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Los Alamos National Laboratory

Integrated Strategy for Plutonium Missions at Los Alamos National Laboratory

June 2020

This staffing plan issued in June 2020 by Los Alamos National Laboratory was prepared during the initial response to the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic. The plan presented here does not reflect any potential impacts associated with SARS-CoV-2. (b) (5) [redacted].

Executive Summary

The Department of Energy (DOE) National Nuclear Security Administration (NNSA) plutonium missions are critical to meeting military requirements to ensure the U.S. nuclear deterrent is modern, responsive, and resilient. A major national priority is to reestablish the capability and capacity for pit production.

Los Alamos National Laboratory (LANL) is designated by NNSA as the nation's Plutonium Center of Excellence. LANL has an experienced and skilled workforce, high-hazard nuclear facilities and associated infrastructure, and unique plutonium processing, fabrication, and experimental capabilities. The nation relies on LANL to perform the following:

The nation relies on LANL to safely, securely, and reliably support nuclear deterrence, nonproliferation, space exploration, and actinide science.

- Produce plutonium pits for the nuclear weapons stockpile
- Produce radioisotope thermoelectric generators (RTGs) for the nuclear weapons stockpile
- Produce Pu-238 heat sources for use by NASA in space exploration
- Evaluate pits returned from the nuclear weapons stockpile to support annual stockpile assessments and to inform future pit designs
- Produce plutonium components for assembly into devices used in subcritical experiments
- Perform fundamental science on the material properties and aging of plutonium
- Process plutonium into forms suitable for disposition to support nonproliferation goals
- Recover americium for the DOE Office of Science

In May 2018, NNSA directed LANL to substantially increase pit production to deliver a minimum of 30 war reserve (WR) pits per year (ppy) starting in 2026. Expanding pit production to this level will require significant resources. The plutonium missions at LANL will be integrated to successfully execute this expansion while still delivering on the other missions.

This document is an integrated strategy that builds on the extensive pit production planning performed during 2019 and incorporates all plutonium missions at LANL. LANL assessed the operational status of and resource requirements for the plutonium missions, which involved a comprehensive review and evaluation of the LANL-wide staffing, capabilities, and facility requirements. This summary-level document contains the following:

- Scope, schedule, and cost summaries for all plutonium missions at LANL through at least 2026
- Management of transuranic waste generated by the plutonium missions at LANL
- (b) (5) [redacted]
- Proposed acquisition strategy, schedule, and budget summary for infrastructure investments
- Estimated staffing requirements for both the enduring workforce at LANL for programmatic missions as well as the interim workforce required for infrastructure investments
- Interim mitigation strategies to address anticipated gaps in the availability of infrastructure

Summarized below are the critical challenges LANL faces and the actions LANL will take to expand pit production while still delivering on all plutonium missions.

First, produce a WR pit in 2023.

Production of the first WR pit will use equipment and staff available today with processes that will be matured within the next two to three years.

Challenge 1: Master the science and engineering required to meet the Lawrence Livermore National Laboratory (LLNL) design agency (DA) specifications for pit production processes.

Path Forward: Build on the successful experience gained from manufacturing WR pits for the W88 at TA-55 PF-4. LANL will mature the technology and manufacturing readiness levels required by the LLNL DA for pit production by continuing to build pits, learning from each pit build to improve production processes. LANL has decades of R&D on plutonium and materials science that can be applied to solving technical challenges. LANL's workforce has a combination of pit production experience and related technical expertise, which provides confidence that LANL will deliver WR pits as required by NNSA.

Next, achieve TA-55 PF-4 availability and reliability.

Experience across the complex shows that nuclear facility outages are a significant risk not only to pit production but to all plutonium missions. Outages have been a challenge for TA-55 PF-4, and LANL's approach to reducing this risk is summarized in the paths forward for the next two challenges.

Challenge 2: Ensure TA-55 PF-4 is reliably available for all plutonium-related missions.

(b) (5) [redacted] TA-55 PF-4 is a Security Category I, Hazard Category 2 nuclear facility with a high level of formality and rigor in the conduct of operations. Programmatic and facility work in TA-55 PF-4 are currently performed (b) (5) [redacted]

Challenge 3: Maintain and update TA-55 PF-4, a 40-year-old nuclear facility, to ensure continued compliance with safety, security, and environmental requirements.

Path Forward: Continue facility recapitalization and eliminate deferred maintenance of the major safety and process systems that enable safe and secure operations at TA-55. NNSA and LANL will partner to prioritize and accelerate the infrastructure investments to increase facility availability. LANL is transitioning the TA-55 PF-4 facility maintenance model to rely less on corrective maintenance by increasing the scheduled preventative maintenance, (b) (5) [redacted]

Achieve an annual 30 ppy production rate by 2026.

To ramp up production to 30 ppy (b) (5) [redacted] equipment must be installed and staffing increased.

Challenge 4: Reconfigure TA-55 PF-4 for efficient pit production.

Path Forward: Complete the ongoing equipment installations and facility modifications to optimize the pit production process flow and establish the capacity for a reliable 30 ppy production rate. LANL has compiled a comprehensive prioritized list of the infrastructure investments required for the pit production mission. These infrastructure investments will be completed through a variety of acquisition methods. The work across all projects will be integrated into one master schedule. The infrastructure investments identified in this integrated strategy will establish the capability at LANL to produce 30 ppy for the active stockpile, which includes pits designed and maintained by both the LANL DA and the LLNL DA.

Challenge 5: Recruit, hire, train, and retain the workforce required for the pit production mission.

Path Forward: Execute a LANL staffing plan that addresses the workforce required for pit production, including the site-wide workforce required for enabling functions. LANL is refining and implementing the plan to recruit, hire, train, and retain the workforce necessary for the pit production mission. The additional workforce requires new infrastructure for offices, parking, training, and production development, which is planned primarily through line-item acquisitions.

Integrate and execute all plutonium missions efficiently and reliably.

To deliver on all plutonium missions and be responsive to emerging requirements, the business systems and operational methodologies of the plutonium enterprise must be strengthened.

Challenge 6: Enhance, standardize, and implement program management tools.

Path Forward: Integrate all plutonium missions operating at TA-55 using standard project management methods and the scheduling software Primavera P6. Define and document the DOE and NNSA requirements for all plutonium missions at LANL through FY26. Develop and integrate resource-loaded baseline schedules with float to be successful on all plutonium missions. Establish, implement, and manage a change control process with appropriate thresholds for LANL, NNSA, and DOE review and approval.

Challenge 7: Reduce the time and frequency of the nuclear material inventories in TA-55 PF-4.

Path Forward: Implement process monitoring and increase the staff and equipment to perform semiannual inventories. (b) (7)(E), (b) (7)(F) [redacted]

Estimated Direct-Funded Enduring Staffing for Plutonium Missions at LANL

Increased staffing is necessary to deliver on the plutonium missions; maintain and operate all facilities; provide security for plutonium mission activities and materials; provide the broad range of support functions; and perform small facility-related projects at a steady level of investment. The increase in enduring LANL staffing will be achieved through three overlapping objectives, as shown in the figure below.

Execute Current Missions – Increase staffing to the level required to reliably operate and maintain LANL's plutonium enterprise and to execute the program of record associated with all plutonium missions. For pit production, this objective is the staffing to reliably deliver the first production unit (FPU) in 2023.

(b) (5) [redacted] – [redacted]

Produce 30 ppy – Increase the pit production staffing to the level required to support a sustained 30 ppy production rate (b) (5) [redacted].

(b) (5)

[redacted]

Estimated Costs for Plutonium Missions at LANL

The annual estimated cost for the enduring staffing and for one-time infrastructure investment projects is shown in the figure below. These functions are funded by programs within the NNSA Office of Defense Programs (NA-10); the NNSA Office of Safety, Infrastructure, and Operations (NA-50); the NNSA Office of Defense Nuclear Security (NA-70); and other sponsors of non-defense programs. The estimated one-time infrastructure investment costs include all labor, materials, and overhead costs for project execution of line-item construction projects, programmatic equipment installation, and minor construction projects.

(b) (5)

[redacted]

Actions and Risks

LANL's in-depth analysis has increased its understanding of the site-wide needs to produce 30 ppy while meeting all other plutonium missions. Through this effort, LANL has identified a number of actions and decisions needed from NNSA and LANL to execute this integrated strategy. The most important and urgent actions to enable the success of this proposal are summarized below.

Authority	Actions
NNSA	• Manage the DOE O 413.3B process and make related decisions to deliver the required infrastructure in time to achieve the plutonium missions. • (b) (7)(E), (b) (7)(F) [redacted] • (b) (7)(E), (b) (7)(F) [redacted]
LANL	• Recruit, hire, and train the workforce to execute this integrated strategy. • Assess LANL's current infrastructure, staff, and programs to provide options for interim solutions to gaps identified in this document. • Refine and integrate the sequence and schedules for the installation of pit production process equipment and construction of infrastructure. • (b) (7)(E), (b) (7)(F) [redacted]
All	Regular engagement of representatives from LANL, LLNL, NA-LA, NA-10, NA-50, NA-70, and NA-APM with the authority to resolve proposed changes, emerging issues, and realized risks associated with pit production.

The following are the significant areas of concern for which LANL is identifying risks:

30 ppy infrastructure – LANL will install the equipment to produce more than 10 ppy and a minimum of 30 ppy through the line-item Los Alamos Plutonium Pit Production Project (LAP4). The NNSA program requirements document states that the equipment required to reliably produce 30 ppy is an objective and not a threshold requirement. [redacted] (b) (5) [redacted]

Program interfaces – TA-55 PF-4 supports many programs that are critical to supporting diverse national missions. For LANL to integrate planning and successfully execute all programs, NNSA must document and manage (under change control) the requirements for all programs operating in TA-55 PF-4.

(b) (7)(E), (b) (7)(F) [redacted]

Product realization process to achieve FPU – Concurrent pit design engineering and production process development create challenges to qualifying processes in time to support pit certification activities.

(b) (5) [redacted].

(b) (7)(E), (b) (7)(F) [redacted]

LANL will update this integrated strategy (b) (5) [redacted]

Table of Contents

List of Figures

(b) (7)(E), (b) (7)(F)

(b) (7)(E), (b) (7)(F)

(b) (7)(E), (b) (7)(F)

(b) (7)(E), (b) (7)(F)

List of Tables

List of Acronyms

AC	Analytical Chemistry
AFS	Alternate Feedstock
B&R	Budget and Reporting Code
CAT III	Security Category 3
CBI	Capability Based Investments
CCP	Central Characterization Program
CD	Critical Decision
CD-0	Critical Decision 0 (Approve Mission Need)
CD-1	Critical Decision 1 (Approved Alternative Selection and Cost Range)
CD-2	Critical Decision 2 (Performance Baseline)
CD-3	Critical Decision 3 (Start Construction)
CD-4	Critical Decision 4 (Approve Start of Operations or Project Completion)
CER	Complete Engineering Release
CMR	Chemistry and Metallurgy Research (Building)
CMRR	Chemistry and Metallurgy Research Replacement
CSED	Criticality Safety Evaluation Document
D&D	Decontamination and Decommissioning
DA	Design Agency
DB	Drop Box
DBT	Design Basis Threat
DEV	Development (phase in product realization process)
DOE	Department of Energy
DOE NE	DOE Office of Nuclear Energy
DOE SC	DOE Office of Science
DOE SR	DOE Savannah River
DPBPS	Defense Programs Business Process System
DSA	Documented Safety Analysis
EAC	Estimate at Completion
ECF	Entry Control Facility
EDRMS	Electronic Document and Records Management System
EE	Engineering Evaluation
EHT	Equipment Hot Testing
EIL	Equipment and Infrastructure List
EIS	Environmental Impact Statement
ES&H	Environment, Safety, and Health
FDR	Final Design Review
FPU	First Production Unit
FST	Full-Scale Test
FTE	Full-Time Equivalent
FYNSP	Future Years Nuclear Security Program

GB	Glovebox
HENC	High-Efficiency Neutron Counter
HC-3	Hazard Category 3
HRP	Human Reliability Program
IAW	In Accordance With
IPR	Interlaboratory Peer Review
IPT	Integrated Project Team or Integrated Product Team
IRT	Integrated Review Tool
ISMS	Integrated Safety Management System
KCNSC	Kansas City National Security Campus
LANL	Los Alamos National Laboratory
LAP4	Los Alamos Plutonium Pit Production Project
LDCC	Laboratory Data Communication Center
LLNL	Lawrence Livermore National Laboratory
LLW	Low-Level (radioactive) Waste
MAR	Material at Risk
MC	Materials Characterization
MC&A	Material Control and Accountability
MFA	Management Focus Area
MIE	Major Item of Equipment
MMP	Manufacturing Modernization Project
MR	Management Reserve
MR&R	Material Recycle and Recovery
MT	Metric Ton
NA-10	NNSA Office of Defense Programs
NA-20	NNSA Office of Defense Nonproliferation
NA-50	NNSA Office of Safety, Infrastructure, and Operations
NA-70	NNSA Office of Defense Nuclear Security
NA-APM	NNSA Office of Acquisition and Project Management
NA-GC	NNSA Office of General Counsel
NA-LA	NNSA Los Alamos Field Office
NAP	NNSA Administrative Policy
NDA	Nondestructive Assay
NEPA	National Environmental Policy Act
NMSSUP II	Nuclear Material Safeguards and Security Upgrade Project Phase 2
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
PA	Production Agency
PF-4	Plutonium Facility Building 4
POC	Pipe Overpack Container
PPI	Process Prove-In (phase in product realization process)
PPIV	Positive Personnel Identification and Verification

ppy	Pits per Year
PRP	Product Realization Process
PRT	Product Realization Team
QER	Qualification Evaluation Release
QUAL	Qualification (phase in product realization process)
R&D	Research and Development
RANT	Radioassay and Nondestructive Testing (Facility)
RC3	Re-Categorizing RLUOB to Hazard Category 3
RCT	Radiological Control Technician
RFP	Rocky Flats Plant
RLUOB	Radiological Laboratory Utility Office Building
RLW	Radiological Liquid Waste
RLWTF	Radioactive Liquid Waste Treatment Facility
ROD	Record of Decision
ROM	Rough Order of Magnitude
S&S	Safeguards and Security
SA	Supplement Analysis
S&CL	Standards and Calibration Laboratory
SNL	Sandia National Laboratories
SNM	Special Nuclear Material
SPEIS	Supplemental Programmatic Environmental Impact Statement
SRS	Savannah River Site
SWEIS	Site-Wide Environmental Impact Statement
TA	Technical Area
TEEX	Texas A&M University Engineering Extension Service
TLW	Transuranic Liquid Waste
TRP III	TA-55 Reinvestment Project Phase III
TRU	Transuranic
TTO	Turnover to Operations
TTP	Turnover to Production
TWF	Transuranic Waste Facility
VA	Vulnerability Assessment
WAC	Waste Acceptance Criteria
WECF	TA-55 West Entry Control Facility
WIPP	Waste Isolation Pilot Plant
WR	War Reserve
XB	Introduction Box

Definition of Terms

Term or Concept	Definition or Meaning
	General
Plutonium Enterprise	• A system of facilities, utilities, equipment, processes, materials, and the workforce that enable the entirety of work with plutonium and other materials and components to deliver on the plutonium missions for the nation. • The plutonium enterprise at LANL includes TA-55 PF-4 as the focal point with RLUOB, CMR, RLWTF, LLW, TWF, RANT, SIGMA and many other supporting facilities and capabilities across LANL that are critical to the operations in TA-55 PF-4. • The plutonium enterprise across the nation integrates facilities and capabilities at DOE, NNSA, LANL, LLNL, SNL, Pantex, NNSS, KCNSC, SRS, WIPP, PNNL, ORNL, vendors, universities, and many others.
Execute Current Missions	• Operate and maintain all facilities to be reliably available for current operating shifts. • Manage all waste streams associated with plutonium missions. • Reliable execute all plutonium missions at LANL per the programs of record. – Pit production is staffed to make 5 ppy and produce the FPU in 2023.
(b) (5) [redacted]	[redacted]
Produce 30 ppy	• Reliably produce and ship 30 WR ppy.
Day Shift	• Shift to perform programmatic scope Monday through Thursday from 6:30 AM to 5:00 PM.
Swing Shift or Off Shift	• Shifts that occur outside the day shift to deconflict construction, maintenance, and support activity from programmatic activity conducted on the day shift.
Enduring Program Costs	• Labor and non-labor costs to execute ongoing program scope. Non-labor costs include materials, services, operating equipment, travel, and recharges. An indirect burden is applied to labor and non-labor costs for the total enduring program cost. • Does not include the one-time infrastructure investments that are paid for by the program.
	Staffing
Direct-Funded Staff or Direct Staff	• Workers funded by a specific program to perform activities that directly benefit that program.
Indirect-Funded Staff or Indirect Staff	• Workers performing activities identified with two or more final cost objectives or at least one intermediate cost objective. Indirect costs are collected in cost pools allocated to a final cost objective based on a predetermined methodology.
Enduring Staff	• LANL staff, craft, and protective force workers needed for to execute enduring programs.
Interim Staff	• LANL staff, craft, and subcontractors needed to execute one-time infrastructure investments (such as line-item construction projects).
LANL Staff	• Workers employed by Triad National Security, LLC. • Job categories—management, professional, science and engineering, technician, and support • Perform both direct-funded and indirect-funded scope.
Craft	• Workers performing maintenance and construction. • LANL craft (managed by LANL through union contracts) perform maintenance, equipment installation, and line-item construction in TA-55 PF-4 and some activity outside of TA-55. • Subcontract craft typically perform line-item construction work outside of TA-55 PF-4.
Subcontractor	• Workers employed by an outside company to provide services defined in a contract with Triad National Security, LLC. – Protective force – Staff augmentation labor to temporarily supplement LANL staff

Term or Concept	Definition or Meaning
Protective Force	• Protective force provides physical security services for LANL (subcontractor Centerra-Los Alamos).
	Infrastructure and Capability Planning
Turnover to Operations (TTO)	• Readiness and other activities to achieve TTO after completion of construction. • TTO is achieved when the declaration to startup operations is issued. • For plutonium capabilities this permits the line organization to conduct operations with plutonium.
Equipment Hot Testing (EHT)	• The initial process and procedure development immediately following TTO that are part of achieving TTP and are funded and managed by a line-item construction project. • Completion of EHT demonstrates the Key Performance Parameters that the line-item project must meet to achieve CD-4.
Turnover to Production (TTP)	• Process and procedure development occur to achieve TTP after TTO is achieved. • For capabilities needed for WR production, the Product Realization Team concurs that Manufacturing Readiness Level 7 is achieved, as defined in Conduct Manufacturing Readiness Level Assessment (C017). • After TTP is achieved the capability can reliably support programmatic work as intended.
War Reserve (WR)	• Nuclear weapons and nuclear weapon material intended for use in the event of war. • A capability or process can be approved for use in WR production by the DA through an engineering evaluation which results in the release of a Qualification Evaluation Release (QER).

1. Introduction

The Department of Energy (DOE) National Nuclear Security Administration (NNSA) plutonium missions are critical to meeting military requirements to ensure the U.S. nuclear deterrent is modern, responsive, and resilient. A major national priority is to reestablish the capability and capacity for pit production.

The term "30 ppy" is used throughout this document to capture the requirement that LANL produce a *minimum* of 30 war reserve pits per year starting in 2026 (b) (5) [redacted]

Los Alamos National Laboratory (LANL) is designated by NNSA as the nation's Plutonium Center of Excellence. LANL has an experienced and skilled workforce, high-hazard nuclear facilities and associated infrastructure, and unique plutonium processing, fabrication, and experimental capabilities. The nation relies on LANL to perform the following:

- Produce plutonium pits for the nuclear weapons stockpile
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In May 2018, NNSA directed LANL to deliver a minimum of 30 war reserve (WR) pits per year (ppy) (b) (5) [redacted] starting in 2026 to support NNSA's broader goal of producing at least 80 WR ppy starting in 2030. Expanding pit production to this level will require significant resources. The plutonium missions at LANL will be integrated to successfully execute this expansion while still delivering on the other missions.

This document is an integrated strategy that builds on the extensive pit production planning performed during 2019 and incorporates all plutonium missions at LANL. LANL assessed the operational status of and resource requirements for the plutonium missions, which involved a comprehensive review and evaluation of the LANL-wide staffing, capabilities, and facility requirements.

