructive Analysis	Evaluate up to 10 secondary stages per year through destructive/non-destructive analyses and disassembly	No secondary stage analysis 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	Performed plutonium metal compatibility testing on process reagents and contact materials
	Analyze TRU waste disposal related to validation of WIPP performance assessment models	No activity
	Perform TRU waste characterization	Conducted characterization of actinide residues for disposal as TRU waste at WIPP
	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

Capability	2008 SWEIS Projections	2021 Operations
Large Vessel Handling[b]	Process up to two large vessels from the Dynamic Experiments Program annually	Completed vessel processing.

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

Parameter	Units[a]	2008 SWEIS Projections	2021 Operations
Radioactive Air Emissions			
Total Actinides[b]	Ci/yr	7.60E−04	3.18E-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	1,259
LLW	m^3/yr	1,835	67
MLLW	m^3/yr	19	3
TRU	m^3/yr	42[d]	4
Mixed TRU	m^3/yr	N/A[d]	0.2

[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 off-site 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[a]

Capability	2008 SWEIS Projections	2021 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
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 stages per year (of depleted uranium, depleted uranium alloy, enriched uranium, deuterium, and lithium)	Fabricated components for fewer than 50 secondary stages
	Fabricate non-nuclear components for research and development; about 100 major hydrotests and 50 joint test stages per year	Fabricated components for fewer than 100 hydrotests and for fewer than 50 joint test stages
	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

[a] These Machine Shop capabilities are being combined with the Sigma Complex Key Facility capabilities because the uranium machining operations will move into the Sigma Building in CY 2022.

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

Parameter	Units[a]	2008 SWEIS Projections	2021 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	0.74
Wastes			
Chemical	kg/yr	9,979	26,398[d]
LLW	m^3/yr	994	635
MLLW	m^3/yr	4	31[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 2021, chemical waste generation at the Sigma Complex exceeded 2008 SWEIS projections because of the disposal of HVAC air intake media, which accounted for 41 percent (10,743 kilograms) of the total. Thirty eight percent (9,952 kilograms) of the chemical waste total was due to the disposal of graphite machining operations.
[e] In CY 2021, MLLW generation at the Sigma Complex exceeded 2008 SWEIS projections because of the disposal of material associated with the cleanup of cadmium and lead in storage, which accounted for 57 percent (17.8 cubic meters), and the disposal of contaminated electronics, which accounted for 24 percent (7.6 cubic meters) of the total.
[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) Comparison of Operations

Capability	2008 SWEIS Projections	2021 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 approximately 10 hydrodynamic tests
	Manufacture up to 50 joint test assembly sets per year	Supported up to approximately 10 joint test assembly
	Conduct production work in the new Mark Quality Manufacturing Center	Supported DOE/NNSA mark quality production work as projected
	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	Activity performed as projected
Dimensional Inspection of Fabricated Components	Perform dimensional inspection of finished components	Activity performed as projected
	Perform other types of measurements and inspections	Activity performed as projected

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

Parameter	Units[a]	2008 SWEIS Projections	2021 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	50,395
LLW	m^3/yr	604	80
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-7. Materials Science Laboratory (TA-03) Comparison of Operations

Capability	2008 SWEIS Projections	2021 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	2021 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.

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

Parameter	Units[a]	2008 SWEIS Projections	2021 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
LLW	m^3/yr	0	0
MLLW	m^3/yr	0	0.1[c]
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 2021, MLLW generation at the MSL exceeded 2008 SWEIS projections because of the disposal of depleted uranium and uranium hydride samples, which accounted for 100 percent (0.1 cubic meter) of the total.

[d] 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	2021 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	2021 Operations
Radioactive Air Emissions			
Not projected[b]	Ci/yr	Not projected[b]	Not measured[b]
NPDES Discharge			
03A027[c]	MGY	17.7	7.7
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) were have been directed to Outfall 001 in September 2016.
[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	2021 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 5,500 pounds (2,495 kilograms) of high explosives and less than 800 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.