This summary-level document contains the following:

- Scope, schedule, and cost summaries for all plutonium missions at LANL through at least 2026
- Management of transuranic waste generated by the plutonium missions at LANL
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- Proposed acquisition strategy, schedule, and budget summary for infrastructure investments
- Staffing requirements for both the enduring workforce at LANL for programmatic missions as well as the interim workforce required for infrastructure investments
- Interim mitigation strategies to address anticipated gaps in the availability of infrastructure

The programs and projects accounted for in this document are listed in Table 1. As shown in Table 1, this integrated strategy bins these programs by

Pit Production and Enabling Functions — programs that directly produce pits or provide enabling functions including security, facility operations, and facility maintenance, and the programs and line-item projects that make one-time infrastructure investments

Enduring — programs that continue indefinitely to execute the plutonium missions at LANL

Interim — programs and line-item projects that make one-time infrastructure investments

Table 1. Programs and projects at LANL associated with plutonium missions

Organization	Program or Project	Pit Production and Enabling Functions	Enduring	Interim
NA-10 Programs	Plutonium Sustainment	X	X	
	Material Recycle and Recovery	X	X	
	Storage	X	X	
	Capability Based Investments	X		X
	RTG Production		X	
	Pit and RTG Surveillance		X	
	Office of Experimental Science		X	
NA-10 Line-Item Projects	Chemistry and Metallurgy Research Replacement	X		X
	Los Alamos Plutonium Pit Production Project	X		X
	TRU Liquid Waste Facility	X		X
	TA-55 Reinvestment Project Phase III	X		X
NA-50	Operations of Facilities	X	X	
	Maintenance and Repair of Facilities	X	X	
	Recapitalization	X		X
NA-20	Plutonium Disposition		X	
NA-70	Defense Nuclear Security	X	X	
DOE NE	Radioisotope Power Systems		X	
DOE SC	Americium Oxide Production		X	
DOE SR	3013 Surveillance and Monitoring		X	

This document addresses each of these programs and projects as follows:

Section 2 – scope and schedule for each program with external deliverables for the nation

Section 3 – waste management associated with executing the plutonium missions at LANL

Section 4 – scope, schedule, and cost for infrastructure investments

Section 5 – staffing requirements and the approach to recruit, train, and retain

Section 6 – interim solutions to resolve gaps in the infrastructure required to support the increased staffing

Section 7 – cost estimates for all programs and projects to deliver on the plutonium missions at LANL for the nation

Figures 1 and 2 show the relationship of LANL's plutonium enterprise to the sponsors, outputs, and other sites. The *Staffing Plan for Plutonium Missions at Los Alamos National Laboratory*, a companion document released with this integrated strategy, provides additional detail on the substantial increase in staffing required for the plutonium missions at LANL.

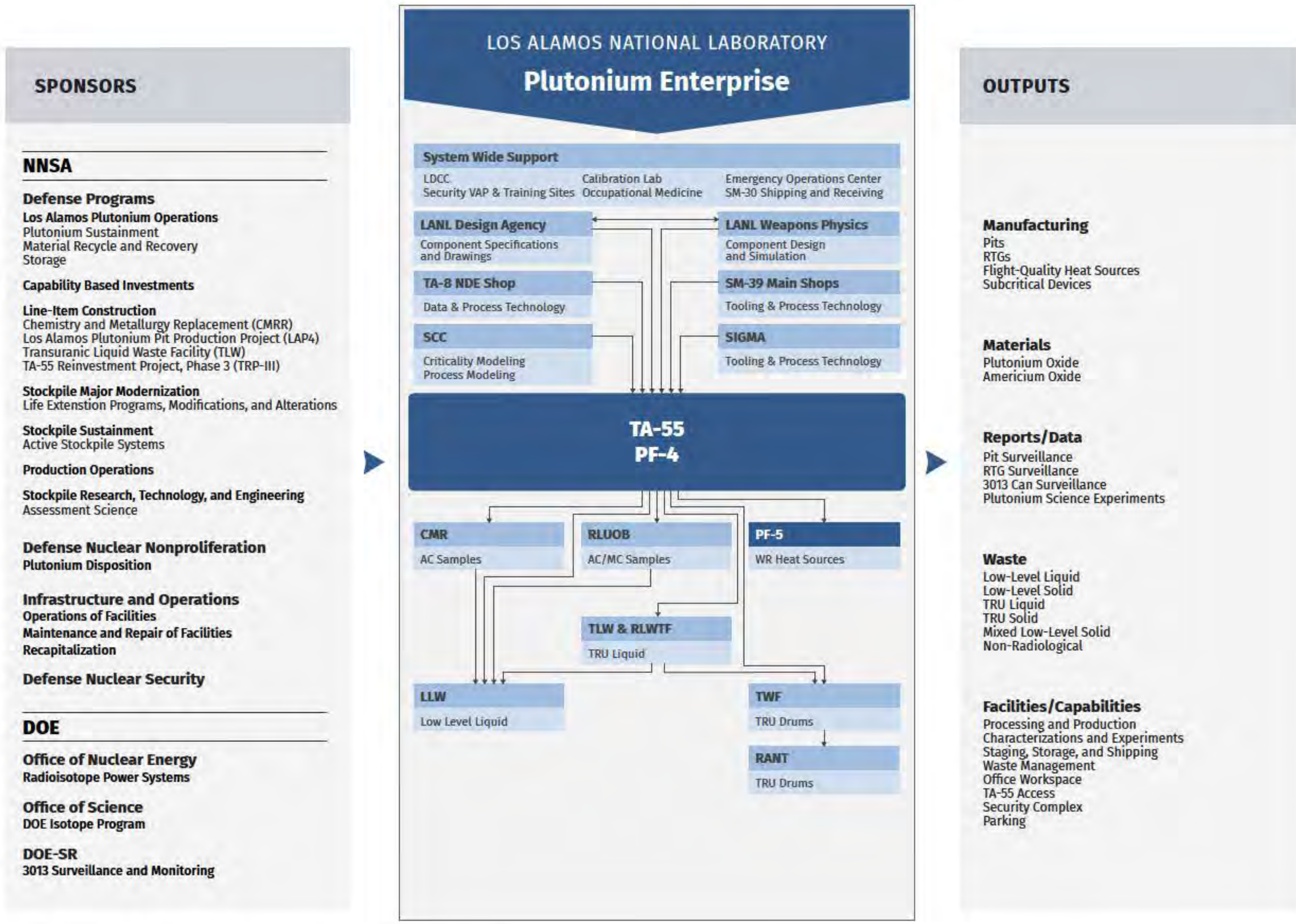

Figure 1. LANL plutonium enterprise – sponsors and outputs

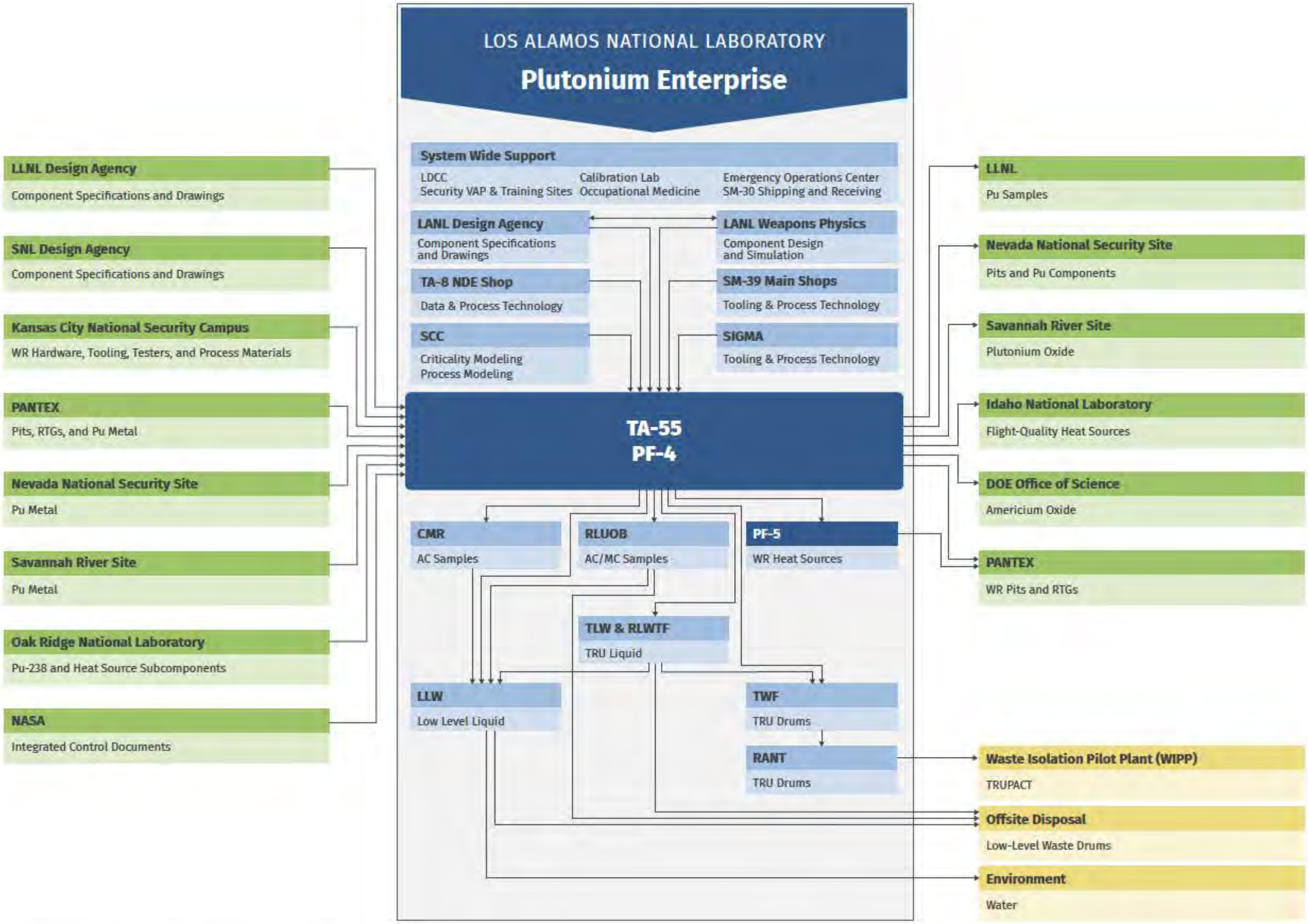

Figure 2. LANL plutonium enterprise – interfaces

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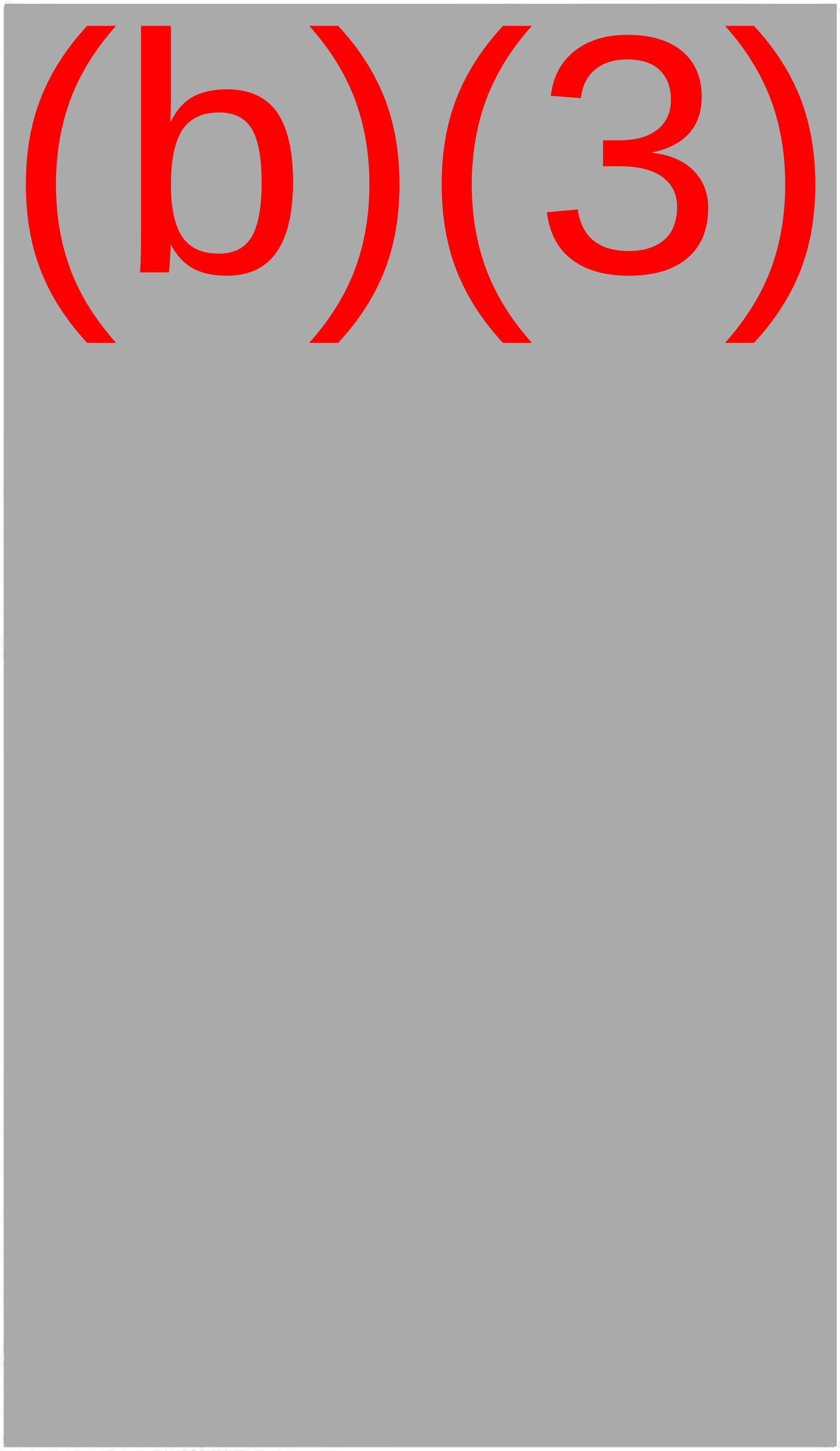
2. Plutonium Missions – Scope and Schedule

LANL is responsible for challenging, interdependent plutonium missions that must all be successful to support diverse national objectives. This section discusses the drivers, milestones, scope, schedule, execution flowsheet, and risks of the plutonium missions that use TA-55 PF-4. Figure 3 provides a summary schedule of the plutonium missions and other critical activities that LANL will integrate and execute in TA-55 PF-4 through 2026. Program execution relies on LANL's plutonium enterprise, an interconnected system of resources, capabilities, and infrastructure. Figure 4 shows how TA-55 PF-4 will evolve to support the scope for all plutonium mission shown in Figure 3.

The NNSA requirement for LANL to deliver the first production unit (FPU) in 2023 and then ramp up to a steady-state production of 30 ppy starting in 2026 is the driver for LANL's need to rapidly increase staffing and to make substantial infrastructure investments within the next 3–5 years. (b) (5) [redacted]

(b) (5)

Figure 3. TA-55 PF-4 integrated summary schedule



Current Primary Program Use
- Plutonium Sustainment
- Pit Surveillance and Science
- Plutonium Disposition
- Pu-238 Programs
- Material Recycle & Recovery
- Americium Oxide Production
- Supports Pu-239 Programs
- Facility Support & General Systems
- Reserve Space

Planned Primary Program Use
- Los Alamos Plutonium Operations
- Pit Surveillance and Science
- Plutonium Disposition
- Pu-238 Programs
- Americium Oxide Production
- Supports Pu-239 Programs
- Facility Support & General Systems
- Reserve Space

Figure 4. Current and future program use of TA-55 PF-4

The key deliverables for the LANL plutonium missions through FY26 are shown in Table 2.

Table 2. Key deliverables for the plutonium missions at LANL through FY26

(b) (5)

[redacted]

The interfaces between pit production and the other programs within TA-55 PF-4 must be understood and managed through centralized production control to ensure all programs are successful. In general, all plutonium programs use the core capabilities at TA-55—shipping/receiving, storage, NDA, and waste management. LANL will ensure that these shared capabilities are appropriately sized and maintained to reliably execute all plutonium missions. Successful program execution requires NNSA to document and formally communicate all program requirements and LANL to establish a program baseline that integrates all program scope and schedules to meet these requirements. The scope, schedule, and risks for each plutonium program at LANL are discussed below.

2.1 Los Alamos Plutonium Operations

Starting in FY21 NNSA plans (pending Congressional approval) to merge Plutonium Sustainment, Material Recycle and Recovery, and Storage into a single program called Los Alamos Plutonium Operations, which will be a program within Plutonium Modernization. The elements of the Los Alamos Plutonium Operations program are discussed below.

2.1.1 Pit Production

(b) (5) [redacted]. The Pit is intended for use in an emerging nuclear weapon system to be acquired through an NNSA weapon acquisition program. The infrastructure investments and manufacturing processes LANL will establish to make 30 ppy starting in 2026 provide the capability to produce the pits in the active nuclear weapons stockpile, which includes pits designed and maintained by both the LANL Design Agency (DA) and the Lawrence Livermore National Laboratory (LLNL) DA.

This section first presents the LANL Production Agency (PA) strategy to advance the technology and manufacturing readiness levels to support the LLNL DA pit certification activities and produce the WR FPU Pit in 2023. The technical approach and production equipment required to ramp up to steady-state production of 30 ppy is then discussed. This integrated strategy addresses the actions LANL must take to achieve the pit production goals and does not discuss the activities at other NNSA sites. To produce 30 ppy in 2026, LANL will complete the following:

- (b) (5) [redacted])
- (b) (5) [redacted]
- (b) (5) [redacted]
- 2023 – Produce FPU
- 2024 – Produce 10 WR pits
- 2025 – Produce 20 WR pits
- 2026 – Produce a minimum of 30 WR pits

Table 3 provides the planned quantities of castings and pit builds and the associated pit disassemblies and characterization activities that LANL will complete to produce the Pit FPU in 2023 and achieve a 30 ppy production rate by 2026. Figure 5 shows the summary-level flowsheet for pit production and Appendix A provides additional flowsheets and discusses the processes to produce pits. LANL will execute the activities shown in Figure 6 to produce the Pit FPU in 2023 while simultaneously establishing the infrastructure, workforce, and pit production competency to produce 30 ppy by 2026. Many of these activities are interdependent and require will careful coordination by LANL, NNSA, and the Los Alamos Field Office (NA-LA).

Table 3. Pit production – scope

(b) (5) [redacted]

(b)(3)

Figure 5. Pit production – flowsheet

Path to FPU

The NNSA-chartered Pit PRT maintains a baseline schedule for the product realization activities required to produce the Pit FPU in 2023. The LLNL DA has specified which Pit production processes require evaluation and qualification by the DA through engineering evaluations (EEs). A summary of the Pit PRT product realization schedule to produce the Pit FPU in 2023 is shown in Figure 7. This figure reflects the Pit PRT baseline schedule at the time of this document's release. This baseline schedule may change in 2020 if the Pit PRT accepts a proposed baseline change request (shown in Figure 8) with substantial changes to establish some float in the critical path to the Pit FPU—product qualification by the DA and changes to the scope and schedule of the LLNL DA certification plan. The Pit product realization process is different than for other WR components. In particular, the EEs for the Pit must be started and completed earlier in the process in order for hardware of acceptable quality to be available for use in the Pit certification experiments and evaluations.

Pit Production Integrated Summary Schedule

(b)(3),(b)(5)

[redacted]

Figure 6. Pit production integrated summary schedule

Pit PRT Baseline Schedule

(b)(3), (b)(5)

[redacted]

*Figure 7. Pit PRT **baseline** schedule*

Pit PRT Proposed Schedule

(b)(3), (b)(5)

[redacted]

*Figure 8. Pit PRT **proposed** schedule*

To reduce the possibility of delays to the EE schedule, LANL is leveraging the experience gained from the production and certification at the Rocky Flats Plant and LANL to align the schedules for LANL PA process development and LLNL DA certification testing. If delays are realized in the EE schedule, recovery strategies may include the following:

- (b) (5) [redacted]
- (b) (5) [redacted]
- (b) (5) [redacted]

Ramp to 30 ppy

As LANL executes the product realization activities shown in Figure 7, LANL must concurrently complete equipment installations and infrastructure investments, hire and train an expanded workforce, and improve production-related business processes. In particular, LANL will complete the turnover to production (TTP) and WR qualification activities for the pit production equipment required to support a 30 ppy production rate concurrently with the ramping up production from a single WR pit in 2023 to 20 pits in 2025.

(b) (7)(E), (b) (7)(F) [redacted] These configurations represent the equipment and layout required to reliably produce 30 ppy using a single shift for production. The gloveboxes and equipment shown in green are required to produce the Pit FPU in 2023 and those in blue are the additional equipment to increase the production rate to 30 ppy. The equipment in green will be used to produce 20 pits in 2025. Meanwhile, the equipment in blue must be installed, approved for plutonium operations, and qualified for WR.

(b)(3)

[redacted]

Table 4 shows a subset of the remaining critical equipment and capabilities to be installed to produce 30 ppy. The year each item is planned to achieve Turnover to Operations (approval to operate with nuclear material) is provided. A full year is estimated to take a piece of equipment from TTO through TTP and be approved to by the LLNL DA for WR use in Pit production. (b) (5) [redacted]

Table 4. Remaining key equipment to be installed to produce 30 ppy

(b)(3), (b)(5) [redacted]

TA-55 PF-4 and the pit production equipment and processes must be reliably available 40 weeks per year for pit production to occur during the day shift. (b) (5) [redacted].