Capability	2008 SWEIS Projections	2021 Operations
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 2,700 parts at TA-16-0260, and several parts manufactured at Pantex were modified in support of hydrotest activities.
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 244 device assemblies for support of the hydro program, proton radiography, NNSS, 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 20 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 2021

[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	2021 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	186,899[c]
LLW	m^3/yr	15	65[d]
MLLW	m^3/yr	<1	17[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] 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 2021, chemical waste generation at the High Explosives Processing Facility exceeded 2008 SWEIS projections because of the disposal of asbestos from re-roofing projects at TA-16, which accounted for 14 percent (26,481 kilograms); disposal of demolition debris from the remodel of TA-16-0969, which accounted for 8 percent (14,329 kilograms) of the total waste; construction and demolition debris generated from the TA-22-0090 conference room upgrade project, which accounted for 8 percent (14,379 kilograms) of the total waste; the disposal of waste generated from a cleaning process to remove oils from aluminum parts at TA-22, which accounted for 6 percent (10,788 kilograms) of the total chemical waste generated, and the disposal of construction debris from TA-08-0022 upgrades, which accounted for 6 percent (10,541 kilograms) at the High Explosives Processing facility.

[d] In CY 2021, LLW waste generation at the High Explosives Facility exceeded 2008 SWEIS projections because of the disposal demolition debris from the demolition of TA-16-0460, -0462, and –0463, which accounted for 100 percent (65 m3) of the LLW generated.

[e] In CY 2021, MLLW waste generation at the High Explosives Facility exceeded 2008 SWEIS projections because of the disposal of demolition debris from the demolition of TA-16-0460, -0462, and –0463, which accounted for 100 percent (17 m3) of the MLLW.

[f] 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	2021 Operations
Volume of Materials Required[a]	Conduct about 1,800 experiments per year	Conducted 404 experiments
	Use up to 6,900 pounds (3,130 kilograms) of depleted uranium in experiments annually	Expended 275 pounds (125 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	No activity
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-1-4, -15, -36, -39, and -40) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2021 Operations
Radioactive Air Emissions			
Depleted Uraniumb	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
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	35,380	179,425[e]
LLW	m^3/yr	918	446
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 2021, chemical waste generation at the High Explosives Treatment Facility exceeded 2008 SWEIS projections because of the disposal of fire suppression products, which accounted for 39 percent (69,724 kilograms); disposal of an underground tank, which accounted for 14 percent (25,809 kilograms); and the removal of asphalt from TA-14, which accounted for 6 percent (12,682 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	2021 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 4 gas boost system tests (all below 100 grams) and 13 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	Activity performed as projected
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	2021 Operations
Radioactive Air Emissions			
TA-16/WETF, Elemental tritium	Ci/yr	300	18.8
TA-16/WETF, Tritium in water vapor	Ci/yr	500	25.8
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	1,724	1,087
LLW	m^3/yr	482	32
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	2021 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 hydrotest 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	Activity performed as projected

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

Parameter	Units[a]	2008 SWEIS	2021 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	1,961
LLW	m^3/yr	10	0
MLLW	m^3/yr	<1	50 [c]
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 2021, MLLW generation at the Target Fabrication Facility exceeded 2008 SWEIS projections because of the disposal of legacy equipment from Rocky Flats, which accounted for 92 percent (46 cubic meters) and because of the disposal of debris associated with Ion Beam coating, which accounted for 8 percent (4 cubic meters) of the waste generated.

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

Capabilities	2008 SWEIS Projection	2021 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

Capabilities	2008 SWEIS Projection	2021 Operations
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[a]	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

[a] 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	2021 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	6,581
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	2021 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 off-site shipments per year	• Conducted target preparation, irradiation and processing to produce isotopes for medical, industrial, and research applications, resulting in ~100 off-site product shipments • Increased diversity of isotopes produced

Capability	2008 SWEIS Projections	2021 Operations
Actinide and TRU Chemistry	Perform radiochemical operations involving alpha-emitting radionuclides	Activity performed as projected
Data Analysis	Re-examine archive data and measure nuclear process parameters of interest to weapons radiochemists	Activity performed as projected
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 off-site 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 SWEIS Projections	2021 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	4.82E−09
Arsenic-72	Ci/yr	1.2E-04	No emissions[c]
Arsenic-73	Ci/yr	2.5E-03	No emissions[c]
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	No emissions[c]
Germanium-68[e]	Ci/yr	8.9E-03	2.14E−04
Rubidium-86	Ci/yr	3.0E-07	No emissions[c]
Selenium-75	Ci/yr	3.8E-04	1.91E−04
Other Activation Products[f]	Ci/yr	5.5E-06	6.42E−03
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes			
Chemical	kg/yr	3,311	12,889[g]
LLW	m^3/yr	268	65
MLLW	m^3/yr	4	10[h]
TRU	m^3/yr	0[i]	0
Mixed TRU	m^3/yr	0[i]	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 2021, chemical waste exceeded the 2008 SWEIS projections at the Radiochemistry Facility because of the disposal of unused/unspent laboratory waste, which accounted for 94 percent (12,170 kilograms) of total chemical waste generated.

[h] In CY 2021, MLLW exceeded the 2008 SWEIS projections at the Radiochemistry Facility because of the disposal of lead-contaminated materials from routine housekeeping and maintenance operations, which accounted for 86 percent (5.4 cubic meters) of total MLLW generated.

[i] 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]	2021 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 off-site 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 389,420 liters of radioactive liquid waste bottoms to an off-site 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 1,154,812 liters of liquid LLW
	Dewater, characterize, and package 60 cubic meters per year of LLW sludge	Packaged 24 cubic meters of LLW sludge (117 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 892,991 liters of treated water through the NPDES outfall; evaporated 172,060 liters of treated water.

[a] The 2008 SWEIS Projections updated to the Expanded Operations Alternative.
[b] All waste is sent offsite 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	2021 Operations
Radioactive Air Emissions			
Americium-241	Ci/yr	Negligible	No emissions[b]
Plutonium-238	Ci/yr	Negligible	No emissions[b]
Plutonium-239	Ci/yr	Negligible	No emissions[b]
Thorium-228	Ci/yr	Negligible	No emissions[b]
Thorium-230	Ci/yr	Negligible	4.14E−08
Thorium-232	Ci/yr	Negligible	No emissions[b]
Uranium isotopes	Ci/yr	Negligible	No emissions[b]
NPDES Discharge			
051	MGY	4.0	0.24
Wastes			
Chemical	kg/yr	499	3,949[c]
LLW	m^3/yr	298	653[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 2021, of chemical waste generation exceeded 2008 SWEIS projections because of disposal of surrogate test water from TA-50 Building 0230, which accounted for 96 percent (3,773 kilograms) of the total chemical waste generated at the RLWTF.

[d] In CY 2021, 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 93 percent (609 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	2021 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 3.5 microamperes - on demand was available to Areas B and C • H-beam was available 6 months of 2021 (up to approximately 3,700 hours, depending on the experimental area) • H+ available for about 4 months and approximately 2,300 hours.
	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	Activity performed as projected
Neutron Research and Technology[a]	Conduct 1,000 to 2,000 experiments/year using neutrons from the Lujan Center and Weapons Neutron Research Facility	Conducted approximately 162 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	No activity

Capability	2008 SWEIS Projections	2021 Operations
Neutron Research and Technology[a] (cont)	• Shock wave experiments involving small amounts, up to nominally 50 grams of plutonium • Support for static stockpile surveillance technology research and development	
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	The Coherent CAPTAIN-Mills (CCM) fundamental neutrino and dark matter physics experiment ran at Lujan from September through December.
	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[a]	Conducted 50 dynamic experiments: 28 high explosives shots in the containment vessel, with up to 10 pounds TNT equivalent high explosives, 20 powder gun experiments with up to 10 ounces (300g) gun powder, and 2 pulsed power experiments with approximately 3.5g of depleted uranium.
	Conduct research using ultracold neutrons; operate up to 10 microamperes per year of negative beam current	Activity performed as projected.
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 13 targets were irradiated in 2021: - 2 rubidium targets for strontium-82; - 4 gallium targets for gallium-68; - 1 scandium target for titanium-44 - 1 germanium target for arsenic-73 - 1 thorium target for production of actinium-225 - 4 R&D target irradiations • Irradiated ~52 research samples for production scoping, cross-section measurements, energy measurements, and secondary neutron activation.

Capability	2008 SWEIS Projections	2021 Operations
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 test stand operation continued. • Radiofrequency quadrupole test stand development and operation. • Continued operation of a C-B and radiofrequency source for development and testing of C-B and structures for advanced accelerator capability development. • Scorpius project prototype fabrication and testing.
Radioactive Liquid Waste Treatment (Solar Evaporation at TA-53)	Treat about 520,000 liters per year of radioactive liquid waste	In CY 2021, LANSCE received 81,500 liters of radioactive liquid waste into its holding tanks, including 18,941 liters from WETF. A total of 58,169 liters were discharged to/in the evaporation tanks in CY 2021.