(b) (5) [redacted]

(b) (7)(E), (b) (7)(F) [redacted]

(b) (7)(E), (b) (7)(F)

[redacted]

Figure 10. Pit production – build cadence to produce 30 ppy

Table 5. Pit production – risk

(b) (5), (b) (7)(E), (b) (7)(F) [redacted]

2.1.2 Subcritical Experiments – Device Subassemblies

The Los Alamos Plutonium Operations program funds and manages the production of plutonium articles for subcritical experiments (SCEs); this work is coordinated with the NNSA Office of Experimental Science. SCEs deliver crucial data for assessment of the current stockpile and certification of the future stockpile. These integrated experiments involve the use of high-explosive detonations to drive significant quantities of special nuclear material, typically plutonium, to weapon-relevant conditions in order to characterize its response. In 2015, NA-10 mandated that the rate of SCEs conducted at the U1a Complex at the Nevada National Security Site (NNSS) be increased to two per year. The national program plans to meet that requirement in FY20 and FY21 with LANL's Red Sage Nightshade series.

Planning and design for the next LANL experimental series, Excalibur, is underway, (b) (5) [redacted] The Excalibur series will be the first to use the U1a .03 Testbed providing new diagnostic capabilities in 6-ft confinement vessels and operating concurrently with the U1a .05 Testbed (3-ft vessels). Future diagnostic improvements in radiography and neutronic reactivity will be delivered by the Enhanced Capabilities for

Subcritical Experiments (ECSE) project in the mid-2020s (the U1a .100/.104 Testbed). At that time, NA-10 requires the experimental cadence to increase to three per year; two will be fielded each year using the new ECSE diagnostics, while a third will use other diagnostics to answer other stockpile stewardship questions.

Los Alamos and Livermore design these experiments, fabrication involves capabilities across the NNSA Complex, and execution at the U1a Complex in Nevada is a partnership between LANL, LLNL, and NNSS. Figure 11 shows a typical facility and process flow for a Los Alamos–led SCE. The plutonium subassembly element is highlighted in blue along with DAF operations, which is supported by the TA-55 gas operations team. This interconnectedness of SCE operations necessitates a detailed schedule that is closely tracked across multiple sites, vendors, and suppliers. The SCE and Los Alamos Plutonium Operations programs are jointly developing a formal framework for the initiation, definition, and production of subcritical experiment plutonium articles.

The following tables and figures provide the scope, schedule, flowsheet, and risks associated with the SCE program related to the plutonium enterprise at LANL. Red Sage is from new flat castings, Excalibur is from modified existing components, Durandal uses modified existing parts and new part production, and Arondight requires process development and new part production. The experimental nature of research and development work necessitates a highly skilled, experienced workforce with ample time allotted for manufacturing development. Figure 12 shows the schedule to fabricate at LANL and then to ship SCE subassemblies from LANL to NNSS.

(b) (7)(E), (b) (7)(F)

[redacted]

Figure 11. Subcritical experiments – national plutonium enterprise (blue shading indicates facilities where plutonium test articles for SCEs are fabricated and assembled)

Table 6. Subcritical experiments – scope

(b) (5)

(b) (5)

Figure 12. Subcritical experiments – schedule

(b)(3)

[redacted]

Figure 13. Subcritical experiments – flowsheet

Table 7. Subcritical experiments – risk

(b) (5)

[redacted]

(b) (5)

2.1.3 Materials Recycle and Recovery (MR&R)

The MR&R program recovers, recycles, and dispositions NA-10 nuclear materials to enable LANL and the programmatic requirements and reduce operational costs and risk. The primary focus in the next six years (FY20–FY26) is to disposition the excess and "no defined use" nuclear material at LANL to optimize the use of the TA-55 PF-4 nuclear materials vault for NA-10 missions. This provides Category I nuclear material vault space usable by all programs. Additionally, the MR&R program prepares salt residues from the plutonium metal purification operations (described in Appendix A) for discard. MR&R operations generally occur in space outside of the pit production area, so the main interface is in the area of TA-55 PF-4 material movement and waste-related infrastructure. Equipment and process interfaces include the aqueous nitrate recovery line and the aqueous chloride recovery line. Additional interfaces occur in the packaging and shipping capabilities.

The following series of tables and figures provide the milestones, scope, schedule, flowsheet, and risks associated with MR&R.

Table 8. MR&R – milestones

MRT#	Title	Date Due	Description	Exit and Grading Criteria
6886	Perform LANL MR&R Mission Operations	Annual at fiscal year-end	Perform recycle, recovery, or disposition of nuclear material at LANL	Completion of 80% Level 3 milestones, including all required milestones
6888	Execute LANL TRU Waste Management	Annual at fiscal year-end	Manage the system health in TRU waste process flow such that TRU waste is processed and packaged at TA-55 and CMR, in order not to interrupt NA-10 planned work at TA-55 and CMR	Completion of 80% Level 3 milestones

Table 9. MR&R – scope

[redacted]

(b) (5)

Figure 14. MR&R – schedule

(b)(3)

Figure 15. MR&R – flowsheet

Table 10. MR&R – risk

(b)(3)

2.1.4 Storage

The core components and activities of the Storage program include the following:

- Safe and secure nuclear materials storage and disposition planning to support NNSA and other missions
- Implementation of DOE Manual 441.1-1, *Nuclear Materials Packaging Manual,* and continued compliance with the manual and packaging best practices
- Support container efforts that improve, maintain, and ensure safe and secure storage capability of nuclear materials
- Configuration and upgrades of the of Security Category 1 storage capabilities at the LANL

The Storage program enables critical safe and secure nuclear storage capabilities, including the nondestructive assay (NDA) of nuclear materials, while integrating storage requirements across all programs at LANL. The program analyzes, prioritizes, and provides recommendations for any significant changes to existing special nuclear material (SNM) storage capabilities and uses storage health metrics to monitor and ensure effective use and continuous improvement of the storage capability at the LANL. Process modeling, forecasting, and decision analysis tools are used to identify, aggregate, and time-phase storage requirements; provide lifecycle planning and formalized inventory management; and inform decisions regarding upgrades, alterations, and reconfigurations. This includes time-phased storage requirements for feed, by-product, and product materials over at least a 15-year timeline.

The Storage program partners with programmatic "nuclear material owners" to implement and ensure continued compliance with the DOE Manual 441.1-1 requirements for nuclear material packaging. LANL, as the design authority for the SAVY-4000 series of containers, ensures that the technical basis exists for the intended use of the SAVY container series and defines the requirements for continued surveillance and life extension activities associated with the containers. LANL also assists facilities across the DOE complex with implementing the SAVY-4000 container system and ensuring that they have the capability to be compliant with the DOE M 441.1-1 requirements. LANL is evaluating designs to expand the SAVY series and provide other containerization options to programmatic organizations as well as alternative nuclear material container and storage solutions to continuously improve both operational efficiency and worker safety, for example, to reduce corrosion during multi-year storage scenarios.

The following series of tables and figures provide the milestones, scope, schedule, flowsheet, and risks associated with Storage.

Table 11. Storage – milestones

MRT#	Title	Date Due	Description	Exit and Grading Criteria
6936	Optimize storage container initiatives	9/30/20	Optimize storage container initiatives including the Container Safety Management Program (CSMP) and plutonium storage container DA functions.	Completion of 80% Level 3 Milestones, unless otherwise noted.

Table 12. Storage – scope

(b) (5)

[redacted]

Figure 16. Storage – schedule

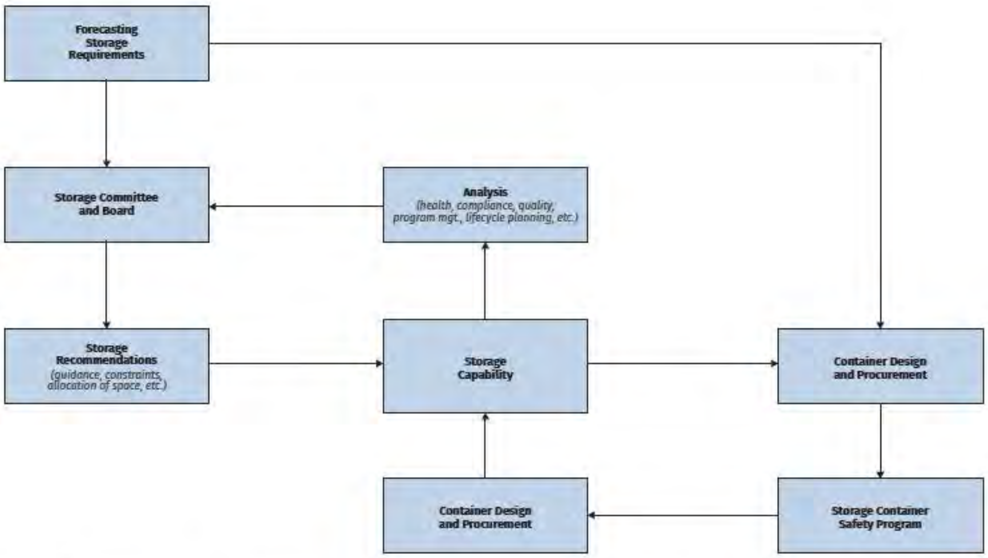


Figure 17. Storage – flowsheet

Table 13. Storage – risk

(b) (5)

2.2 Pit and RTG Surveillance

Beginning in FY21, pit and RTG surveillance will be managed by NNSA's Stockpile Sustainment program (pending Congressional approval). NNSA's nuclear weapons component surveillance program is used to assess performance, reliability, and safety of the nation's nuclear stockpile. It is also used to obtain data to support decisions regarding weapon life extensions, Alts, Mods, repairs, rebuilds, and legacy pits in storage. The goals of the surveillance program include the following:

- Identify defects (e.g., from manufacturing, aging, etc.) that affect safety, security, performance, or reliability
- Identify aging-related changes and trends
- Provide critical data for the annual Weapon Reliability Report and stockpile assessments

The number of components that will undergo destructive testing at LANL in a given fiscal year are determined principally by the DAs in consultation with PAs and NNSA as part of the Integrated Weapons Evaluation Team (IWET). The IWET for each weapon system documents component selections under the Stockpile Execution Program Plan (SEPP) section of the Logistics, Accountability, Planning, and Scheduling (LAPS) application.

IWET table quantities are reflected in the Quality Evaluation Requirements Tracking System (QERTS) along with unit serial numbers and delivery dates that are aligned with the Production and Planning Directive (P&PD) Annex D timeline standards. LANL may, with concurrence of the appropriate Federal Program Engineers (FPEs), adjust planned dates in QERTS as necessary.

Table 14. Pit and RTG surveillance – milestones

MRT#	Title	Date Due	Description	Exit and Grading Criteria
6944 B61 6950 B83 6955 W80 6965 W76 6970 W78 6978 W87 6989 W88	Complete Weapon Surveillance Activities IAW Directive Documents	Q4 FY21	Complete surveillance activities in accordance with the directive documents including QERTs alignment to IWET directive as the official performance measure.	FPMs will use completion dates in QERTS in assessing the quarterly surveillance performance for all sites.
TBD	Complete Weapon Surveillance Activities IAW Directive Documents	Annual at fiscal year-end	Complete surveillance activities in accordance with the directive documents including QERTs alignment to IWET directive as the official performance measure.	FPMs will use completion dates in QERTS in assessing the quarterly surveillance performance for all sites.

2.2.1 Pit Surveillance

LANL evaluates pits returned from the nuclear weapons stockpile as part of the LANL and LLNL annual stockpile assessment. Several weapons from each system are selected annually to be disassembled and inspected. The pits from each of the dismantled weapons are nondestructively inspected at Pantex, and the LANL and LLNL DAs use the inspection data combined with the original build records from the Rocky Flats Plant to determine which pits to further destructively evaluate. The pits selected by the LANL DA for destructive testing are designated in document BC6K1199 (U) *Annual Surveillance Selections for Boost Testing and/or Destructive Testing*.

(b) (7)(E), (b) (7)(F) [redacted]

The following tables and figures provide the scope, schedule, flowsheet, and risks associated with pit surveillance at LANL.

Table 15. Pit surveillance – scope

(b) (5)

[redacted]

Figure 18. Pit surveillance – schedule

(b)(3) [redacted]

Figure 19. Pit surveillance – flowsheet

Table 16. Pit surveillance – risk

(b)(3) [redacted]

2.2.2 RTG Surveillance

LANL destructively evaluates radioisotope thermoelectric generators (RTGs) returned from the nuclear weapons stockpile and annually evaluates the performance of RTGs in a shelf-life program to provide data to the Sandia National Laboratories (SNL) DA for the annual assessment of the stockpile. Shelf-life program testing is limited to an electrical evaluation, while destructive testing consists of a number of evaluations, including electrical, gas sampling, and materials characterization. Similar to pit surveillance and pit production, the equipment and staff at TA-55 PF-4 for RTG surveillance are also used to evaluate newly fabricated RTGs and NASA heat sources. The critical equipment and process interfaces include electrical testers, gas sampling systems, scanning electron microscopes, and metallography equipment. The scope and schedules for RTG surveillance and production must be integrated, baselined, and controlled to be successful.

(b) (5) [redacted].

The following series of tables and figures provide the scope, flowsheet, and risks associated with RTG surveillance at LANL.

Table 17. RTG surveillance – scope

(b) (5) [redacted]

(b)(3) [redacted]

Figure 20. RTG surveillance – flowsheet

Table 18. RTG surveillance – risk

(b) (5) [redacted]

2.3 Office of Experimental Science

The NNSA Office of Experimental Science, manages the Assessment Science program to perform a wide range of research on plutonium and associated components at LANL. This research provides the scientific data and improved models used in the annual assessment of the active nuclear weapons stockpile and to design and certify new pits for the future stockpile. These activities will provide the technical basis for revising the DA pit specifications that improve production efficiency and yield. Scientific work requires a deep understanding of the equipment, processes, and materials, which also improves pit production.

(b) (7)(E), (b) (7)(F) [redacted]

The following tables and figures provide the milestones, scope, schedule, flowsheet, and risks associated with plutonium research at LANL.

Table 19. Office of Experimental Science – milestones

(b) (5) [redacted]

(b) (5)

[redacted]

(b) (5)

[redacted]

Table 20. Office of Experimental Science – scope

(b) (5)

[redacted]

Figure 21. Office of Experimental Science – schedule

[redacted] (b)(3)

Figure 22. Office of Experimental Science – flowsheet

Table 21. Office of Experimental Science – risk

[redacted] (b) (5)

2.4 Plutonium Disposition

The Plutonium Disposition program, known locally as the ARIES program, reduces the threat of nuclear weapons proliferation by converting weapon-useable plutonium to oxide for disposition in a form that is not viable for use in weapons. In FY20, LANL will produce plutonium oxide from surplus plutonium metal that meets MOX fuel specifications. However, as directed by NNSA in December 2018, the program will implement a dilute and dispose option that ease the requirements associated with MOX fuel. (b) (5) [redacted] To meet this goal, the production rate at LANL will increase, requiring an increase in staff and substantial infrastructure investments.

The Plutonium Disposition program also swaps plutonium stored in the TA-55 PF-4 vault and unwanted plutonium turnings from pit production and surveillance machining operations in exchange for bulk metal to provide feed metal for pit production.

The following tables and figures provide the milestones, scope, schedule, flowsheet, and risks associated with plutonium disposition at LANL.

Table 22. Plutonium Disposition – milestones

(b) (5) [redacted]

Table 23. Plutonium Disposition – scope

(b) (5)

[redacted]

Figure 23. Plutonium Disposition – schedule

(b)(3)

Figure 24. Plutonium Disposition – flowsheet

Table 24. Plutonium Disposition – risk

(b)(3)

2.5 Pu-238 Production Programs

The Radioisotope Power Systems (RPS) program at LANL supports DOE and the National Aeronautical Space Administration (NASA) in four areas: design, surveillance, development, and production of the general purpose heat source (GPHS) and the light weight radioisotope heater unit (LWRHU). The RPS program enables NASA missions to have power and heat in remote and challenging environments. LANL has supported previous NASA missions: Galileo, Ulysses, Mars Pathfinder, Cassini-Huygens, Mars Exploration Rovers, New Horizons, and Mars Science Laboratory. Going forward, the planned constant rate production at LANL will support NASA's Mars 2020 (2020 launch) and New Frontiers – Dragonfly mission (2026 launch).

Oak Ridge National Laboratory (ORNL) produces new Pu-238 and precious metal clad vent sets to support fueled clad production at LANL. Idaho National Laboratory (INL) receives the Pu-238 heat sources fabricated by LANL for storage and eventual assembly into a power system.

LANL also produces WR RTGs for NNSA.

The following tables and figures provide the milestones, scope, schedule, flowsheet, and risks associated with Pu-238 programs at LANL.

Table 25. Pu-238 production programs – milestones

(b) (5)

[redacted]

The table below shows the GPHS production plan based on the constant rate production strategy. LWRHU scope is currently unfunded but is included in the funding profile at the request of the DOE.

Table 26. Pu-238 production programs – scope

[redacted] (b) (5)

Figure 25. Pu-238 production programs – schedule

[redacted] (b)(3)

Figure 26. Pu-238 production programs – flowsheet. RTG assembly and testing activities performed in TA-55 PF-5 are not shown.

Table 27. Pu-238 production programs – risk

(b) (5)

[redacted]

2.6 Americium Oxide Production

The DOE Office of Science manages the DOE Isotope Program to separate and recover Am-241 from the pyrochemical residues that result from plutonium purification operations at LANL. The Am-241 is then converted to an oxide. Feed items will be selected to maximize Am-241 recovery.

In FY21, LANL will execute an experimental plan to identify and improve efficiencies in the americium oxide production flowsheet shown in Figure 27 and to determine the cost per gram. DOE will use the result to determine whether it is cost-effective for LANL to make americium oxide.

This integrated strategy assumes this program will continue at current levels of funding and staffing. Future revisions of this document will reflect DOE's decision.

(b)(3) [redacted]

Figure 27. Americium Oxide Production – flowsheet

2.7 3013 Surveillance and Monitoring

The 3013 Surveillance and Monitoring program at LANL provides the technical basis to safely store plutonium-bearing materials across the DOE Complex and validates safe storage for up to 50 years. To accomplish this objective, a shelf-life and field-support surveillance team supports the technical basis of safe storage conditions for materials packaged in DOE-STD-3013 containers for up to 50 years. These efforts form the technical base for the integrated surveillance of plutonium bearing materials packaged by SRS, Hanford Site, LANL, Rocky Flats Environmental Technology Site, and LLNL. These activities are fundamental to the scope specifying minimal safety requirements for the storage of these 3013 containers at LANL, LLNL, NNSS, Pantex, and SRS. Based on the results, the TA-55 PF-4 documented safety analysis (DSA) includes a damage ratio of zero for the 3013 container, providing a notable material at risk (MAR) reduction for the facility. (b) (5) [redacted]

The 3013 Surveillance and Monitoring program is used to assess the safe long-term storage of thousands of 3013 containers at the storage sites. It is used to obtain data to support critical decisions for the safety analysis of the storage facilities and the transportation of these containers in Type B shipping packages.

The goals of the 3013 Surveillance and Monitoring program include the following:

- Identify the probability of a container breach that would affect safety for the storage facilities around the complex
- Provide critical data analysis and recommendations for the 3013 Design Authority and their annual review for long term safe storage associated with 3013 containers

The following series of tables and figures provide the milestones, scope, schedule, flowsheet, and risks associated with the 3013 Surveillance and Monitoring program.

Table 28. 3013 Surveillance and Monitoring – milestones

MRT #	Title	Date Due	Description	Exit and Grading Criteria
N/A	3013 Surveillance and Monitoring Mission Operations	Annual at fiscal year-end	Provide annual review of 3013s in storage and the selection of those containers for destructive evaluation	Annual report to the Savanah River Field Office

Table 29. 3013 Surveillance and Monitoring – scope

[redacted] (b) (5)

(b) (5)

Figure 28. 3013 Surveillance and Monitoring – schedule

(b)(3) [redacted]

Figure 29. 3013 Surveillance and Monitoring – flowsheet

Table 30. 3013 Surveillance and Monitoring – risk

(b) (5) [redacted]

2.8 Stockpile Responsiveness

The NNSA Stockpile Responsiveness program is managed by NA-10. (b) (5) [redacted] Future updates to this document will provide the scope and schedule details of this program.

3. Waste Management

Waste management includes the generation, storage, characterization, certification, and shipping of waste streams from multiple LANL facilities to offsite entities, such as the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico, for final disposition. The plutonium missions at LANL generate several types of regulated waste including

TRU Waste – Solid or liquid waste that contains alpha-emitting transuranic radionuclides possessing half-lives greater than 20 years and in concentrations greater than 100 nCi/g.

Low-Level Waste (LLW) – Solid or liquid radioactive waste that does not fit into the categorical definitions for intermediate-level waste, high-level waste, spent nuclear fuel, transuranic waste, or certain byproduct materials known as 11e(2) wastes, such as uranium mill tailings. It is essentially a definition by exclusion; LLW is a category of radioactive waste that does not fit into the other categories. Low-level waste has a limit of 100 nCi/g of alpha-emitting transuranic isotopes with a half-life greater than 5 years; any more than 100 nCi/g, and it must be classified as transuranic waste.

Mixed Low-Level Waste – Radiological waste that contains a Resource Conservation and Recovery Act (RCRA)-listed or characteristic hazardous waste.

Non-Radiological Regulated Waste – Including RCRA, hazardous, or other regulated wastes.

This June 2020 release of the integrated strategy discusses TRU solid waste only, as it is the most urgent concern. LANL has a backlog of TRU solid waste to be shipped to WIPP; this backlog will be addressed to ensure that LANL's plutonium missions proceed without interruption. Future updates to this integrated strategy will address the other types of waste created by plutonium programmatic activities.

The locations of the radiological waste management facilities are shown in Figure 30 and brief descriptions of those facilities are listed in Table 31.

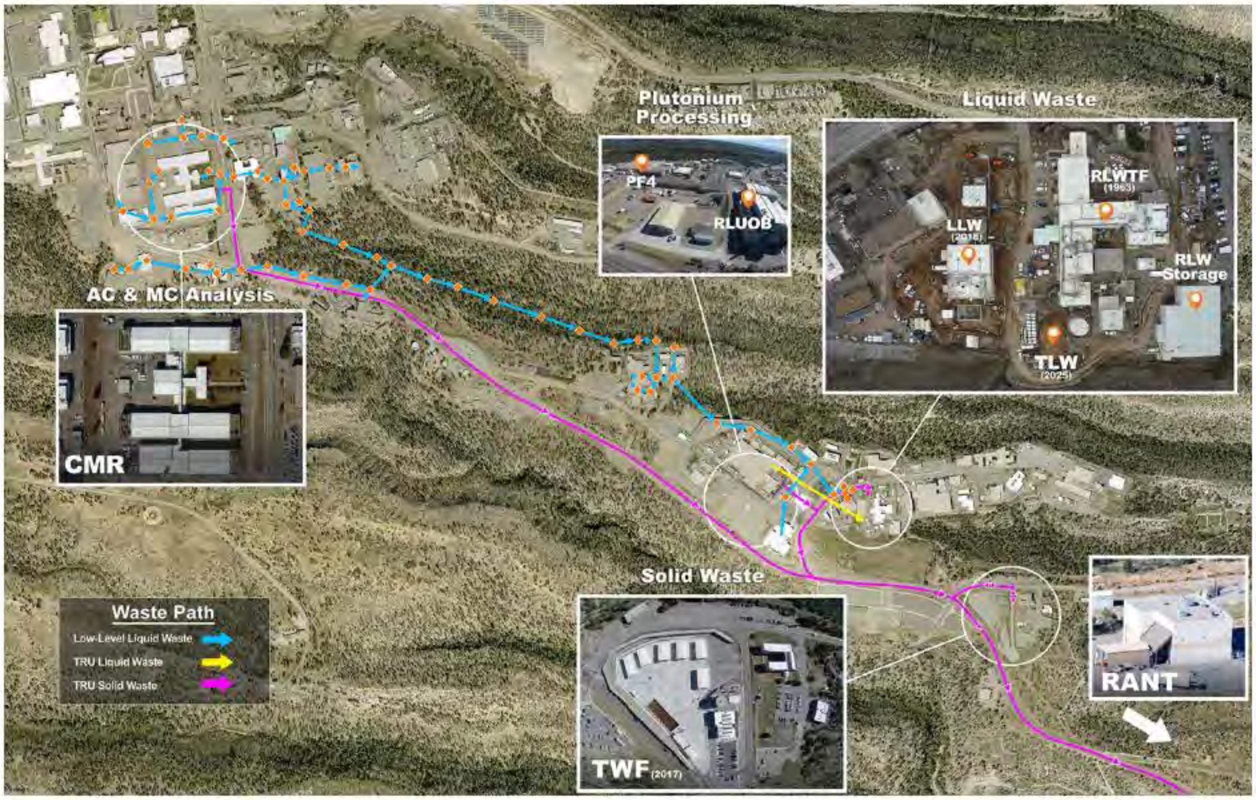


Figure 30. LANL radiological waste management system

Table 31. LANL radiological waste management facilities and capabilities

Technical Area	Facility or Capability	Description and Function
55	Plutonium Facility Building 4 (PF-4)	Pu-238 and Pu-239 programmatic operations, which create radiological waste Characterization, generation, and storage of TRU waste containers
	Radiological Laboratory Utility Office Building (RLUOB)	AC and MC operations that create radiological waste AC operations to characterize radiological waste
50	Radiological Liquid-Waste Treatment Facility (RLWTF)	Collection and treatment of radioactive liquid waste from facilities across LANL to meet discharge or disposal limits. • Primary operations – collection, storage, treatment, and discharge to the environment. • Secondary operations – disposition of radioactive sludge and residues generated in the treatment processes.
	Low-Level Liquid Waste Facility (LLW)	Storage, treatment, and discharge of low-level radioactive liquid waste from facilities across the LANL
63	TRU Waste Facility (TWF)	Storage, inspection, and certification of TRU waste containers prior to transfer to RANT
54	Radioassay Nondestructive Testing Facility (RANT)	Staging and loading of TRU waste containers into TRUPACT containers for shipment to WIPP

3.1 Transuranic Waste

Sources of TRU waste consist primarily of contaminated items, material processing by-products with no intended use, and waste processing by-products. Contaminated items include room maintenance trash such as gloves, HEPA filters, rags, and items routinely used for cleaning and upkeep and programmatic trash including graphite molds, tooling, dismantled process equipment, and gloveboxes. (b) (5), (b) (7)(E), (b) (7)(F) [redacted].

The TRU solid waste management process begins with packaging discarded material into sealed containers and updating the MC&A system to categorize the material as waste. The containers are typically standard 55-gallon drums or pipe overpack containers (POCs); they are collectively referred to as drum equivalents (DEs). This integrated strategy does not address the containers used to discard large TRU waste items, such as decommissioned gloveboxes, nor does it address the waste associated with the Chemistry and Metallurgy Research Building (CMR) de-inventory.

After a TRU waste container is generated, it is categorized based on composition, the concentration of radioisotopes, and the presence of non-nuclear hazardous materials, which determine the waste management requirements. Existing records for each container are analyzed and characterization documents are generated in the next element of the flowsheet, shown in Figure 31. During this process, containers are placed into protected, controlled-access storage areas. Prior to shipping, all testing and documentation is reviewed against WIPP's Waste Acceptance Criteria (WAC) and, if compliant, certified ensuring that the container's contents and its preparation do not pose a risk of a container breach. LANL is responsible for onsite transportation and storage of the containers, while the Central Characterization Program (CCP) is responsible for performing characterization and certification, as described in Table 32.

The TRU solid waste (discarded material) attributed to a program is the combination of waste associated with maintenance of gloveboxes used by the program and waste created as a by-product of the program's activities. LANL created a model to predict the number of containers needed for the maintenance waste created annually by program (fixed estimate) and a model to predict the number of containers needed for the waste associated with programmatic activities (variable by year). The models' output is shown in Table 33.

(b) (5) [redacted]

Planned container generation, the first stage of the TRU waste management process, is shown in Figure 32 by program. Containers remain onsite in storage until they are processed through the waste management flowsheet and shipped to WIPP. Figure 33 shows the historical and expected balance of closed TRU waste containers onsite (in green). The balance is increased monthly with newly generated containers (dark green) and reduced by the number of containers shipped offsite to WIPP (blue). The figure will be refined as waste-generation models and WIPP shipping schedules are updated.

There is a clear need to decrease the number of containers onsite. Table 35 provides LANL's strategies to decrease container generation and increase rates of shipping offsite.

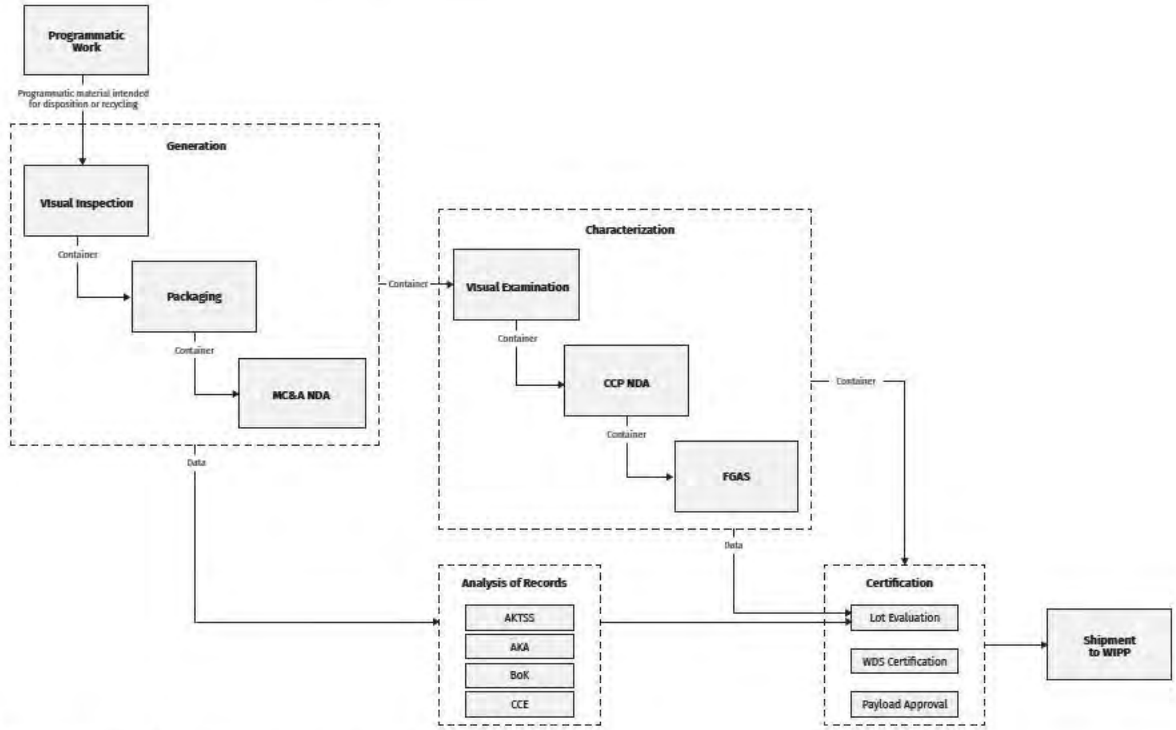


Figure 31. TRU waste management – flowsheet

Table 32. TRU waste management flowsheet descriptions

Label	**Description**
Generation	Programmatic material intended for disposition officially enters the waste system
Visual Inspection	LANL employees assess waste before packaging begins to ensure compliance and prevent rejected containers
Packaging	The contents are placed into a WIPP approved container is sealed closed
MC&A NDA	LANL measures the nuclear material to ensure that SNM is not lost or diverted
Characterization	CCP identifies and documents the material constituents of waste
Visual Examination	CCP observes and records the waste being packaged and the container being sealed
CCP NDA	Non-Destructive Assay – CCP measures the container for nuclear material
FGAS	Flammable Gas– CCP samples air from container and analyzes it for flammable and volatile gases
Analysis of Records	CCP reviews documentation on how waste was created and managed
AKTSS	Acceptable Knowledge Tracking Spreadsheet – CCP collates information into a single data system
AKA	Acceptable Knowledge Assessment – CCP reviews records and ensures waste complies with established AK
BoK	Basis of Knowledge – CCP evaluates waste for fuels and oxidizing properties
CCE	Chemical Compatibility Evaluation –CCP evaluates waste for potentially reactive combinations of contents
Certification	CCP finds waste compliant with WIPP's Waste Acceptance Criteria
Lot Evaluation	The findings from VE, NDA, FGAS, AKA, BoK, and CCE are reviewed by CCP for certification
WDS Certification	Upon certification containers are placed into the WIPP Data System and become available for shipment
Payload Approval	Containers are selected by LANL to optimize payload efficiency, and WIPP authorizes a shipment
Shipping	LANL loads TRUPACT containers, stages shipments, and transfers custody to a driver from WIPP

Table 33. Projected TRU solid waste container generation – FY21-FY26

(b) (5)

Table 34. TRU solid waste management – staffing to increase capacity

(b) (5)

(b) (5)

[redacted]

Figure 32. TRU solid waste –generation of closed containers

(b) (5)

Figure 33. TRU solid waste – containers stored onsite and shipped offsite

Table 35. Strategies to reduce TRU solid waste onsite

(b) (5)

[redacted]

3.2 Low-Level Waste

This section will be addressed in a future update to this document.

3.3 Mixed Low-Level Waste

This section will be addressed in a future update to this document.

3.4 Non-Radiological Regulated Waste

This section will be addressed in a future update to this document.

4. Plutonium Missions – Infrastructure Investments

NNSA is recapitalizing LANL facilities and equipment to modernize and expand an aging capability to produce pits. This is required to produce 30 ppy by 2026. DOE and NNSA are also making substantial investments in the plutonium enterprise at LANL to deliver on the other plutonium missions critical to the nation. Because some of the new infrastructure will not be available when first required, LANL will repurpose existing infrastructure at LANL and build/buy/lease facilities in nearby locations (discussed in Section 6).

LANL receives funding from many sources in DOE and NNSA to establish, upgrade, and maintain the LANL plutonium enterprise. The funding supports projects to install, modify, or upgrade equipment; upgrade and maintain facilities and associated utilities; and build new facilities. To facilitate success of the plutonium missions, LANL has compiled all infrastructure investments required for the plutonium missions into a single, integrated, prioritized list—the Equipment and Infrastructure List (EIL). Specifically, the EIL (provided in Appendix D) captures the infrastructure investments, (b) (5) [redacted] required to produce 30 ppy while delivering on the other plutonium missions. Infrastructure investments in the EIL are funded by the following programs:

- Los Alamos Plutonium Operations (starting in FY21)
  - Plutonium Sustainment (FY20)
  - Material Recycle and Recovery (FY20)
- Stockpile Sustainment for Pit Surveillance
- Plutonium Disposition
- Pu-238 Production Programs (DOE NE3 and NA-10)
- Americium Oxide Production
- Chemistry and Metallurgy Research Replacement (CMRR)
- Los Alamos Plutonium Pit Production Project (LAP4)
- TA-55 Reinvestment Project III (TRP III)
- Transuranic Liquid Waste (TLW) Facility
- Recapitalization
- Operations of Facilities
- Maintenance and Repair of Facilities
- Capability Based Investments (CBI) Program
- LANL Site Support

NNSA and LANL are defining the requirements, identifying the acquisition strategies, and planning the execution details for each infrastructure project in the EIL. Many of the projects will be executed concurrently using shared resources. Additional considerations for project execution include the following:

- Completion dates to produce 30 WR pits in 2026
- Completion dates to support the increase in staffing
- NEPA compliance, permitting, and other regulatory requirements
- Integration with ongoing facility operations and maintenance and with other plutonium-related programs
- Craft work will be performed in operational high-hazard nuclear facilities

The infrastructure investments include equipment installations in TA-55 PF-4 and the Radiological Laboratory Utility Office Building (RLUOB), construction of new facilities in and around TA-55, and modifications to existing facilities and utilities along the Pajarito corridor. LANL document SDRD-103398-LAP4-00001, *Enduring Infrastructure Requirement Plan in Support of the Integrated Strategy for Plutonium Missions at Los Alamos National Laboratory,* describes the infrastructure investments to produce 30 ppy. There are three categories of infrastructure investments—program funded projects; line-item projects; and minor construction projects funded by Recapitalization, CBI, and LANL Site Support. Execution of infrastructure investment projects for these three categories follows the processes shown in Figure 34.

Achieving TTO for new or upgraded equipment begins with preparation for operational startup, which includes developing procedures and maintenance plans and implementing MC&A, radiation protection, criticality safety, safety basis, and conduct of operations. Readiness to startup radiological operations is assessed through a management self-assessment, contractor readiness assessment, or federal readiness assessment.

Figure 35 and Figure 36 show the program-defined TTO need dates (not planned execution dates) for the process equipment and facility infrastructure captured in the EIL that are required to produce 30 ppy. The process equipment is sorted by major process steps in the pit production flowsheet, and the infrastructure investments are sorted by facility. Many pieces of equipment and infrastructure are required to be completed by the same date. LANL prioritized the EIL to develop an integrated execution strategy.

	Project Initiation →	Design & Prototyping →	Procurement & Fabrication →	Construction →	Turnover to Operations (TTO)	Turnover to Production (TTP)	War Reserve (WR)
Program Funded Projects	**Initiation** • Title I Design • Statement of Need • Requirements Criteria Documents • Prototyping initiated • Technical Specification Requirements	**Design** • Prototyping completed – Title II Design – 30/60/90/100 • Design approved for execution • Readiness Level Determination (Joint Evaluation Team)	**Procurement & Fabrication** • Title III Design • Long-lead procurements • Long-lead fabrications • System testing initiated	**Construction** • Title III Design • Construction • Installation • D&D complete – Punch-list closeout – Work order closeout – DCF closeout • System testing	**TTO** • Readiness – MSA – CRA – FRA • Declaration to startup operations	**TTP** • Management Observation Team first run in operations • Hot testing • Hot process development • System/Product Qualification • If the intended use of the equipment is for WR Production, the NNSA chartered Product Realization Team must concur that Technology Readiness Level 9 and Manufacturing Readiness Level 7 have been achieved per C018 and C017, respectively.	**WR** • Qualification plans • Design Agency Engineering Evaluation • Qualification Evaluation Release
Line-Item Projects	**Pre CD-0** *Initiation* • Mission Need Statement • Program Requirements Document	**CD-0** *Approve Mission Need* • Draft Construction Project Data Sheet • Functional Requirements Document • Facility Design Description • System Design Description • Conceptual Design 0-15% (Title I Design) **CD-1** *Approve Alternative Selection and Cost Range* • 15-30% Preliminary Design • 60/90/100% design (Title II Design) **CD-2** *Performance Baseline* • Enter budget process for construction	**CD-3A** *(Optional)* • Long-lead procurements • Long-lead fabrications • Receipt inspection • Site preparation • Site characterization • Limited area access • Safeguards & security	**CD-3** *Start Construction* If no CD-3A: • Long-lead procurements • Long-lead fabrications • Receipt inspection of procurements • Site preparation Project Execution: • Construction • Installation • D&D Initiate Project Closeout: • Initiate DCF closeout • Initiate work order closeout	**TTO** *Readiness - Approve Start of Operations* • Complete DCF closeout • Complete work order closeout • Readiness – MSA – CRA – FRA • Declaration to start up hot operations	**TTP** *Equipment Hot Testing* • Acceptance criteria for each piece of equipment identified by Key Performance Parameters (KPP) • Completion of each KPP will be documented with a memo for the owning line organization • The line organization's acceptance memo documents completion of each KPP and is the formal transition of the equipment from the project to the program **CD-4 Project Closeout** • CD-4 package approved by NNSA ***After KPP approval, remaining TTP activities completed by the program (see above).***	**Program Execution** *(see activities listed above)*
Minor Construction Projects	**Planning** • Title I Design • Class 3 cost estimate	**Design** • Title II Design • Design approved for execution	**Execution** • Contract for procurements awarded • In-house resources committed to schedule • Long-lead procurements	• Project mobilized • Materials and labor delivered to project site • Site preparation and/or demolition • Fieldwork • Installation	• Punch-list closeout • Work order closeout • DCF closeout • Readiness • Startup testing • Project closeout	**Program Execution** *(see activities listed above)*	**Program Execution** *(see activities listed above)*

Figure 34. Process for achieving TTO, TTP, and WR with the key activities, deliverables, stage gates, and decision points by project category. Colors align with project schedules shown in later figures.

(b)(3), (b)(5), (b)(7)(E) and (b)(7)(F)

[redacted]

Figure 35. Pit production mission defined TTO need dates for process equipment. Planned execution dates are not shown.

(b)(3), (b)(5), (b)(7)(E) and (b)(7)(F)

[redacted]

Figure 36. Pit production mission defined TTO need dates for facility investments. Planned execution dates are not shown.

4.1 Los Alamos Plutonium Operations

The Los Alamos Plutonium Operations program (Plutonium Sustainment through FY20) will provide the funding and direction for installation of the process equipment and gloveboxes required to produce 10 ppy. The projects are primarily in TA-55 PF-4 and include decontaminating and decommissioning (D&D) legacy process equipment, upgrading equipment and gloveboxes, and installing new process equipment and gloveboxes. A summary of these projects is shown in Table 36. Each project has a TTO need date determined by assessing when it must be available for use to support the Pit PRT schedule. Most projects must achieve TTO by March 2022 in order to produce the Pit FPU in 2023. These TTO need dates are one year earlier than when the equipment is needed for pit production to allow time after TTO to first complete TTP and then for the equipment to be approved by the LLNL DA for WR use (if required).

The Los Alamos Plutonium Operations program will also be responsible for the MR&R projects in TA-55 PF-4 to repurpose and upgrade gloveboxes to process newly generated residues and dispose of legacy materials from the TA-55 PF-4 vault. These infrastructure investments are primarily in two rooms in TA-55 PF-4 and will provide enduring and reliable support for the recycle, recovery, and disposition of plutonium from the byproducts of pit production and other NA-10 plutonium programs.