[a] 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	2021 Operations
Radioactive Air Emissions			
Argon-41	Ci/yr	8.87E+02	1.48E+01
Particulate and Vapor Activation Products	Ci/yr	Not projected[a]	8.56E-01
Carbon-10	Ci/yr	2.65E+00	5.92E-01
Carbon-11	Ci/yr	2.25E+04	1.21E+02
Nitrogen-13	Ci/yr	3.10E+03	3.23E+01
Oxygen-15	Ci/yr	3.88E+03	6.06E+01
Tritium as Water	Ci/yr	Not projected[b]	1.28E+01
NPDES Discharge			
Total Discharges	MGY	29.5[c]	32.2[d]
03A048	MGY	Not projected[e]	31.9
03A113	MGY	Not projected[e]	0.29
Wastes			
Chemical	kg/yr	16,783	35,773[f]
LLW	m^3/yr	1,070	221
MLLW	m^3/yr	1	16[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] 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] In CY 2021, LANSCE beam operations were full production to all experimental areas which caused the increase in water use.

[e] The 2008 SWEIS did not calculate individual flow per outfall.

[f] In CY 2021, chemical waste generated at LANSCE exceeded 2008 SWEIS projections because of the disposal of material associated with scheduled maintenance work at LANSCE, which accounted for (13,865 kilograms); disposal of items during facility-wide cleanup, which accounted for (9,163 kilograms); and the disposal of asbestos from the Rosen Auditorium upgrade, which accounted (7,448 kilograms) of the chemical waste generated at LANSCE.

[g] In CY 2021, MLLW generated at LANSCE exceeded the 2008 SWEIS projections because of the disposal of legacy material during cleanup activities, which accounted for 31 percent (5 cubic meters); and the disposal of de-ionized water from the beam line, which accounted for 68 percent (11 cubic meters) of the MLLW generated.

[h] 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, -54, -60, and -63)

Capability	2008 SWEIS Projections	2021 Triad Operations	2021 N3B Operations
Waste Characterization, Packaging, and Labeling	Characterize 640 cubic meters of newly generated TRU waste	2,302 cubic meters	No activity
	Characterize 8,400 cubic meters of legacy TRU waste	No activity	Characterized 1052.9 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	Activity performed as projected	Activity performed as projected
	Support, certify, and audit generator characterization programs	Activity performed as projected	Activity performed as projected
	Maintain waste acceptance criteria for LANL waste management facilities	Activity performed as projected	Activity performed as projected
	Maintain waste acceptance criteria for off-site 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
Waste Transport, Receipt, and Acceptance	Ship 540 cubic meters per year of newly generated TRU waste to WIPP	258 cubic meters shipped	No activity
	Ship 8,400 cubic meters per year of legacy TRU waste to WIPP	No activity	Shipped approximately 169.9 cubic meters of legacy TRU to WIPP for disposal
	Ship LLW to off-site disposal facilities	Shipped approximately 2,988 cubic meters of LLW for off-site disposal	Shipped approximately 1628.92 cubic meters of LLW for off-site disposal

Capability	2008 SWEIS Projections	2021 Triad Operations	2021 N3B Operations
Waste Transport, Receipt, and Acceptance (cont)	Ship 55 cubic meters of MLLW for off-site treatment and disposal in accordance with EPA land disposal restrictions	Shipped approximately 165 cubic meters of MLLW for off-site disposal	Shipped approximately 120.63 cubic meters of MLLW for off-site disposal
	Ship 6,400 metric tons of chemical wastes for off-site treatment and disposal in accordance with EPA land disposal restrictions	Shipped approximately 4,322 metric tons of chemical waste for off-site disposal	Shipped approximately 1.95 metric tons of chemical waste for offsite disposal
	• Ship LLW, MLLW, and chemical waste from DD&D and remediation activities • Ship additional LLW, MLLW, and chemical waste from DD&D and remediation activities	Activity performed as projected	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 off-site 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 off-site 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	2021 Triad Operations	2021 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[a]	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[b]	Activity performed as projected	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 on-site 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

[a] LANL does not perform compaction anymore.
[b] Receipt of TRU waste at TWF commenced in October 2017.

Table A-28. Solid Radioactive and Chemical Waste Facilities (TA-50, TA-54, TA-60, and TA-63) Operations Data

Parameter	Units[a]	2008 SWEIS Projections	2021 Operations
Radioactive Air Emissions[b]			
Tritium	Ci/yr	6.09E+01	Not measured[b]
Americium-241	Ci/yr	2.87E−06	1.59E−10
Plutonium-238	Ci/yr	2.24E−05	6.47E−10
Plutonium-239	Ci/yr	8.46E−06	2.83E−11
Uranium-234	Ci/yr	8.00E−06	3.32E−09
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	1.45E−08
NPDES Discharge			
No outfalls	MGY	No outfalls	No outfalls
Wastes[d]			
Chemical	kg/yr	907	0[e]
LLW	m^3/yr	229	0[e]
MLLW	m^3/yr	8	0[e]
TRU	m^3/yr	27[f]	0[e]
Mixed TRU	m^3/yr	N/A[f]	0[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 off-site 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, high efficiency particulate air filters, personal protective clothing and equipment, and process wastes from size reduction and compaction.

[e] N3B assumed operational and management control of several facilities in TA-54. Waste numbers generated as part of N3B operations can be found in Table 3-8. The SWEIS Yearbooks will no longer publish waste numbers to compare with this Key Facility because of the change in waste operations between N3B and Triad. All site-wide waste generation numbers are captured in chapter 3.2.

[f] 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	2021 Operations
Plutonium Stabilization	Recover, process, and store existing plutonium inventory	Activity performed as projected
Manufacturing Plutonium Components	Produce a minimum of 30 war reserve plutonium pits per year and to implement surge efforts to exceed 30 pits per year up to the analyzed limit to meet the Nuclear Posture Review and national policy[a]	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)
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[b]	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

Capability and Operations Tables for Key and Non-Key Facilities

Capability	2008 SWEIS Projection	2021 Operations
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
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 NNSS 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

[a] In September 2020, DOE/NNSA issued an amended ROD selecting to implement elements of the Expanded Operations Alternative for an increase in pit production, to produce no fewer than 30 pits per year at LANL with additional surge capacity, if needed, to meet Nuclear Posture Review and national policy (Public Law 115-232, Section 3120) up to the analyzed limit of producing up to 80 pits per year (DOE 2020b).

[b] 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	2021 Operations
Radioactive Air Emissions			
Plutonium isotopes[b]	Ci/yr	1.95E−05	5.06E−09
Tritium in Water Vapor	Ci/yr	7.50E+02	2.03E−01
Tritium as a Gas	Ci/yr	2.50E+02	1.15E−01
NPDES Discharge			
03A181	MGY	4.1	3.0
Wastes			
Chemical	kg/yr	8,618	31,012.[c]
LLW	m^3/yr	757	322
MLLW	m^3/yr	15	58[d]
TRU	m^3/yr	336[e]	61
Mixed TRU	m^3/yr	N/A[e]	212

[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 2021, chemical waste at the Plutonium Facility Complex exceeded 2008 SWEIS projections because of waste generated as a result of maintenance of equipment at RLUOB, which accounted for 76 percent (23,586 kilograms) of the chemical waste, and the disposal of water drained from equipment at the TA-55 gate, which accounted for 34 percent (10,649 kilograms) of the total chemical waste generated at the Plutonium Complex.
[d] In CY 2021, MLLW at the Plutonium Facility Complex exceeded 2008 SWEIS projections because of the disposal of TRU waste containers recategorized as MLLW, which accounted for 24 percent (14 cubic meters) of MLLW waste generated and from the disposal of routine maintenance and housekeeping, which accounted for 22 percent (13 cubic meters) of the MLLW generated at the Plutonium Complex.
[e] 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	2021 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	77.4
001	MGY	N/A[c]	65.2[d]
13S	MGY	N/A[c]	0
03A160	MGY	28.5	0[e]
03A199	MGY	N/A[c]	12.2
Wastes			
Chemical	kg/yr	651,000	847,762[f]
LLW	m^3/yr	1,529	45
MLLW	m^3/yr	31	2
TRU	m^3/yr	23[g]	0
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.

[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 CY 2021 exceeded 2008 SWEIS projections for Non-Key facilities because of the disposal of press filter cakes from Sanitary Effluent Reclamation Facility, which accounted for 31 percent (265,280 kilograms); disposal of spill material from an old mixing tanks, which accounted for 12 percent (98,629 kilograms); and the disposal of construction and demolition debris from refurbishing projects, which accounted for 9 percent (77,317 kilograms) of the chemical waste generated.