Figure 37 through Figure 40 show the location of the planned D&Ds and equipment installations on the first floor of TA-55 PF-4. These projects, shown in Figure 41 and Figure 42, are being planned and executed according to the process described in Figure 34.

Table 36. Los Alamos Plutonium Operations – infrastructure investments

(b) (5)

(b)(3)

Figure 37. Los Alamos Plutonium Operations – (b) (7)(E), (b) (7)(F)

(b)(3)

Figure 38. Los Alamos Plutonium Operations – (b) (7)(E), (b) (7)(F)

(b)(3)

[redacted]

Figure 39. Los Alamos Plutonium Operations – (b) (7)(E), (b) (7)(F) [redacted]

(b)(3) [redacted]

Figure 40. Los Alamos Plutonium Operations – (b) (7)(E), (b) (7)(F) [redacted]

(b)(3)

[redacted]

Figure 41. Los Alamos Plutonium Operations – schedule of infrastructure investments for plutonium recycle and recovery, purification, foundry, and machining

(b)(3)

Figure 42. Los Alamos Plutonium Operations – schedule of infrastructure investments for inspection, welding, assembly, and other supporting operations

4.2 Pit and RTG Surveillance

(b)(3)

The RTG Surveillance program will upgrade the gas sampling system. A summary of these projects is shown in Table 37.

Table 37. Pit and RTG surveillance – infrastructure investments

(b) (5) [redacted]

Figure 43. Pit and RTG surveillance – schedule of infrastructure investments

4.3 Office of Experimental Science

The Office of Experimental Science has no infrastructure investments planned related to plutonium science.

4.4 Plutonium Disposition

The Plutonium Disposition program has several projects to replace aging infrastructure, upgrade existing equipment, and reduce risk by eliminating single point failures. NA-20 fully funds projects at project initiation. The funding for multi-year projects is "fenced" in carryover to continue each project without interruption. Plutonium Disposition and the Plutonium Sustainment (Los Alamos Plutonium Operations starting in FY21) program are jointly funding shipping/receiving upgrades to increase capacity, and Plutonium Disposition is investing in additional NDA capability to reduce reliance on shared NDA resources.

A summary of these projects is shown in Table 38.

Table 38. Plutonium Disposition – infrastructure investments

(b) (5) [redacted]

(b)(3)

Figure 44. Plutonium Disposition – (b) (7)(E), (b) (7)(F)

(b)(3)

[redacted]

Figure 45. Plutonium Disposition – (b) (7)(E), (b) (7)(F) [redacted]

(b)(3), (b)(5)

Figure 46. Plutonium Disposition – schedule of infrastructure investments

4.5 Pu-238 Production Programs

The Pu-238 production programs provide funding and direction for the installation of process equipment and gloveboxes (b) (7)(E), (b) (7)(F) that are required to produce heat sources for space and defense programs. Equipment projects will address aging infrastructure and single points of failure, as well as improve process efficiency to improve throughput and yield rates. The projects include D&D of legacy process equipment, equipment, glovebox refurbishments, and installation of new equipment and gloveboxes. Projects are prioritized by the need to reduce programmatic risk while meeting heat source production requirements.

A summary of these projects is shown in Table 39.

Table 39. Pu-238 production programs – infrastructure investments

(b) (5) [redacted]

(b)(3) [redacted]

Figure 47. Pu-238 production programs – (b) (7)(E), (b) (7)(F) [redacted]

(b)(3) [redacted]

Figure 48. Pu-238 production programs – (b) (7)(E), (b) (7)(F) [redacted]

(b)(3), (b)(5)

[redacted]

Figure 49. Pu-238 production programs – schedule of infrastructure investments

4.6 Americium Oxide Production

The Americium Oxide Production program will relocate a furnace controller in (b)(3) [redacted]. A summary of this project is shown in Table 40.

Table 40. Americium Oxide Production – infrastructure investments

(b) (5) [redacted]

Figure 50. Americium oxide production – schedule of infrastructure investments

4.7 3013 Surveillance and Monitoring

The 3013 Surveillance and Monitoring program has no infrastructure investments planned.

4.8 Stockpile Responsiveness

The Stockpile Responsiveness program has no infrastructure investments planned.

4.9 Line-Item Projects

LANL has completed seven line-item projects and has four in progress (CMRR, LAP4, TRP III, and TLW) to enable pit production and the other plutonium missions at LANL. These line-item projects will comply with all applicable design standards and codes and are being planned and executed according to the process described in Figure 34. Many elements of the infrastructure required for the 30 ppy mission will be established along the Pajarito corridor at LANL. A map showing conceptual designs and the locations of some of these elements is shown in Figure 51.

To execute these projects, a significant increase in the number of craft is required. LANL will use craft on multiple work fronts operating on multiple shifts. As the design and detailed execution schedules mature, it is expected that there will be a significant period of time where TA-55 PF-4 is a construction facility. (b) (5) [redacted] LANL has a plan to address recruitment and retention of craft, many of whom commute more than 75 miles (each way) daily, which will include offering incentives like per diem.

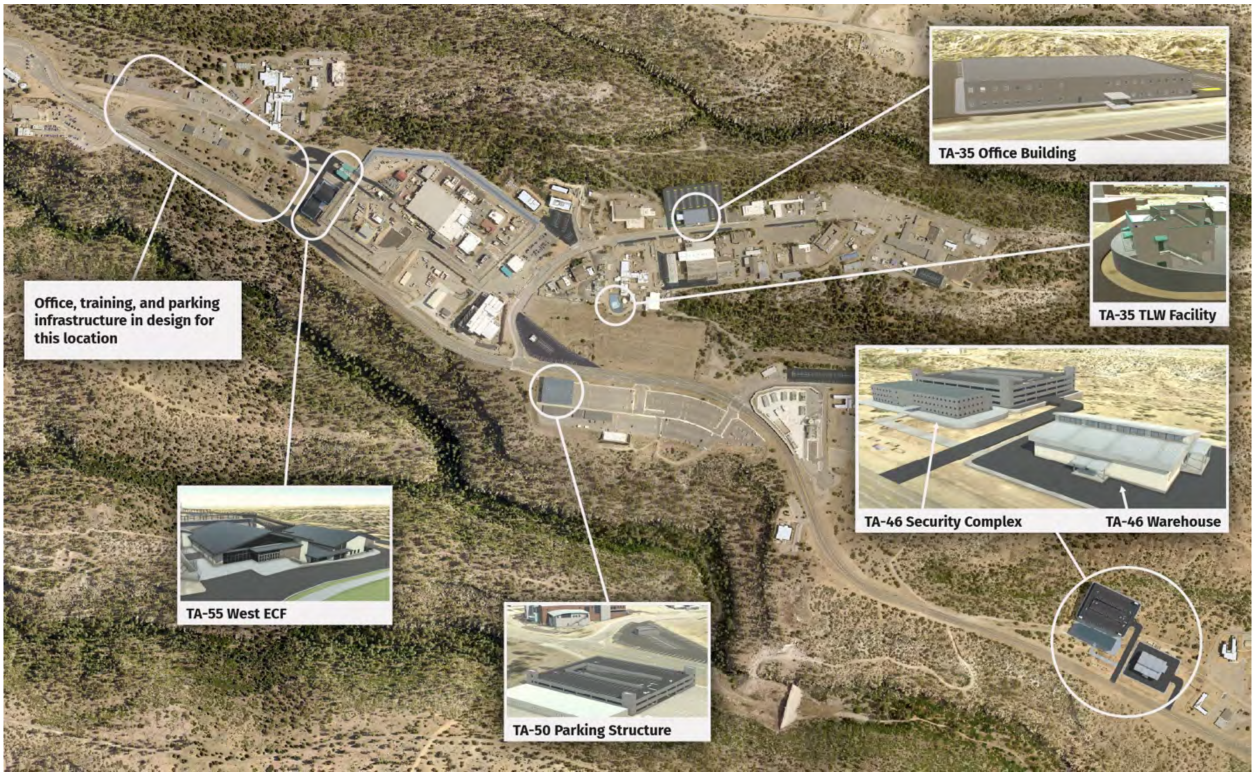


Figure 51. Infrastructure investments along the Pajarito corridor

4.9.1 Chemistry and Metallurgy Research Replacement (CMRR) Project

The CMRR project establishes at TA-55 the infrastructure to consolidate and modernize AC and MC capabilities to support all plutonium missions at LANL. There are four CMRR subprojects to upgrade RLUOB, TA-55 PF-4, and infrastructure along the Pajarito corridor. Two CMRR subprojects have approved baselines (b) (5) [redacted] The other two CMRR subprojects are in planning: one will install equipment and support the recategorization of RLUOB to a Hazard Category 3 (HC-3) nuclear facility, and the other will install AC and MC capabilities in TA-55 PF-4.

The schedules for the four CMRR subprojects are shown in Figure 52. The infrastructure investments listed under “Infrastructure” are planned to be executed in CMRR and will become part of the PEI2 subproject after review and approval by NNSA.

(b) (5)

Figure 52. CMRR – schedule of infrastructure investments

4.9.1.1 CMRR RLUOB Subprojects

The two CMRR RLUOB subprojects are RLUOB Equipment Installation Phase 2 (REI2) and Re-categorizing RLUOB to Hazard Category 3 (RC3). The schedule for these is shown in Figure 53 and is discussed below.

(b) (5)

Figure 53. CMRR RLUOB subprojects – schedule

RLUOB Equipment Installation Phase 2 (REI2) Subproject

The REI2 subproject improves the utilization of RLUOB by reconfiguring existing laboratory space and equipping empty laboratories with AC and MC capabilities. The increased radiological limit for RLUOB to 38.6 g of Pu-239 equivalent, consistent with the new limit established by NNSA Supplemental Guidance NA-1 SD G 1027, provides the justification to equip the now-underutilized laboratory space.

The EIL activities for CMRR REI2 are summarized in Table 41. Specific capabilities to be installed include the following:

- Coulometry
- X-ray fluorescence
- Sample preparation for the following analyses:
  - Trace elements
  - Mass spectrometry
  - X-ray fluorescence
  - Radiochemistry

Table 41. CMRR REI2 subproject – infrastructure investments

(b) (5)

Re-categorizing RLUOB to Hazard Category 3 (RC3) Subproject

The RC3 subproject completes the build-out of AC and MC capabilities in RLUOB. This project includes the installation of gloveboxes, open-front hoods, and standalone equipment required for robust AC and MC operations. RC3 also supports installation of AC and MC capabilities for R&D, troubleshooting production processes, and other applications for LANL's role as the nation's Plutonium Center of Excellence.

RC3 also includes the facility modifications and improvements that are required to elevate RLUOB to a HC-3 nuclear facility with a MAR limit of 400 g of Pu-239 equivalent. This increase makes it possible to improve utilization of RLUOB for AC and MC operations.

The EIL activities for CMRR RC3 are summarized in Table 42. Specific capabilities to be installed include the following:

- Coulometry
- Iron spectrophotometry
- Interstitials analysis
- Ion chromatography

Table 42. CMRR RC3 subproject – infrastructure investments

(b) (5)

4.9.1.2 CMRR PF-4 Subprojects

The two CMRR PF-4 subprojects are PF-4 Equipment Installation Phase 1 (PEI1) and PF-4 Equipment Installation Phase 2 (PEI2). The locations of the D&D and installation of equipment in TA-55 PF-4 and the schedule for these projects are shown in Figure 54 through Figure 56.

(b)(3) [redacted]

Figure 54. CMRR PF-4 subprojects – (b) (7)(E), (b) (7)(F) [redacted]

(b)(3) [redacted]

Figure 55. CMRR PF-4 subprojects – (b) (7)(E), (b) (7)(F) [redacted]

(b)(3), (b)(5)

Figure 56. CMRR PF-4 subprojects – schedule

PF-4 Equipment Installation Phase 1 (PEI1) Subproject

The PEI1 subproject consolidates and modernizes AC and MC capabilities in TA-55 PF-4 by repurposing some existing gloveboxes for new processes, removing other gloveboxes and equipment, and installing new gloveboxes and equipment. PEI1 establishes the capabilities in TA-55 PF-4 to process large amounts of nuclear material into small samples prior to transfer to RLUOB for analysis.

The EIL activities for CMRR PEI1 are summarized in Table 43. Specific capabilities to be installed include the following:

- Small-sample fabrication and preparation for AC
- Surface science
- Physical property measurements

Table 43. CMRR PEI1 subproject – infrastructure investments

(b) (5) [redacted]

PF-4 Equipment Installation Phase 2 (PEI2) Subproject

The PEI2 subproject will establish a robust and modern MC capability to support all plutonium missions and maintain LANL as the nation's Plutonium Center of Excellence. This subproject will D&D legacy equipment and install new gloveboxes and equipment.

The EIL activities for CMRR PEI2 are summarized in Table 44. Specific capabilities to be installed include the following:

- Physical properties
- Small sample fabrication and preparation
- Mechanical testing
- Surface science
- Sample preparation

Table 44. CMRR PEI2 subprojects – infrastructure investments

(b) (5) [redacted]

4.9.1.3 CMRR Infrastructure

Additional infrastructure in and around TA-55 is needed for the increased staffing required to produce 30 ppy. This scope is expected to be part of the CMRR PEI2 subproject. The EIL activities are summarized in Table 45. Specific infrastructure to be installed includes the following:

- (b) (7)(E), (b) (7)(F) [redacted]
- TA-55 PF-3 Change Room Expansion – change rooms with approximately 600 additional lockers
- (b) (7)(E), (b) (7)(F) [redacted]
- TA-55 West vehicle access

- Office and Parking
- Warehouse – approximately 60,000 sq ft warehouse for WR bonded storage, facility critical spares, and other program supplies

Table 45. CMRR infrastructure – infrastructure investments

(b) (5)

4.9.2 Los Alamos Plutonium Pit Production Project (LAP4)

LAP4 will provide the additional equipment and infrastructure to produce more than 10 ppy and up to 30 ppy at LANL. LANL will draft a CD-1 package (submission to NNSA expected in 2020) with NA-APM to define scope and provide a bounding cost and schedule range. The information provided in this document relating to LAP4 represents pre-conceptual design maturity and does not represent concurrence from NA-APM regarding scope, cost, and schedule. The LAP4 strategy is to authorize the project in a single CD-1 submittal (expected in 2020) with seven subprojects. The CD dates (early planning) for each subproject are shown in Figure 57.

(b) (5)

Figure 57. LAP4 – estimated schedule and cost

4.9.2.1 LAP4 TA-55 PF-4 Equipment D&D Subproject

This subproject groups 75 equipment D&D activities inside of TA-55 PF-4, which allows for dedicated craft and other facility resources to focus solely on D&D. Since many of these activities are predecessors to equipment installations, these activities must start as soon as possible. As such, a CD-3A package will be prepared during the NNSA review and approval of the CD-1 package. The schedule of these activities is shown below.

Table 46. LAP4 TA-55 PF-4 Equipment D&D – infrastructure investments

(b) (5)

(b)(3)

Figure 58. LAP4 – TA-55 PF-4 Equipment D&D subproject – (b) (7)(E), (b) (7)(F)

(b)(3), (b)(5)

[redacted]

Figure 59. LAP4 – TA-55 PF-4 Equipment D&D subproject – schedule

4.9.2.2 LAP4 Equipment Installation Subprojects

LAP4 is responsible for the installation, startup of radiological operations, and hot testing of TA-55 PF-4 equipment to produce 30 ppy. The LAP4 Equipment Installation subprojects achieve CD-4 after completing the hot testing to achieve the Equipment Hot Testing (EHT) milestone. A summary diagram of the sequence of activities and milestones to transition from LAP4 to the Los Alamos Plutonium Operations is provided in Figure 60.

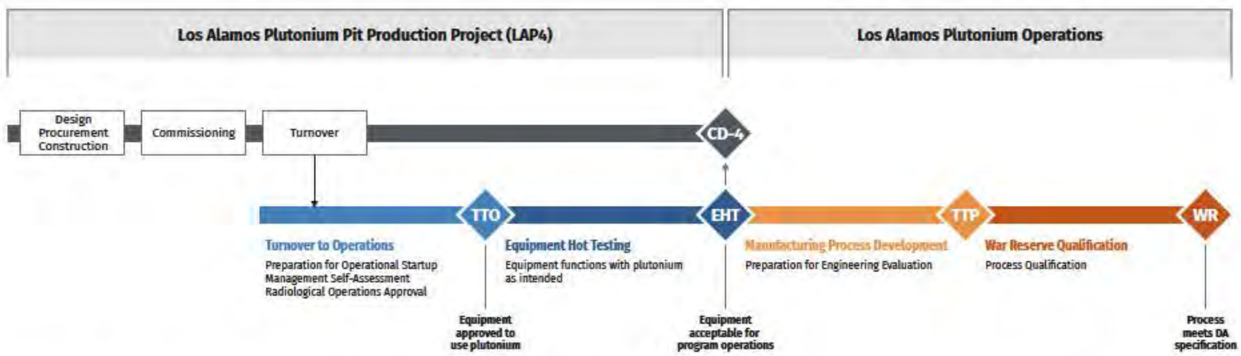


Figure 60. LAP4 equipment installation subprojects – path to CD-4

After the TA-55 Facility Operations Director approves the equipment and processes to be used for radiological operations, the milestone for TTO is met. LAP4 is then responsible to fund operational groups to perform hot testing. The equipment installed or upgraded will undergo hot testing in phases as the construction turnover and subsequent operational start-up of specific equipment is completed. Prior to CD-2, an operational test plan for each piece of equipment will be written with the end user and approved by the ALDWP Actinide Operations Director and the relevant LAP4 program owner representative. This plan will establish the performance parameters (e.g., type and number of tests, duration, and accuracy/precision) and acceptance criteria that serve as the basis for the collection of data of sufficient quality and quantity to prove the equipment functions with plutonium as intended.

Once the EHT of a particular TA-55 PF-4 equipment capability or set of capabilities is complete, an equipment test report shall be issued. The responsible line management (division level) for the equipment capabilities will provide a confirmation memo to declare the completion of EHT. This declaration is reviewed and concurred by the LAP4 program owner representative. The confirmation memos for the installed equipment constitute the objective evidence for the LAP4 subproject closeout (CD-4). After CD-4 is achieved for a subproject, responsibility for operating, maintaining, and qualifying for WR manufacturing (if applicable) is transferred to the Los Alamos Plutonium Operations program.

Table 47. LAP4 equipment installation subprojects – infrastructure investments

[redacted] (b) (5)

(b)(3)

Figure 61. LAP4 equipment installation subprojects – (b) (7)(E), (b) (7)(F)

The schedule for the (b) (5) installations for the LAP4 Pit Production Equipment Installation for 20 ppy subproject is shown in Figure 62.

(b)(3), (b)(5)

Figure 62. LAP4 Pit Production Equipment Installation for 20 ppy subproject – schedule

(b) (5) [redacted] (b)(3)

(b)(3), (b)(5) [redacted]

Figure 63. LAP4 Aqueous Chloride Equipment Installation for 20 ppy subproject – schedule

The schedule for the (b) (5) installations for the LAP4 Pit Production Equipment Installation for 30 ppy subproject is shown in Figure 64.

(b)(3), (b)(5)

Figure 64. LAP4 Pit Production Equipment Installation for 30 ppy subproject – schedule

4.9.2.3 LAP4 TA-55 Access Subproject

This LAP4 subproject will design and construct a new TA-55 West Entry Control Facility (WECF). The WECF will be a permanent facility for the increased staff required to produce 30 ppy to efficiently enter and exit the TA-55 protected area. The WECF is proposed to be a multi-story facility with two wings, an entry control wing and an administrative wing. The entry control wing includes secure and unsecure queuing areas, a locker area, a waiting area, secure and unsecure break areas, a hardened guard booth, an Argus equipment room, at least twelve PPIVs with metal detectors, stairs, and two elevators. The administrative wing includes an access control suite, badge office, clearance processing office, investigator interview rooms, waiting area, deployed security offices, bioassay collection point, two Human Reliability Program (HRP) testing areas, large conference room, and breakroom.

Figure 65. LAP4 TA-55 Access subproject – conceptual design of the West Entry Control Facility

Table 48. LAP4 TA-55 Access subproject — infrastructure investments

(b) (5) [redacted]

Figure 66. LAP4 TA-55 Access subproject – schedule

4.9.2.4 LAP4 Office/Parking/Security Subproject

This LAP4 subproject adds office and parking structures at TA-48, which will be integrated into office and parking structures to be completed by the CMRR project. (b) (5) [redacted] This subproject also contains the security complex located at TA-46.

Table 49. LAP4 Office/Parking/Security subproject

(b) (5) [redacted]

Figure 67. LAP4 Office/Parking/Security subproject – schedule

4.9.2.5 LAP4 TA-48 Plutonium Training and Development Subproject

This multipurpose facility will contain training and process-development areas as well as a machine shop, cafeteria, large auditorium, and parking.