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

Appendix B: Chemical Usage and Emissions Data

Chemical Usage and Emissions Data

Chemical Usage and Estimated Emissions (kg/year)				
Key Facility	Toxic Air Pollutants*	CAS Number	2021 Usage	2021 Estimated Air Emissions
High Explosives Processing Facilities	Ethanol	64-17-5	65.7912673	23.02694356
	Isopropyl Alcohol	67-63-0	54.54134801	19.0894718
	Propane	74-98-6	92.01585741	0.000
	Toluene-2,4-diisocyanate (TDI)	584-84-9	9.305583605	3.256954262
High Explosives Testing Facilities	Acetylene	74-86-2	7.895020279	0
	Benzoyl Peroxide	94-36-0	3.00005E-07	1.05002E-07
	Methyl Alcohol	67-56-1	4.752073335	1.663225667
	Methyl Methacrylate	80-62-6	0.094501458	0.03307551
	Propane	74-98-6	22.92576606	0
	Sulfur Hexafluoride	2551-62-4	243.5621943	85.246768
Bioscience Facilities	Acetic Acid	64-19-7	0.105101622	0.036785568
	Acetone	67-64-1	113.9057578	39.86701523
	Acetonitrile	75-05-8	58.23889875	20.38361456
	Allyl Alcohol	107-18-6	0.256203954	0.089671384
	Ammonium Chloride (Fume)	12125-02-9	3.000046297	1.050016204
	Aniline & Homologues	62-53-3	0.511007886	0.17885276
	Chloroform	67-66-3	1.779867467	0.622953614
	Ethanol	64-17-5	78.16709269	27.35848244
	Ethyl Acetate	141-78-6	184.0108397	64.40379389
	Ethyl Ether	60-29-7	20.34931403	7.122259912
	Formic Acid	64-18-6	0.061000941	0.021350329
	Hexane (other isomers)* or n-Hexane	110-54-3	117.3038103	41.05633359
	Hydrogen Chloride	7647-01-0	1.050016204	0.367505671
	Isopropyl Alcohol	67-63-0	18.44778469	6.456724641
	Maleic Anhydride	108-31-6	0.500007716	0.175002701
	Malononitrile	109-77-3	0.100001543	0.03500054
	Methyl Acrylate	96-33-3	0.239003688	0.083651291
	Methyl Alcohol	67-56-1	88.70536892	31.04687912
	Methyl Ethyl Ketone (MEK)	78-93-3	6.448099508	2.256834828
	Methylene Chloride	75-09-2	290.8458604	101.7960511
	Morpholine	110-91-8	0.100001543	0.03500054
	n,n-Dimethylformamide	68-12-2	47.50073304	16.62525656
	Nitric Acid	7697-37-2	10.59046343	3.706662202
	Propargyl Alcohol	107-19-7	0.094851464	0.033198012
	Pyridine	110-86-1	0.98301517	0.34405531
	Tetrahydrofuran	109-99-9	14.20821926	4.972876742
	Tetrasodium Pyrophosphate	7722-88-5	0.500007716	0.175002701
	Toluene	108-88-3	0.086701338	0.030345468
	Triethylamine	121-44-8	2.916045001	1.02061575
	Xylene (o-,m-,p-Isomers)	1330-20-7	77.72519947	27.20381981

Chemical Usage and Estimated Emissions (kg/year)				
Key Facility	Toxic Air Pollutants*	CAS Number	2021 Usage	2021 Estimated Air Emissions
LANSCE	Acetone	67-64-1	58.41941554	20.44679544
	Acetylene	74-86-2	17.10587727	0
	Ethanol	64-17-5	3.160048766	1.106017068
	Ethyl Acetate	141-78-6	0.033284314	0.01164951
	Isobutane	75-28-5	54.3402459	19.01908606
	Isopropyl Alcohol	67-63-0	25.90539978	9.066889922
	Molybdenum	7439-98-7	4.750073304	1.662525656
	Phosphoric Acid	7664-38-2	0.946014599	0.33110511
	Propane	74-98-6	105.8754648	0
	Sulfur Hexafluoride	2551-62-4	162.3747962	56.83117866
	Tantalum Metal	7440-25-7	3.500054013	1.225018905
	Toluene	108-88-3	5.202080279	1.820728098
Plutonium Complex	Acetone	67-64-1	0.791012207	0.276854272
	Acetylene	74-86-2	44.73844825	0
	Ethanol	64-17-5	131.5825346	46.05388711
	Ethyl Acetate	141-78-6	0.055473856	0.01941585
	Hydrogen Chloride	7647-01-0	8.400129632	2.940045371
	Hydrogen Fluoride, as F	7664-39-3	1.982030587	0.693710705
	n,n-Dimethylformamide	68-12-2	10.45016127	3.657556444
	Nitric Acid	7697-37-2	26.47615858	9.266655505
	Oxalic Acid	144-62-7	0.050000772	0.01750027
	Phosphoric Acid	7664-38-2	18.92029198	6.622102193
	Potassium Hydroxide	1310-58-3	14.50022377	5.07507832
	Propane	74-98-6	1.20648793	0
	Silica, Quartz	14808-60-7	1.100016976	0.385005941
	Sulfur Hexafluoride	2551-62-4	81.18739809	28.41558933
	Sulfuric Acid	7664-93-9	0.018410284	0.006443599
	Uranium (natural) Sol.&Unsol.Comp. as U	7440-61-1	0.001400022	0.000490008
Radiochemistry Facility	1,4-Dioxane	123-91-1	2.072031976	0.725211192
	2-Aminopyridine	504-29-0	0.025000386	0.008750135
	Acetic Acid	64-19-7	15.23973518	5.333907314
	Acetone	67-64-1	75.93717188	26.57801016
	Acetonitrile	75-05-8	8.814536027	3.08508761
	Aluminum numerous forms	7429-90-5	0.001000015	1.00002E-05
	Ammonium Chloride (Fume)	12125-02-9	0.500007716	0.175002701
	Aniline & Homologues	62-53-3	0.102201577	0.035770552
	Cobalt, elemental & inorg.comp., as Co	7440-48-4	0.050000772	0.000500008
	Copper	7440-50-8	0.502107749	0.005021077
	Cyclohexane	110-82-7	0.077901202	0.027265421

Chemical Usage and Emissions Data

Chemical Usage and Estimated Emissions (kg/year)				
Key Facility	Toxic Air Pollutants*	CAS Number	2021 Usage	2021 Estimated Air Emissions
Radiochemistry Facility (cont)	Dicyclopentadienyl Iron	102-54-5	0.010000154	0.003500054
	Diethylamine	109-89-7	0.354005463	0.123901912
	Ethanol	64-17-5	15.20697628	5.322441697
	Ethyl Ether	60-29-7	6.426099169	2.249134709
	Formic Acid	64-18-6	0.122001883	0.042700659
	Furfuryl Alcohol	98-00-0	0.100001543	0.03500054
	Hexane (other isomers)* or n-Hexane	110-54-3	2.63604068	0.922614238
	Hydrogen Bromide	10035-10-6	7.490115589	2.621540456
	Hydrogen Chloride	7647-01-0	255.8889489	89.56113212
	Hydrogen Fluoride, as F	7664-39-3	6.937107055	2.427987469
	Hydrogen Peroxide	7722-84-1	55.22335222	19.32817328
	Indium & compounds, as In	7440-74-6	0.200003086	0.07000108
	Isopropyl Alcohol	67-63-0	16.17124956	5.659937345
	Lead, el.&inorg.compounds, as Pb	7439-92-1	0.003500054	3.50005E-05
	Malononitrile	109-77-3	0.250003858	0.08750135
	Methyl Acrylate	96-33-3	0.239003688	0.083651291
	Methyl Alcohol	67-56-1	0.792012222	0.277204278
	Methyl Ethyl Ketone (MEK)	78-93-3	0.200003086	0.07000108
	Methylene Chloride	75-09-2	21.15232643	7.403314249
	n,n-Dimethylformamide	68-12-2	0.950014661	0.332505131
	Naphtalene	91-20-3	0.050000772	0.01750027
	n-Butyl Alcohol	71-36-3	0.8100125	0.283504375
	n-Heptane	142-82-5	1.367621105	0.478667387
	Nitric Acid	7697-37-2	1382.547178	483.8915124
	Nitrous Oxide	10024-97-2	12.2331426	4.281599909
	Oxalic Acid	144-62-7	0.800012346	0.280004321
	Pentane (all isomers)	109-66-0	1.252019321	0.438206762
	Phosphoric Acid	7664-38-2	52.88221609	18.50877563
	Potassium Hydroxide	1310-58-3	1.000015432	0.350005401
	Propane	74-98-6	206.7329962	0
	Pyridine	110-86-1	10.81316687	3.784608405
	Tantalum Metal	7440-25-7	5.001077178	1.750377012
	Tetrahydrofuran	109-99-9	1.420821926	0.497287674
	Toluene	108-88-3	5.202080279	1.820728098
	Tungsten as W insoluble Compounds	7440-33-7	0.500007716	0.005000077
	Zinc Oxide Fume	1314-13-2	0.050000772	0.000500008
Solid Radio-active Chemical Waste Facility	Hydrogen Chloride	7647-01-0	1.949092579	0.682182403
	Silica, Quartz	14808-60-7	3.090426192	1.081649167
	Sulfuric Acid	7664-93-9	34.84514474	12.19580066