Table 50. LAP4 TA-48 Plutonium Training and Development subproject – infrastructure investments

(b) (5) [redacted]

Figure 68. LAP4 TA-48 Plutonium Training and Development subproject – schedule

4.9.3 TA-55 Reinvestment Project III (TRP III)

TRP III upgrades the TA-55 fire protection system by installing a fire alarm system replacement for TA-55 PF-4 and adding a second alarm panel for the non-nuclear facilities at TA-55. TRP III will replace the obsolete fire alarm control panel, detection system, initiating devices, monitoring modules, addressable relay modules, and notification system that services TA-55 PF-4 and other structures at TA-55. The existing system was installed when the facility was constructed in the mid-1970s. The current panel and the associated existing fire detection, control, and evacuation devices are not compliant with the National Fire Protection Association or Americans with Disabilities Act, and repair and replacement parts are not available. The fire alarm control panel represents a single-point vulnerability for TA-55 PF-4. TRP III has received CD-0 approval. (b) (5) [redacted]

Table 51. TRP III – infrastructure investments

(b) (5) [redacted]

Figure 69. TRP III – schedule

4.9.4 Transuranic Liquid Waste (TLW) Facility Project

The TLW facility project replaces the antiquated TRU liquid waste treatment capability located in the Radioactive Liquid Waste Treatment Facility (RLWTF) at TA-50. The TLW facility will be an important component of the nuclear waste processing system at LANL, which is necessary for a reliable 30 ppy mission. The TLW facility will be an independent HC-3 nuclear facility designed to treat 29,000 liters of liquid TRU waste per year. The design capacity is based on supporting the programs of record for all plutonium missions in TA-55 PF-4, including producing 30 ppy.

(b) (5) [redacted]

Table 52. TLW Facility – infrastructure investments

(b) (5) [redacted]

(b) (5) [redacted]

Figure 70. TLW Facility – schedule

4.10 Minor Construction Projects

The EIL includes the minor construction projects required to support all plutonium missions associated with TA-55 PF-4, RLUOB, the nuclear waste facilities, and supporting infrastructure. The small projects are funded by Recapitalization, CBI, and LANL Site Support. These projects cover a wide range of scope, complexity, and technical challenges (office buildings, seismic upgrades, fire water loop reconfiguration, etc.). These projects ensure facilities are reliably available for programmatic work, meet federal and state requirements, and address Defense Nuclear Facility Safety Board concerns.

4.10.1 Recapitalization

The NA-50 Recapitalization program is responsible for infrastructure investments that upgrade or enhance facility functions and building systems to improve reliability, safety, security, sustainability, productivity, and/or efficiency. Planned investments include the TA-55 PF-4 fire water loop, fire penetrations, ventilation, and seismic switch upgrades for the electrical power distribution system. This integrated strategy assumes steady-state (b) (5) [redacted]

Table 53. Recapitalization – infrastructure investments

(b) (5) [redacted]

(b) (5)

[redacted]

Figure 71. Recapitalization – schedule

4.10.2 Operations of Facilities and Maintenance and Repair of Facilities

The NA-50 Operations of Facilities and Maintenance and Repair of Facilities programs are responsible for small projects in support of facility maintenance, assessment, and compliance within the facilities TA-55 PF-4, RLUOB, RLWTF, RANT, and TWF. These projects are focused on radiological instrumentation operability, fire hazard evaluations, documented safety analyses (DSAs), and other emergent scope. These facility systems, evaluations, and compliance efforts are essential for reliable facility operations and support all plutonium programs.

Table 54. Operations of Facilities and Maintenance and Repair of Facilities – infrastructure Investments

(b) (5) [redacted]

Figure 72. Operations of Facilities – schedule of infrastructure investments

(b) (5) [redacted]

Figure 73. Facility Maintenance and Repair of Facilities – schedule of infrastructure investments

4.10.3 Capability Based Investments (CBI)

The NA-10 CBI program is responsible for several projects in TA-55 PF-4 to replace the material conveyance system (known as the trolley system) with upgraded components. Other projects include modifications to the inert gas distribution system and the dry vacuum system. These facility systems are required by all plutonium programs. This integrated strategy assumes steady-state CBI funding (b) (5) [redacted]) in the outyears for infrastructure investments for the LANL plutonium enterprise.

As shown in Figure 74, the completion dates of the CBI projects (b) (5) [redacted] and will be executed according to the process shown in Figure 34. (b) (5) [redacted]

Table 55. CBI – infrastructure investments

(b) (5) [redacted]

Figure 74. CBI – schedule

4.10.4 LANL Site Support

The LANL Site Support program addresses institutional office and parking needs through institutional general plant projects (IGPP) and other actions. An office building at TA-35, parking structure at TA-50, and expanded surface parking in areas around TA-55 are planned and expected to be complete by 2023.

(b) (5) [redacted]

Table 56. LANL Site Support – infrastructure investments

(b) (5) [redacted]

Figure 75. LANL Site Support – schedule

5. Plutonium Missions – Staffing

LANL is committed to developing and maintaining a robust workforce with the expertise and skills necessary to produce 30 ppy in 2026 while meeting all other plutonium missions. LANL will identify, recruit, hire, train, and retain a workforce to

- Produce 30 ppy while delivering on all plutonium missions;
- Maintain nuclear and high-hazard facilities and the associated utilities and infrastructure;
- Manage environmental protection, safety, quality, and security programs and requirements;
- Manage the disposition of TRU waste onsite and its shipment to WIPP;
- Provide business, IT, and other support services; and
- Complete infrastructure investments projects and activities.

This integrated strategy addresses the LANL staff, craft, and subcontractors to meet all plutonium missions and how LANL will recruit, train, and retain them. This includes both the enduring staff to deliver on missions and the interim staff to establish the infrastructure.

The programs accounted for in this document are listed in Table 57. Section 5.1 provides the estimates for the enduring staff for plutonium programs and Section 5.2 addresses the interim staffing required to complete the infrastructure investments for the plutonium missions. Increases in enduring and interim staff will occur concurrently; planning for both must be integrated to ensure success for all plutonium missions. Direct-funded staff, indirect-funded staff, interim staff, and other terms are defined in the Definition of Terms section near the beginning of this document.

Additional details are provided in the *Staffing Plan for Plutonium Missions at Los Alamos National Laboratory*.

Table 57. Programs and projects at LANL associated with plutonium missions

Organization	Program or Project	Pit Production and Enabling Functions	Enduring	Interim
NA-10 Programs	Plutonium Sustainment	X	X	
	Material Recycle and Recovery	X	X	
	Storage	X	X	
	Capability Based Investments	X		X
	RTG Production		X	
	Pit and RTG Surveillance		X	
	Office of Experimental Science		X	
NA-10 Line-Item Projects	Chemistry and Metallurgy Research Replacement	X		X
	Los Alamos Plutonium Pit Production Project	X		X
	TRU Liquid Waste Facility	X		X
	TA-55 Reinvestment Project Phase III	X		X
NA-50	Operations of Facilities	X	X	
	Maintenance and Repair of Facilities	X	X	
	Recapitalization	X		X
NA-20	Plutonium Disposition		X	
NA-70	Defense Nuclear Security	X	X	
DOE NE	Radioisotope Power Systems		X	
DOE SC	Americium Oxide Production		X	
DOE SR	3013 Surveillance and Monitoring		X	

5.1 Enduring Staffing

LANL performed a series of staffing analyses in FY19 that identified the staffing required for plutonium missions. The increase in enduring LANL staffing will be achieved through three overlapping objectives.

> **Execute Current Missions –** Increase staffing to the level required to reliably operate and maintain LANL's plutonium enterprise and to execute the program of record associated with all plutonium missions. For pit production, this objective is the staffing to reliably deliver the first production unit (FPU) in 2023.
>
> (b) (5) [redacted] – [redacted]
>
> **Produce 30 ppy –** Increase the pit production staffing to the level required to support a sustained 30 ppy production rate (b) (5) [redacted] on a single production shift.

5.1.1 All Plutonium Programs

Figure 76 shows the direct-funded LANL staff, craft, and subcontractors required to execute all of the enduring plutonium programs; it excludes the interim LANL staff, craft, and subcontractors needed to execute one-time infrastructure investments. Figure 77 shows the same staffing data binned by funding source.

(b) (5) [redacted]

Figure 76. All plutonium missions – estimated direct-funded enduring staffing by staffing objective

(b) (5)

Figure 77. All plutonium programs – estimated direct-funded enduring staffing by funding source

5.1.2 Pit Production and Enabling Functions

shows the estimated direct-funded enduring LANL staff, craft, and subcontractors required to produce 30 ppy by FY26 by staffing objective, and Table 58 shows the same staffing data binned by job category. The FY19 base is the actual direct-funded FTEs that supported pit production and enabling functions.

(b) (5)

Figure 78. Pit production and enabling functions – estimated direct-funded enduring staffing by staffing objective

Table 58. Pit production and enabling functions – estimated direct-funded enduring staffing

(b) (5)

[redacted]

5.2 Interim Staffing

LANL will hire a large interim workforce to complete the many infrastructure investments to support the plutonium enterprise at LANL. Establishing the capability to produce 30 ppy is the primary reason for these infrastructure investments.

Interim staffing needs (LANL staff and subcontractors) were estimated using a resource loaded schedule for infrastructure investments. Interim craft staffing was estimated using current and historical averages of craft per construction execution dollar. Figure 79 shows the estimated staffing needed for one-time infrastructure projects, with a confidence range of +50% and –20%.

As the scope and execution plan for line-item projects are further refined, staffing estimates will be improved. The initial estimates are intended to inform planning for infrastructure needs (workstations, parking, busing, etc.) and recruiting, hiring, and training needs.

(b) (5)

Figure 79. Interim staffing –estimated range (+50% to –20%) of LANL staff, craft, and subcontractors to establish the infrastructure to produce 30 ppy

5.3 Indirect-Funded Staffing

Indirect-funded staff support multiple cost objectives across LANL. Indirect-funded functions include human resources, information technology, business services, emergency management, procurement, legal counsel, finance, and accounting. The growth in direct-funded staffing for the expanded LANL plutonium enterprise is difficult to correlate with the associated growth in indirect-funded functions. Estimates of increased staffing for indirect-funded functions are influenced by a variety of factors. For example, the number of direct-funded staff determine the number of indirect-funded staff needed to provide HR, badging, and occupational medicine services. Similarly, the number and locations of facilities affect the staffing needed to provide emergency management services and maintain grounds and facilities, and hours of operation affect the staffing needed to provide business and IT services.

The indirect-funded staffing levels shown in Figure 80 reflect a maximum bounding estimate based on current overhead costs and burden rate structure. LANL has not determined if all of this affordable indirect-funded staffing is required to support the plutonium missions. If less indirect staff are needed to fully support the plutonium missions, the overhead rate structure and associated costs could be adjusted accordingly. LANL will update the staffing analysis in FY21 to better understand which indirect-funded organizations and what job categories should grow to support all plutonium missions. Once required increases in indirect-funded staffing are better understood, LANL will adjust the burden rate structure if necessary.

(b) (5)

Figure 80. Potential indirect-funded staffing

5.4 Strategy to Recruit, Train, and Retain Staff

LANL is recruiting to meet the required levels forecasted in the staffing plan. The recruiting strategy is to attract qualified and skilled personnel through three approaches: (1) creating a pipeline of early-career hires for high-demand areas; (2) identifying mid-career professionals with the specific skill sets needed for pit production; and (3) targeting specific highly skilled late-career individuals. As the staffing requirements and high-demand competency areas are further refined, the recruiting plan and strategy will be updated.

Most staff supporting plutonium missions require a DOE Q clearance, HRP certification, and one to two years of on-the-job training to be qualified and proficient. Coupled with the new training and qualification programs designed to reduce the time-to-train, LANL is prioritizing hires in critical skills job categories to ensure staff are ready and available to support mission needs on time.

To execute the pit production mission, LANL must rapidly recruit and hire the staff to meet the substantial staffing increase identified. While current hiring rates are at an all-time high (1,250 LANL staff hires in FY19), the pace of hiring will need to be even higher to support all plutonium missions. LANL is developing targeted recruiting initiatives to address hiring for critical skills hires, understaffed job categories, and job categories requiring 50+ hires over the next five years. Some of the specialized recruiting tools for these jobs categories include on-the-spot offers, large-scale hiring fares with candidate referrals, and expansion of university and college partnerships.

Worker training and qualification are fundamental to ensuring safe and secure nuclear facility operations. It is imperative that all staff have the appropriate knowledge, skills, and abilities prior to performing assigned duties. Worker training must consider not only the scope of work performed on programmatic equipment in gloveboxes, but also facility and support-related operations, such as material control and accountability (MC&A), safety basis, radiological control, criticality safety, waste management, etc. Facilities for training and development are planned as part of the LAP4 line-item project. Figure 81 shows the progression of and average time needed to complete training and qualification required for different occupations supporting plutonium missions at TA-55 PF-4.

Retention of the workforce is critical to reduce costs associated with attrition and alleviate impacts to program execution. (b) (4) [redacted] LANL recognizes the importance of first identifying the needs and motivators for the diverse workforce and then implementing the associated policies and practices to improve the employee retention. LANL is exploring monetary and non-monetary compensation and benefits offerings to improve the retention of both early- and late-career LANL employees, as well as the unique retention challenges associated with staff with critical skills.

(b) (5)

Figure 81. Recruiting, training, and retention goals and deliverables for the LANL plutonium enterprise

6. Interim Solutions for Execution

LANL is committed to executing this integrated strategy. However, the existing infrastructure around TA-55 is insufficient for the current plutonium missions workforce, and the increased staffing needed for the expanded pit production mission will exacerbate the existing infrastructure shortfalls.

Planned construction projects will address long-term infrastructure needs, but these projects will not be completed in time to meet the increased demand. Interim measures to improve utilization of space around TA-55 are underway, but they will not fully meet immediate infrastructure needs. Consequently, additional interim measures that can be funded and implemented quickly (e.g., leasing, providing trailers or other temporary buildings, and busing from nearby parking) are necessary.

This section presents the critical elements of the infrastructure that must be addressed through interim measures.

Office and Parking Space around TA-55

Existing office space and parking around TA-55 are insufficient for the current workforce, and the increased staffing for the expanded pit production mission will further widen the gaps between the amount of space needed and the amount available. Office space utilization at TA-55 currently averages 74 square feet per person, which is significantly below the DOE standard of 180 square feet per person. LANL has already converted many conference rooms at TA-55 to shared office spaces, each with 10–15 workstations, and offices designed for single occupancy are now used at double or triple occupancy.

LANL is also increasing the population density in office areas near TA-55 and relocating non–plutonium missions staff to other locations at LANL. Plutonium missions staff that need to be located at or near TA-55 but not necessarily within the protected area are currently located at TAs-35, -46, -48, and -50, which are adjacent to TA-55. Approximately 145 staff at TAs-35, -46, -48, and -50 support non–plutonium missions and therefore do not need to be located near TA-55. These staff are being relocated to other sites at LANL, which will provide some decompression in office areas near TA-55. Even after these relocations are realized, 189 current plutonium missions staff will still need office workspace at or near TA-55.

Figure 82 and Figure 83 show the gaps between the space required and that available for office workspaces and parking, respectively. The gaps will remain problematic until the planned infrastructure investments are completed.

(b) (5)

Figure 82. Required, planned, and interim office workspace around TA-55

(b) (5)

Figure 83. Required, planned, and interim parking around TA-55

Office and Parking Space for the Security Workforce

The security workforce (LANL staff and protective force) must increase substantially and at a faster pace than other elements of the workforce. This accelerated growth is necessary to make TA-55 PF-4 available (b) (5) which is needed to deconflict program activity from craft work for maintenance and construction. The current space for the security workforce does not fully meet the needs of the existing workforce, and it will not meet the needs of a larger workforce. A new security complex at TA-46 is planned (b) (5)

Training and Development Facility

LANL's capacity to train the current workforce is near its limit, which creates substantial inefficiencies and delays in training and qualifying the workforce. The planned surge in hiring to support the expanded pit production mission will put further strain on the limited current capacity. Additional inefficiencies are due to on-the-job training (OJT) occurring in active programmatic space during the day shift. Sharing program execution space and time with a workforce in training creates challenges to meeting programmatic commitments. Interim solutions must be implemented to more efficiently train the workforce and reduce impacts to programmatic operations until the training and development center is completed.

Table 59 presents options for interim measures to address gaps between needs and availability for office space, parking, and facilities for worker training, the security workforce, and waste management.

Table 59. Infrastructure – interim solutions

(b) (5), (b) (7)(E), (b) (7)(F)

[redacted]

(b) (5), (b) (7)(E), (b) (7)(F)

[redacted]

7. Plutonium Missions – Estimated Costs

This section provides the estimated costs required to execute plutonium missions at LANL. Establishing the infrastructure and workforce to reliably produce 30 ppy by 2026 constitutes the majority of the anticipated growth in costs. LANL anticipates the funding for the other plutonium programs to be fairly consistent over the next 5–10 years. The enduring costs for the plutonium missions are primarily associated with the workforce at LANL to

- Produce 30 ppy while delivering on all plutonium missions;
- Maintain nuclear and high-hazard facilities and the associated utilities and infrastructure;
- Manage environmental protection, safety, quality, and security programs and requirements;
- Manage the disposition of TRU waste onsite and its shipment to WIPP; and
- Provide business, IT, and other support services.

There are several programs that enable the plutonium missions at LANL; specifically, the facility operations and maintenance programs in NA-50 and the physical security and nuclear material safeguards programs in NA-70 are critical to maintaining a safe, secure, reliable, and efficient LANL plutonium enterprise. It is imperative that the NNSA provide the funding for these programs as identified in this section to ensure all elements of the capability to produce 30 ppy can be established when required. (b) (5) [redacted] Note that some of these programs, e.g., NA-50 Operations of Facilities, have significant funding to perform other work at LANL. This document identifies the estimated costs for the plutonium missions only.

The programs accounted for in this document are listed in Table 60. Section 7.1 provides the cost estimates for all programs and Section 7.2 provides the cost estimates the subset of programs required to produce 30 ppy.

Table 60. Programs and projects at LANL associated with plutonium missions

Organization	Program or Project	Pit Production and Enabling Functions
NA-10 Programs	Plutonium Sustainment	X
	Material Recycle and Recovery	X
	Storage	X
	Capability Based Investments	X
	RTG Production	
	Pit and RTG Surveillance	
	Office of Experimental Science	
NA-10 Line-Item Projects	Chemistry and Metallurgy Research Replacement	X
	Los Alamos Plutonium Pit Production Project	X
	TRU Liquid Waste Facility	X
	TA-55 Reinvestment Project Phase III	X
NA-50	Operations of Facilities	X
	Maintenance and Repair of Facilities	X
	Recapitalization	X
NA-20	Plutonium Disposition	
NA-70	Defense Nuclear Security	X
DOE NE	Radioisotope Power Systems	
DOE SC	Americium Oxide Production	
DOE SR	3013 Surveillance and Monitoring	

7.1 All Plutonium Programs

The estimated costs for the all programs and line-item projects required for the plutonium missions at LANL are presented in the section. Figure 84 shows the estimated enduring program costs, which are primarily for labor and the associated burdens for the programs. The costs are binned by the three staffing objectives. The critical early hires are identified for each objective. The "Execute Current Mission" objective is to be able to reliably deliver on all plutonium missions and produce up to 10 ppy. The "Produce 30 ppy" objective reflects the costs to increase rate production to reliably produce a minimum of 30 ppy.

(b) (5)

Figure 84. All plutonium programs – estimated enduring costs

The costs for the all programs and projects are shown in Figure 85, Figure 86, and Table 61. Figure 85 summarizes the costs at the major organization within DOE and NNSA, while Figure 86 and Table 61 break the costs down to the specific program managed by each organization. The costs are further separated to distinguish costs to execute enduring programs from costs to complete one-time infrastructure investments.

(b) (5)

Figure 85. All plutonium programs – estimated costs by funding source for enduring programs and one-time infrastructure investments

(b) (5)

Figure 86. All plutonium programs – estimated costs at the program level for enduring programs and one-time infrastructure investments

Table 61. All plutonium programs – estimated costs at the program level for enduring programs and one-time infrastructure investments

(b) (5)

[redacted]

7.2 Pit Production and Enabling Functions

The estimated LANL costs for the programs required to produce at least 30 ppy, as identified in Table 60, are presented in this section.

Figure 87 shows the estimated enduring program costs, which are primarily for labor and the associated burdens for the programs required to produce 30 ppy. The costs are binned by the three staffing objectives. The critical early hires are identified in each objective. The "Execute Current Mission" objective is to be able to reliably deliver on all plutonium missions and produce up to 10 ppy. The "Produce 30 ppy" objective reflects the costs to increase rate production to reliably produce a minimum of 30 ppy.

(b) (5)

[redacted]

Figure 87. Estimated costs by staffing objective for pit production and the enabling functions required to produce a minimum of 30 ppy

Figure 88 shows the estimated costs for the enduring programs (shown in Figure 87) with the estimated costs for the infrastructure investments required to produce 30 ppy. Costs are binned by the funding organization in NNSA. (b) (5) [redacted]

(b) (5) [redacted]

Figure 88. Estimated enduring and one-time infrastructure investment costs for pit production and the enabling functions required to produce a minimum of 30 ppy

8. Conclusion

This integrated strategy was built on LANL's knowledge and experience acquired through a long and substantial history of working with plutonium in nuclear facilities and producing pits. In addition to this foundational base of plutonium expertise, LANL performed a comprehensive site-wide assessment of the enabling functions and capabilities critical to the reliable, safe, and secure production of 30 ppy starting in 2026. Prior to 2019 no study or analysis at LANL has considered this breadth of facilities, workforce, and capabilities.

Five major challenges are addressed in this integrated strategy: (1) integration of the programs of record for plutonium missions that operate at TA-55 PF-4; (2) management of the TRU waste generated by the plutonium missions at LANL; (3) installation and construction of equipment, facilities, and utilities; (4) hiring and training a large workforce; and (5) maturation of pit fabrication and inspection processes. These challenges have complicated interdependencies that must be understood and managed to successfully deliver the WR Pit FPU in 2023 followed producing 30 pits in 2026. This requires careful coordination by LANL, NNSA, and the NA-LA.

LANL will issue an annual revision to this integrated strategy in April to document progress and changes. The next revision of this integrated strategy will

- Refine the analysis to identify the job categories, skills, and quantities of staffing associated with
  - infrastructure investments,
  - non-pit production programs, and
  - indirect-funded functions;
- Update the acquisition strategies for the CMRR, LAP4, TLW, and TRP III line-item projects.
- Include expanded sections on two functions that are critical to the Los Alamos plutonium enterprise
  - physical security and
  - facility operations and maintenance;
- Discuss the funding model for distributing the costs associated with shared scope to operate programs in TA-55 PF-4;
- Review, update, and validate the models that assess the critical capabilities and systems for plutonium missions; and
- Further integrate the pit production mission with other plutonium-related programs to successfully execute all programs of record.

LANL is committed to producing a minimum of 30 ppy (b) (5) [redacted] while delivering on its other plutonium missions. This document captures the high-level planning and integration of activities and resources required to execute the plutonium missions at LANL. Timely routine assessments of execution metrics will inform future revisions of this integrated strategy and ensure the planning basis continues to be refined and is actionable.

Appendix A. Interfaces with the Pit Flowsheet and Support Systems

Pit production operations and the associated facility systems use a large amount of space at TA-55 PF-4 and draw upon many support systems across LANL. The plutonium operations at LANL, and in TA-55 PF-4 in particular, are a central component of a larger, NNSA complex-wide system (Figure A-1). This section addresses how the LANL system of facilities, capabilities, and workforce support pit production. Figure A-2 shows a high-level flowsheet of pit production operations.

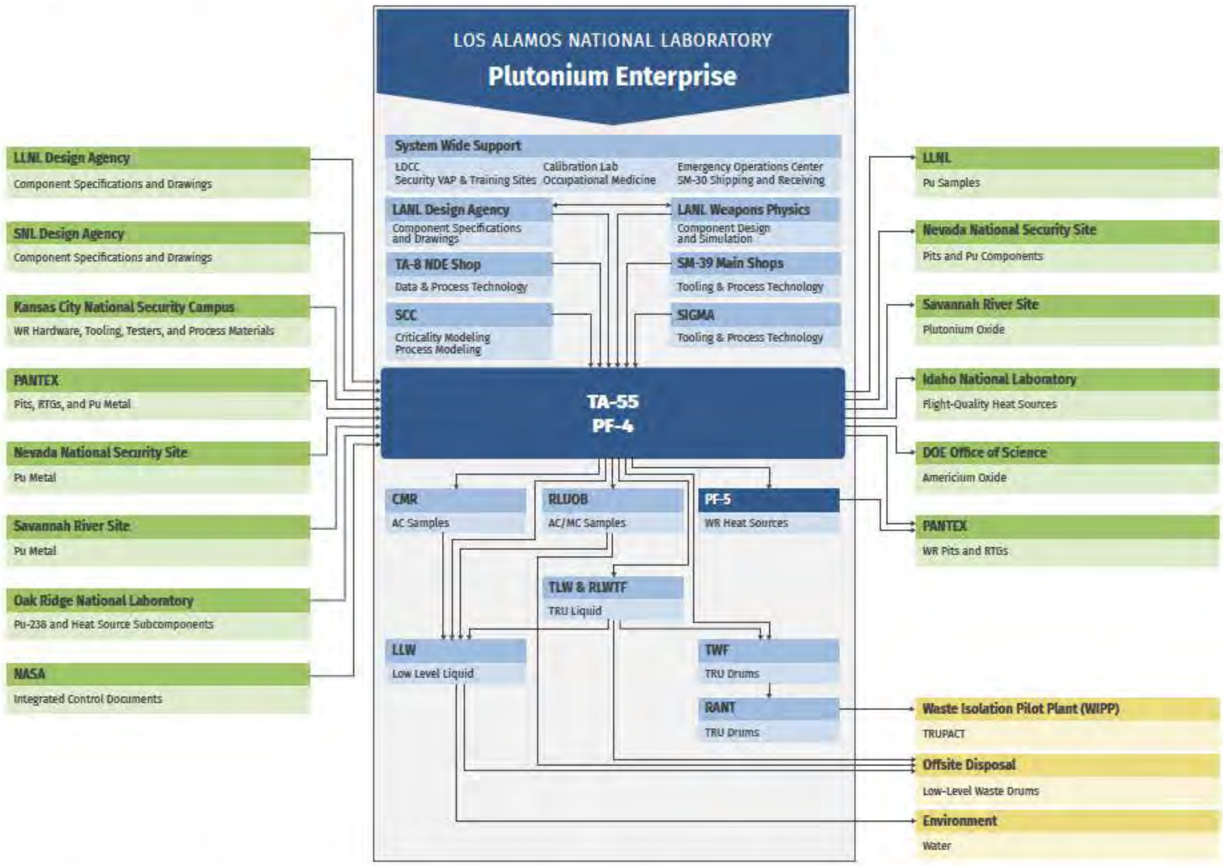


Figure A-1. Systems diagram showing the facilities at LANL and other sites and the interfaces for pit production

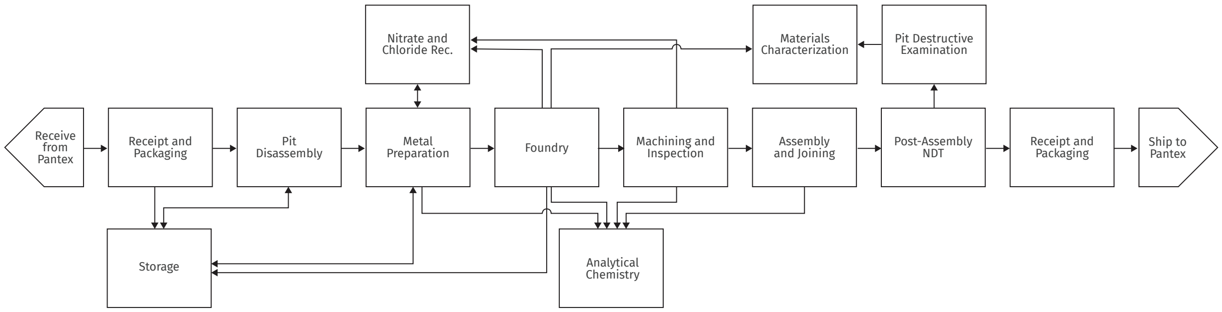


Figure A-2. High-level pit production process flowsheet. Solid and liquid TRU and low-level waste are generated throughout the flowsheet.

A.1 Shipping/Receiving, Storage, and Support Operations

Shipping and receiving are the means by which nuclear materials enter and exit TA-55 PF-4. Material control and accountability (MC&A), nondestructive assay (NDA), controlled storage, and physical security are all required to ensure that the material is appropriately protected while awaiting processing or shipping.

Incoming pits or other special nuclear material (SNM) are delivered from off-site sources in approved shipping containers. The containers are opened to obtain the material and confirmatory measurements prior to processing. Product items (e.g., pits, test items, samples) to be shipped are packaged in an approved configuration, and intra-site nuclear material transfers, including waste, are processed and packaged in an approved configuration. All interfaces with the secure shipping infrastructure occur in this functional area. Investments in the shipping and receiving operations in TA-55 PF-4 are nearly complete and accommodate the new, heavier shipping containers.

To protect nuclear material during transportation, security organizations are integrated throughout the shipping and receiving process. NDA in TA-55 PF-4 is critical to ensure that SNM is accounted for throughout processing, including the disposition of waste when security processes validate that the waste materials can have safeguards terminated. The expanded pit production mission requires that LANL have in place sufficient NDA capacity to support the work.

LANL investments in the storage of Security Category I nuclear material provide a resilient storage capability. These investments, which include reconfiguration of the TA-55 PF-4 vault and the ongoing efforts by the MR&R program to de-inventory the vault, will provide the SNM storage capacity for pit production. Additionally, installation of SNM staging gloveboxes within the pit production process line will increase storage capacity of work in process and thereby improve manufacturing efficiency by reducing the frequency of material transfers to and from the vault.

A.2 Analytical Chemistry and Materials Characterization (AC and MC)

Multiple processes in the pit production flowsheet generate material and samples that require analysis. Analytical chemistry (AC) operations examine plutonium-bearing samples for process control and troubleshooting information as well as the plutonium metal in the pit to ensure the DA-specified amount and isotopic distribution of plutonium and other elements are within specified ranges. AC capabilities are being transitioned to TA-55 PF-4 and RLUOB in preparation for the end of operations in the Chemistry and Metallurgy Research (CMR) Building. Staff in CMR are preparing to qualify some of the AC processes through EEs specified by the LLNL DA while concurrently developing the AC processes required for the new equipment and configurations in TA-55 PF-4 and RLUOB. RLUOB is being upgraded to a material-limited Hazard Category 3 (HC-3) nuclear facility.

Materials characterization (MC) operations analyze plutonium metal and pit-derived samples for physical properties such as grain size, surface chemistry, and strength to validate results from key manufacturing steps, including casting, welding, and assembly or to assist in process troubleshooting. To ensure product quality and production stability, some newly fabricated pits are disassembled and examined using processes similar to those used for pit surveillance. A major capability that must be integrated with other programs is the sample extraction through pit disassembly, coring, and sample preparation. MC activities include characterizing microstructure by optical metallography, electron microscopy, and x-ray diffraction and characterizing material response to static and dynamic mechanical strain. As with AC, LANL is working to establish a robust suite of MC capabilities in TA-55 PF-4 and RLUOB.

A.3 Plutonium Supply and Purification Operations

Pit production requires both a feed supply of plutonium metal and the capability to recover plutonium from various material streams generated during production processes. Feed plutonium metal is available from metal reserves from sites across the weapons complex or from pits from Pantex. The product generated by plutonium supply operations is purified plutonium metal that is suitable for use in pit production or other programs.

A.3.1 Process Description Summary

Pyrochemical processing methods are central to supplying pure plutonium metal for pit production and other programs. In general, the majority of feed is aged plutonium, from which Am-241 must be removed to reduce the radiation dose to personnel. After removal of the Am-241, the plutonium metal is further purified through electrorefining.

Pyrochemical operations generate salt residues and some impure metal. These byproducts are further processed by aqueous chemical operations to recover additional plutonium. The aqueous chemical operations involve dissolving the pyrochemical byproducts using nitric or hydrochloric acid and then using traditional chemical separation methods to extract the plutonium as plutonium oxide. The recovered oxide is then returned to pyrochemical operations, where the plutonium oxide is reduced to plutonium metal. Figure A-3 provides a summary flowsheet of plutonium supply and purification operations.

(b) (7)(E), (b) (7)(F)

Figure A-3. Simplified plutonium supply and purification flowsheet. Solid and liquid TRU and low-level waste are generated throughout the flowsheet.

A.3.2 Key Considerations in Plutonium Supply

The plutonium supply operations are a focus of many areas of concern, highlighting the need to ensure viable support functions. Key considerations are discussed briefly below.

Safety basis: Safety basis analyses must strike a balance between ensuring worker and public safety and maximizing allowable operational flexibility. Plutonium in solution and molten-metal forms are key contributors to facility material at risk (MAR), and thus warrants additional consideration in terms of safety controls. For example, ensuring that gloveboxes for processing molten plutonium have seismically qualified stands is an important component of safe operations, and containerization of plutonium in safety-class containers should be utilized wherever possible.

Criticality safety: Programmatic success relies on the modification of criticality safety limits in the aqueous operations areas to safely restore the capacities required for recovering material at the rates necessary to support expanded pit production. Aqueous operations are the greatest area of concern for criticality safety, as fissile solutions have markedly smaller critical masses than fissile material in solid form. Criticality safety process assessments and the development of limits that support programmatic operations are key to proceeding safely and efficiently.

Environment, safety, and health (ES&H): During the purification or recovery of plutonium, the material often contains large amounts of americium or is in a form with little self-shielding (such as a solution), thereby creating concerns for personnel radiation exposure. Increased radiation protection support, including increased staffing levels of radiological control technicians (RCTs) in nuclear facilities, is necessary for achieving mission success. Increasing RCT staffing levels and improving employee retention are urgent actions necessary for the pit production mission to be successful.

Waste management: The aqueous chemical operations generate radioactive liquid and solid waste, with aqueous recovery operations generating mostly liquid waste. Liquid waste is transferred to the Radioactive Liquid Waste Treatment Facility (RLWTF) at TA-50. Solid waste is generated throughout the metal supply processes and consist primarily of transuranic (TRU) and low-level waste. Typical solid TRU waste includes glovebox gloves, process items, process residues, and old equipment. Low-level waste includes personal gloves and other potentially contaminated items not in direct contact with SNM. The primary activities in solid waste management are staging, characterizing, certifying, and shipping radioactive solid waste (both low-level and TRU) to the appropriate disposal site.

Facility and process equipment maintenance: Plutonium supply and purification processes, especially those related to aqueous recovery, use corrosive materials and can result in equipment and infrastructure degradation, requiring periodic replacement or enhanced maintenance. Replacement of the aqueous operations are planned.

Shipping, receiving, staging, storage: The majority of interfaces with facility infrastructure are related to plutonium metal supply operations, including shipping, storage, and NDA. NDA is particularly important to "close out" batches prior to periodic inventories. Measurements are required because of the changes in material form during processing. LANL is taking action in concert with NNSA to increase the operational time between inventory periods to achieve required programmatic capacity.

A.4 Manufacturing Operations

In general, pit manufacturing consists of foundry, machining, and welding and assembly followed by post-assembly analysis. Production of particular pit types may involve all or only some of those processes, depending on the individual design and fabrication requirements. Inspections are conducted throughout manufacturing operations to ensure that components meet specifications. Thus, robust quality assurance and business systems (to collect and manage manufacturing and inspection data) are essential to provide evidence to NNSA that the pit was produced according to DA specifications.

A.4.1 Process Description Summary

Plutonium metal purified using pyrochemical processes is used to manufacture new pits. The pure plutonium metal is melted and cast in a two-step process. The first step is to alloy pure plutonium metal in an aliquot casting. The aliquots are then cast into shells, which are heat-treated and inspected.

The first machining process, referred to as waist-banding, removes a ring from the cast shell. Samples for AC and MC samples are taken from the ring. The AC samples are used to verify that the chemistry and isotopic concentrations meet DA specifications, and the MC samples are used to verify the plutonium microstructure is typical of that for material in the nuclear weapons stockpile. Next, the cast shells are transferred to the machining area, where they are machined to the DA's dimensional specifications. The shells are then dimensionally inspected, radiographed to ensure material uniformity, measured for density, and cleaned.

The plutonium shells, nonnuclear components, and tubulation components are assembled and welded. Various types of welding, pumpdown, gas filling, and bakeout operations are performed as part of the assembly and joining processes. Inspections, such as gas sampling, dimensional verification, radiography, weighing, and leak testing, are conducted to ensure that the components and final assemblies meet DA specifications. Upon successful testing and collection of relevant process data, the newly produced pit can be accepted as a WR component. A summary flowsheet of the pit-fabrication operations is provided in Figure A-4.

(b) (7)(E), (b) (7)(F)

Figure A-4. Simplified pit fabrication flowsheet. Solid and liquid TRU and low-level waste are generated throughout the flowsheet.

A.4.2 Key Considerations in Pit-Manufacturing Operations

Areas of concern regarding pit manufacturing operations primarily focus on the supporting infrastructure. Key considerations are discussed briefly below.

Safety basis: The bounding accident for TA-55 PF-4 is a post-seismic fire. The TA-55 PF-4 structure must survive a seismic event and the amount of MAR potentially involved in a resulting fire must be kept below specified levels to ensure that any potential offsite doses remain below regulatory limits. Safety systems are evaluated within the DSA, which is updated annually. Additional modifications to reduce offsite doses will be determined by each DSA update.

ES&H: Depending on the design, some pits may contain hazardous materials, such a beryllium, that can create concerns for worker safety. Although all operations involve work with plutonium, radiation protection concerns for manufacturing operations are generally less than those for the plutonium supply operations because clean (i.e., low Am-241) plutonium is used to manufacture pits.

Product quality: Pit production and acceptance as a WR component requires extensive product quality control and record keeping support to validate that the product meets DA specifications. Establishing and maintaining a viable quality program, especially one that can manage quality requirements at expanded capacity, is essential.

Facility infrastructure and maintenance: Many processes used in pit manufacturing operations use specialized equipment requiring enhanced maintenance and require the facility support systems to be reliably available. The casting, machining, and welding operations require complicated vacuum, cooling, electrical supply, and control systems.

Construction: Expanding production to 30 ppy has increased the requirements for infrastructure investments.
(b) (5) [redacted]

Key LANL facilities outside TA-55: Critical facilities and capabilities at LANL provide vital support for the pit production program. These capabilities include the following:

- Sigma Facility and Main Shops – graphite mold production, component inspection, and production tooling. These facilities also provide process technology for pit manufacturing.
- Nicholas C. Metropolis Center for Modeling and Simulation – criticality modeling performed in the facility supports almost every plutonium operation at TA-55.
- TA-8 nondestructive evaluation facility – development of nondestructive evaluation methods, including x-ray radiography.

Appendix B. LANL Focus Areas

To capture and integrate all site-specific inputs, resources, and requirements to successfully execute the plutonium missions, LANL formed teams for each focus area that meet regularly to develop and manage the plan for their team's support for the plutonium missions. The focus area teams are discussed in the subsections below.

B.1 National Environmental Policy Act (NEPA)

NNSA is responsible for management and implementation of NEPA requirements and the regulations and policies promulgated thereunder including, but not limited to, the Council of Environmental Quality NEPA regulations (40 CFR 1500-1508), the DOE NEPA implementing regulations (10 CFR 1021), and NNSA Policy (NAP) 451.1, NEPA Compliance Program.

NNSA has re-examined the potential environmental impacts associated with the proposed restructuring of pit production capabilities and operations at a programmatic level, where pit production could be performed at LANL in New Mexico and SRS in South Carolina. Since at least 1999, pit production at LANL at a level of approximately 80 ppy has been analyzed in several NEPA documents. Prior federal decisions have authorized pit production levels of no more than approximately 20 ppy at LANL. NNSA is completing NEPA analyses before making an agency-level decision on authorizing 30 ppy at LANL.

NNSA has prepared a Final Supplemental Analysis (SA) of the Complex Transformation Supplemental Programmatic Environmental Impact Statement (Complex Transformation SPEIS) to evaluate adopting a Modified Distributed Centers of Excellence Alternative for plutonium operations from the Complex Transformation SPEIS to enable producing a minimum of 50 pits per year at a repurposed Mixed-Oxide Fuel Fabrication Facility at SRS and a minimum of 30 pits per year at LANL, with additional surge capacity at each site, if needed, to meet the requirements of producing pits at a rate of no fewer than 80 pits per year by 2030 for the nuclear weapons stockpile. For site-specific activities, NNSA has also prepared a draft SA for the LANL Site-Wide Environmental Impact Statement (LANL SWEIS) and a draft Environmental Impact Statement (EIS) for SRS.

Throughout the NEPA review process, NNSA will remain sensitive to the impacts a proposal may have on other NEPA analyses and documents. NNSA will also remain sensitive to the impacts of proposing and assessing other activities that may affect the NEPA process for the pit production mission. These activities include similar actions at LANL, SRS, or other sites that may dovetail with those associated with pit production. NNSA needs to ensure that the relevant documents are consistent in terminology and approach, which would reduce duplication of effort and potential confusion. This process will involve review of, commenting on, and editing of NEPA documents for proposals that may affect or be affected by the pit production program. It will also include development of standardized language to be used in all NEPA documents related to pit production.

B.1.1 Summary of Work Scope

This NEPA strategy is composed of a three-tiered approach to address pit production activities, site-specific environmental impacts, and programmatic actions across the complex. The strategy identifies at least three analysis documents necessary to further the purpose of NEPA, including an SA to the Complex Transformation SPEIS; an SA to the LANL SWEIS; and an EIS addressing pit production at the proposed Savannah River Plutonium Processing Facility (not addressed in this document).