Chemical Usage and Estimated Emissions (kg/year)				
Key Facility	Toxic Air Pollutants*	CAS Number	2021 Usage	2021 Estimated Air Emissions
Target Fabrication Facility	1,4-Dioxane	123-91-1	1.036015988	0.362605596
	Acetic Anhydride	108-24-7	1.000015432	0.350005401
	Acetone	67-64-1	23.73036621	8.305628174
	Acetonitrile	75-05-8	25.18438865	8.814536027
	Ammonium Chloride (Fume)	12125-02-9	0.500007716	0.175002701
	Benzene	71-43-2	0.879013565	0.307654748
	Carbon Tetrabromide	558-13-4	0.200003086	0.07000108
	Cyclohexane	110-82-7	137.1061158	47.98714055
	Diphenylamine	122-39-4	0.010000154	0.003500054
	Divinyl Benzene	1321-74-0	0.465007176	0.162752512
	Ethanol	64-17-5	178.9255952	62.62395832
	Ethyl Acetate	141-78-6	32.47250112	11.36537539
	Ethyl Ether	60-29-7	6.426099169	2.249134709
	Ethyl Formate	109-94-4	0.461007114	0.16135249
	Furfuryl Alcohol	98-00-0	1.250019291	0.437506752
	Hexane (other isomers)* or n-Hexane	110-54-3	10.54416272	3.690456952
	Hydrogen Chloride	7647-01-0	0.525008102	0.183752836
	Isophorone Diisocyanate	4098-71-9	0.005280081	0.001848029
	Isopropyl Alcohol	67-63-0	121.0418679	42.36465378
	Methyl Alcohol	67-56-1	38.01658668	13.30580534
	Methyl Iodide	74-88-4	0.100001543	0.03500054
	Methyl Methacrylate	80-62-6	16.06524792	5.622836773
	Methylene Chloride	75-09-2	42.30465285	14.8066285
	n,n-Dimethylformamide	68-12-2	19.95030788	6.982607757
	o-Phenylenediamine	95-54-5	0.100001543	0.03500054
	Pentaerythritol	115-77-5	0.050000772	0.01750027
	Pentane (all isomers)	109-66-0	0.626009661	0.219103381
	Propyl Alcohol	71-23-8	0.401506196	0.140527169
	Silica, Quartz	14808-60-7	2.500038581	0.875013503
	tert-Butyl Alcohol	75-65-0	0.780012037	0.273004213
	Tetrahydrofuran	109-99-9	1.776027408	0.621609593
	Toluene	108-88-3	13.87221408	4.855274927
	Toluene-2,4-diisocyanate (TDI)	584-84-9	0.100001543	0.03500054
	Trimethylamine	75-50-3	0.316504884	0.11077671
	Tungsten as W insoluble Compounds	7440-33-7	3.000046297	0.030000463
	Vanadium, Respirable Dust & Fume	1314-62-1	0.101001559	0.035350546
Tritium	Acetone	67-64-1	12.65619531	4.429668359
	Acetylene	74-86-2	5.921265209	0

Appendix C: Nuclear Facilities List

Los Alamos
NATIONAL LABORATORY
EST. 1943

List of Los Alamos National Laboratory Nuclear Facilities

LIST–SBD-503-R1.1

Prepared by:

Gregory D. Smith Safety Basis Division	Signature	12/19/18 Date

Approver:

James L. Tingey Safety Basis Division Leader	Signature	1/2/19 Date

☒ Unclassified ☐ UCNI ☐ Classified ☐ OUO	Derivative Classifier Name: KAREN J McHugh 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

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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.