Overall implementation of this strategy has been overseen and coordinated by the NNSA Office of General Counsel (NA-GC) NEPA Compliance Officer assigned to the program as a whole. NEPA Document Managers and NEPA Compliance Officers for the individual NEPA documents in the strategy have been identified and assigned. Pursuant to NAP 451.1, NA-10 is responsible for assigning a NEPA Document Manager to perform contracting, project management, and other functions as specified in NAP 451.1 for each of the NEPA documents associated with the strategy. NA-GC has assigned a NEPA Compliance Officer to oversee and guide the NEPA Document Manager(s), as well as perform other functions specified in NAP 451.1.

Responsibility for contracting for support services rests with NA-10. Contracted services for technical support to the NA-GC include reviewing and commenting on NEPA documentation, associated technical/regulatory analyses, editorial services, planning and project management support, document preparation, and associated services.

The tiered NEPA strategy for pit production activities across the complex began with an SA to the Complex Transformation SPEIS. This SA re-examines impacts for complex-wide activities within and between various NNSA sites that were analyzed in the Complex Transformation SPEIS. NNSA provided the draft SPEIS SA for public comment in June 2019 and, after considering comments, finalized the Complex Transformation SA in December 2019. Reviewed activities include, but are not limited to, various activities at SRS, LANL, Pantex, Nevada National Security Site, and Y-12. Other NEPA analyses, including, but not limited to, site-specific EISs, SAs, and Environmental Assessments, may be utilized to examine NEPA coverage for pit related activities throughout the complex. The SA for the Complex Transformation SPEIS informs the NEPA analysis for the proposed pit production activities at both SRS and LANL.

LANL support for the SA to the Complex Transformation SPEIS included the following:

- Prepared an annotated outline and a draft SA. The draft SA was posted online for public comment.
- Prepared final SA for NNSA signature and posting online.
- Prepared a draft Notice of Intent published in the Federal Register Vol. 84, No. 111 (June 10, 2019): 26849. The Notice of Intent announced NNSA's intent to prepare the SRS EIS and provided public notice of the NEPA strategy for the pit production mission.
- Prepared a draft amended Record of Decision (ROD) that publicly announced NNSA's decision for a change in pit production levels at LANL.

In March 2020, NNSA released a draft LANL SWEIS SA for public review and comment. Although no final decision has yet been reached regarding the type of NEPA document needed to support an NNSA ROD for LANL, in the draft LANL SWEIS SA, NNSA's preliminary conclusion is that no further NEPA documentation is required at this time to move from the currently authorized production level of 20 ppy to 30 ppy with an allowance to surge to the analyzed limit. For the purposes of this integrated strategy, it is assumed that this preliminary conclusion will be made a final determination, because prior NNSA sensitivity analysis suggests that expanded pit production is expected to be bounded by previous analysis. (b) (5) [redacted] Contracted support services required for NA-LA include technical/regulatory analysis, review, researching existing documentation, document preparation, and associated support activities by LANL. Contracted support services for NA-GC include review and comment on drafts of the document.

The LANL SWEIS re-analyzed environmental impacts for production levels of approximately 80 ppy at LANL; the ROD for the LANL SWEIS and the ROD for the Complex Transformation SPEIS are for a production level of approximately 20 ppy. LANL currently operates under this authorization level and may produce up to approximately 20 ppy without further federal action. In order for LANL to move to a pit production level beyond approximately 20 ppy to a level of 30 ppy with surge capabilities, NNSA would have to issue amended RODs for the Complex Transformation SPEIS and LANL SWEIS, if appropriate, based upon NNSA's evaluation of existing NEPA coverage or after additional NEPA review.

With respect to site-specific NEPA analysis at LANL, LANL support for an SA to the LANL SWEIS requires the following:

- Completing an initial and final draft SA to the LANL SWEIS.
- Preparing a draft Comment Response Document, addressing comments received on the draft LANL SWEIS and assisting NNSA in preparing responses to stakeholders.
- If appropriate, preparing a draft amended ROD that would publicly announce NNSA's decision to increase pit production levels at LANL above 20 ppy.

B.1.2 Technical Approach and Solutions

LANL will continue to work closely with NA-GC during the NEPA analysis process and the preparation of related documents.

Additional critical elements involved in NEPA planning have included or will include the following:

- Preparing a list of key terms with definitions to provide clarity and consistency for specific actions that would be addressed in the SA to the Complex Transformation SPEIS as well as site-specific LANL and SRS NEPA documents.
- Reviewing the LANL equipment and infrastructure list (EIL) to include its scope in the NEPA analysis and provide options for new facility locations.
- Coordinating resources for completion of necessary NEPA analysis and related documents.

The LANL NEPA team continues to review updates to the EIL for this Strategy, and NNSA has preliminarily determined that no additional NEPA analysis would likely be required for a majority of the items reviewed. The preliminary determination is included in the draft SA for the LANL SWEIS. Many planned actions are covered by the current ROD and prior NEPA analysis. Some items on the EIL may require additional NEPA analysis and associated NEPA documents. As noted above, any action associated with production levels beyond approximately 20 ppy at LANL requires, at minimum, completing the LANL SA and an amended ROD authorizing such action for both the Complex Transformation SPEIS and the LANL SWEIS.

For those aspects, if included in the project scope, that may require additional NEPA analysis before moving forward, additional NEPA coverage could be accomplished through reliance on Categorical Exclusions, as appropriate; an Environmental Assessment; a supplement to the LANL SWEIS and other existing NEPA documents; and/or preparation of a new EIS or LANL SWEIS (actions without existing NEPA coverage and that could be constructed after 2022 are candidates for this approach). Any additional analysis, if needed, would consider cumulative impacts and factors in furtherance of the goals of NEPA.

B.1.3 Schedule for Conducting Scope of Work

The NEPA team worked with other LANL focus area teams to develop information needed to complete the analysis required for the LANL SWEIS SA. NNSA completed and signed the SA for the Complex Transformation SPEIS in December 2019. Additionally, NNSA posted a draft SA to the LANL SWEIS in March 2020. The public comment period for the LANL SWEIS SA closed in May 2020, and NNSA is reviewing and considering public comments received. (b) (5) [redacted]

B.2 Safety Basis

B.2.1 Summary of Work Scope

Safety basis provides compliant, approved safety basis documents such as documented safety analyses (DSAs) required for operation of nuclear facilities to protect workers, the public, and the environment. DSAs are prepared in accordance with DOE-STD-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis* or DOE-STD-1228-2019, *Preparation of Documented Safety Analysis for Hazard Category 3 DOE Nuclear Facilities*.

A DSA describes a facility and work performed therein to provide a systematic identification of hazards. DSAs evaluate normal, abnormal, and accident conditions and are used to derive the hazard controls and safety management programs necessary for safe operation of the facility. The DSA drives programmatic and facility requirements, such as for MAR and seismic anchorage.

B.2.2 Technical Approach and Solutions

A strategy has been developed to upgrade the safety basis documents for each of the nuclear facilities at LANL to meet the requirements in DOE-STD-3009-2014:

- **TA-55 PF-4**: Annual DSA updates will be made to the safety basis, with a schedule to complete an upgrade to meet DOE-STD-3009-2014 (b) (5) [redacted].
- **RLUOB**: The safety design strategy defining the approach for RLUOB to become an HC-3 nuclear facility was submitted by LANL and is approved by NNSA. This approach requires development, review, and approval of a new safety basis that is compliant with DOE-STD-3009-2014. Recently identified code compliance issues in RLUOB related to fire protection, not driven by safety basis credited controls, must be addressed prior to the start-up of HC-3 operations.
- **TWF**: A revision to the safety basis has been developed to replace the seismic switch and upgrade the fire suppression system. The seismic switches have been replaced and the fire water pumps will be replaced in FY20. (b) (5) [redacted]
- **Radioassay Nondestructive Testing (RANT)**: Annual DSA updates are made to the safety basis, (b) (5) [redacted]
- **Radioactive Liquid Waste Treatment Facility (RLWTF)**: The annual DSA updates and ongoing maintenance to this facility will continue until the replacement facility (TLW) is operational.
- **TRU Liquid Waste (TLW)**: The safety design strategy for TLW will be revised to use DOE-STD-1228-2019. A new DSA will be developed and submitted per DOE-STD-1228-2019 to start up operations of TLW facility.

Safety basis change control activities must be integrated into the overall equipment and project schedule for TA-55 PF-4. Similarly, safety basis must be integrated into development of the pit flowsheet and MAR limits.

Other improvements to the safety basis approach for the LANL plutonium missions are discussed briefly below.

TA-55 Criticality Safety DSA Addendum: A TA-55 PF-4 DSA addendum has been developed and approved (FY19) by NA-LA to provide an alternate method for criticality safety analysis of Design Basis Accidents such as seismic events and fires. DOE Order 420.1C requires Design Basis Accidents to be evaluated in process-specific criticality safety evaluations documents (CSEDs). Analyzing the criticality hazards in the DSA instead of process specific CSEDs will streamline development of CSEDs.

Dispersion Methodology: A new dispersion model methodology has been developed and must be implemented for all Hazard Category 2 nuclear facilities. Additionally, a new methodology to reduce dispersion factors through plume meander is being developed. Analysis is required to address canyon effects, and data will be collected from a new mobile weather station positioned in the canyons to support this analysis.

Meteorology: Four new weather stations (three stationary and one mobile) will be installed in FY20 to supply data required for dispersion analyses.

B.2.3 Schedule for Conducting Scope of Work

(b) (5)

B.3 Product Quality

B.3.1 Summary of Work Scope

The Production Agency Quality Division and the LANL's Institutional Quality and Performance Assurance Division implement an assurance framework to ensure compliance with customer requirements. All LANL program quality assurance and implementation plans must adhere to the program outlined in the LANL's overarching quality program as defined in SD330, *Los Alamos National Laboratory Quality Assurance Program* (LANL QAP). Following is an overview of the guiding documents for implementation of the SD330 criteria for each of the major programs.

Weapons Programs

Pit and RTG production, Subcritical experiments, and Pit and RTG Surveillance operate under LANL's PA-PLAN-01062, *Weapon Quality Assurance Program-Production Agency* (WQAP-PA), which provides a foundation for implementing the following:

- NNSA NAP-401.1, Weapon Quality Policy;
- NNSA 56XB, Development and Production Manual;

- Defense Programs Business Process System (DPBPS);
- QP 100, Application of Quality Requirements to UK and US Procurement Contracts and Loan Authorizations for Research, Design & Development;
- Elements of LANL SD330, *Los Alamos National Laboratory Quality Assurance Program*; and
- Other Contract Officer direction.

Non-weapons Programs

Work outside direct weapons production programs implement SD330 requirements either directly or through standalone quality assurance or implementation plans along with other national or federal standards

- Office of Experimental Science
- Materials Recycle and Recovery (MR&R)
- Storage Program
- Plutonium Disposition (ARIES)
- PA-PLAN-01016, ARIES Oxide Production Project Quality Implementation Plan
- The national consensus standard - American Society of Mechanical Engineers (ASME) NAQ-1-2008, Quality Assurance Requirements for Nuclear Facility Applications, as revised by the NAQ-1a-2009 Addenda.
- DOE-STD-3013, Stabilization, Packaging, and Storage of Plutonium-Bearing Materials
- NASA Power Production
- RPS-PLAN-003, Radioisotope Power Systems (RPS) Program Quality Assurance Program Plan (QAPP)
- AmO_2 Production
- PA-PLAN-01042, Quality Assurance Plan for Americium-241 Oxide ($^{241}AmO_2$) Production Program
- 3013 Surveillance and Monitoring

Program Execution

The Production Agency Quality Division ensures compliance with the relevant quality requirements by implementing the following:

Design Agency Engineering Evaluations: The requirements outlined in NAP-401.1 govern the development, design, engineering, production, testing, and surveillance of weapons, weapon components, assemblies, subassemblies, and weapon-related materials. These requirements are implemented through the WQAP-PA. The LANL PA quality engineers work with the component PRTs to ensure that each production process meets DA design intent to produce a product that meets requirements and specifications.

Software Quality Assurance: The LANL Weapons Production Software Quality Assurance Program provides a software engineering and assurance framework to ensure compliance with NAP-401.1 and DOE O 414.1, *Quality Assurance*. This program is designed to ensure that weapon and weapon related software will satisfy customer requirements for software that is purchased or developed by NNSA or its contractors.

(b) (5), (b) (7)(E), (b) (7)(F)

[redacted]

Nuclear Enterprise Assurance: Nuclear Enterprise Assurance is the nuclear security enterprise program that was established in DOE O 452.4C, *Security and Use Control of Nuclear Explosives and Nuclear Weapons* and NAP-24A to prevent or mitigate potential consequences of deliberate unauthorized acts in the nuclear weapon lifecycle that may lead to a denial of authorized use or degradation of weapon reliability or performance. Nuclear Enterprise Assurance includes weapon trust assurance and supply chain risk management. LANL is a member of the Nuclear Enterprise Assurance Digital Systems Assurance Working Group, whose purpose is to work with the Department of Defense and other government agencies to address emerging digital threats.

Standards and Calibration: Items fabricated for nuclear weapons use have design tolerance or limit requirements that must be measured with equipment that has National Institute of Standards and Technology (NIST) traceability as directed by NAP-401.1. The LANL Standard and Calibration Laboratory (S&CL) determines if equipment procured meets manufacturers' stated accuracy through calibration testing or analysis. This testing is performed by the S&CL, NIST, or an approved vendor. The S&CL maintains the central archives of equipment and item calibration documentation. As a part of maintaining records, the S&CL utilizes a recall system to alert equipment owners of recalibration dates.

Weapons Material and Chemical Certification and Compatibility: Materials and parts may require compatibility assessments and analysis to ensure certifications from suppliers are valid and prevent damage or deterioration to weapons components from incompatible materials. This process directly supports the requirements listed in NAP-401.1 Attachment 4 to detect and mitigate subversion, along with satisfying the requirement to validate certificates.

Procurement and Receipt Inspection: The supplier evaluation and export control teams created the NAP-401.1 required Supplier Assessment Checklist to evaluate a supplier's technical capabilities, rigor of Quality Management System, and ability to supply product in accordance with quality requirements and technical capabilities for the product(s) and service(s) being procured. (b) (7)(E), (b) (7)(F) [redacted]

Receipt Inspection verifies that all documents supporting the product, such as Certificates of Conformance or Analysis, are present and complete in addition to all other specified criteria.

B.3.2 Technical Approach and Solutions

WR Component Qualification/Evaluation: This element includes the development and validation of the technical processes through the required Process Qualifications or Engineering Evaluations as described in DPBPS T046, Sec 2.2.1 in addition to qualification of the data collection system used during PPI as required. It also includes reviewing, grading, and qualifying software associated with the production systems, reviewing specific process instructions to ensure compliance with WQAP-PA requirements, and reviewing electronic data collection for product verification. The DA-specified EEs and subsequent documentation must be completed prior to FPU. Changes to process and product requirements shall be managed through the Engineering Authorization system.

Equipment Calibration: Experience at LANL with the W88 pit production demonstrated that coordination between the organizations that operate equipment and the S&CL can be problematic if left to individual process owners to manage. Sandia National Laboratories found that a central control system, staffed by dedicated personnel who monitor, retrieve, and deliver calibrated equipment to the processes, improved equipment calibration compliance and reduced the number of errors and time spent correcting them. LANL is transitioning to a similar system.

Electronic Data Collection (MMP): The volume of paperwork makes successful product submittals at a 30 ppy production rate highly unlikely. A more efficient data management system is in development to alleviate this problem. (b) (4) [redacted] LANL's Manufacturing Modernization Project (MMP) platform will enable the replacement of most paper data sheets with an electronic data collection system. If this system is not available in time, significant increases in staffing levels will be necessary to ensure product acceptance at 30 ppy.

The LANL Associate Laboratory Director for Weapons Production (ALDWP) has developed a vision for the use of digital manufacturing technologies to provide improved program performance for plutonium operations. Collectively, these technologies include both new hardware and new software, as well as significant implementation of improved processes across multiple mission areas and their associated product lines. The overarching vision encompasses four major functional areas of productive manufacturing output:

- Production data collection and product sale
- Production planning and scheduling
- Production inventory management
- Production operations

A five-year plan (dated Dec 4, 2019) focuses on the first functional area, product data collection and product sale, and lays out a path for effective implementation of this capability to realize program performance improvements that are needed to execute the LANL's missions. The other functional areas are an integral part of the overall vision for digital manufacturing; however, their implementation is funded independently of the first functional area's implementation.

This vision recognizes the rather unique requirements derived from manufacturing operations involving special nuclear materials and the quality requirements associated with nuclear weapons and other high-visibility missions. A detailed set of statements that describe the overall vision for digital manufacturing at LANL are included in Appendix A of the five-year plan. This plan is focused on those components of the vision that are necessary to execute the collection of production data and use this data in the electronic sale of product. The statements specific to this functional area include the following:

- A single system used to accomplish real-time tracking of task-level work completion in the plant
- A single process used to define data requirements for all production activities including fabrication of products for sale
- A single system used to collect real-time production data whether for product sale, production process improvements, or general research
- A single electronic system used to demonstrate products meet requirements and facilitate product sales
- All production operational data available in an authoritative system for engineering analysis

(b) (5) [redacted]

B.3.3 Schedule for Conducting Scope of Work

(b) (5)

[redacted]

B.4 Criticality Safety

B.4.1 Summary of Work Scope

The Nuclear Criticality Safety (NCS) Division addresses the nuclear criticality safety for all fissionable material operations at LANL to ensure that operations remain subcritical under normal and credible abnormal conditions. LANL's trained and qualified analysts assist operations staff by developing criticality safety evaluation documents (CSEDs), reviewing procedures, providing event response, and participating in annual fissionable material operations reviews (FMORs). The criticality safety program is assessed triennially.

B.4.2 Technical Approach and Solutions

Staffing: (b) (5) [redacted]

To achieve the long-term staffing numbers, the NCS Division must continue to create and enhance the work environment to attract outside criticality safety personnel as well as retain and promote high-performing employees within the division. For attracting new staff, LANL established a student pipeline program in 2017 and currently has partnerships with Texas A&M University and the University of California at Berkeley. In FY20, NCS Division is working to extend the pipeline to the University of New Mexico in Albuquerque. Through the pipeline programs, students are hired for summer internships at LANL, and with a successful summer experience, students may be given a job offer and submitted for a security clearance. After graduation, the students may be offered full-time positions as analysts. Once hired, the new analysts are assigned a mentor to assist them with completing the qualification process, which typically takes about two years, but for recent pipeline hires, the duration is reduced. For retaining staff, the NCS Division has created a strong mentoring program, a mentor support group, a retention program, and offers ample opportunities for professional development. With this new culture of analyst career development, the division has attracted and hired three analysts with prior NCS experience.

(b) (5) [redacted]

Criticality Safety Evaluation Document (CSED) Backlog: LANL is responsible for more than 400 fissionable material operations (FMOs). (b) (5) [redacted] In NSP-19-0021, Backlog Evaluations of CSEDs, LANL analyzed the CSEDs in the backlog requiring re-work and identified those that do not comply with DOE O 420.1C and those for which there are federally approved compensatory measures. The CSEDs were binned into groups with similar issues, and NCS Division began working revisions based on the CSED Priority List. (b) (5) [redacted]

CSEDs for Pit Production and Other Plutonium Missions: In FY20, to support current and expanding mission needs, LANL has developed three general CSEDs to address the issues of (1) size reduction of legacy equipment, (2) D&D of legacy gloveboxes, and (3) installation (construction). These platforms will reduce the required evaluation time for these kinds of operations by 80 to 90%. CSEDs for missions and D&D activities are managed and prioritized by the TA-55 Nuclear Criticality Safety Board. Nuclear criticality safety and production operations will work together to define the CSEDs required for pit production. The integrated schedule to develop CSEDs to support pit production and other missions while eliminating the CSED backlog is in a criticality safety program integrated schedule. In FY20, a DSA addendum, Changes for NCS regarding Water Ingress into Gloveboxes, was approved by NA-LA for TA-55, and NCS Division began pilot implementation for selected operations. Based on the success of these pilot CSEDs, NCS Division will work with the TA-55 operating organizations in an effort to expand implementation to provide larger and more consistent criticality safety limits for PF-4 operations.

Process Improvements: Additional initiatives to make the implementation of criticality safety more efficient are identified in the annual LANL Nuclear Criticality Safety Performance Improvement Plan. Specifically, NCS Division continues to expand the use of Standard Criticality Safety Requirements platforms that will reduce the time necessary to bring new operations online.

Specific Training for Criticality Safety:

- Collaborate with programmatic operations groups to ensure that the groups' criticality safety officers are trained and qualified to perform specific low-risk activities, allowing criticality safety analysts to focus on more complex activities; and
- Streamline training by redesigning training modules for additional roles, such as an accelerated qualification program for highly experienced engineers.

General Issues:

- Collocate nuclear criticality safety staff near TA-55; and
- Integrate early with IPT design reviews of new or modified equipment.

B.4.3 Schedule for Conducting Scope of Work

Objective	Date	Activity, Deliverable, or Milestone
Current Mission Support	Ongoing	Continue triennial assessments
Current Mission Support	Ongoing	Continue triennial assessments

B.5 Physical Security

B.5.1 Summary of Work Scope

The Physical Security team analyzed current S&S functions at TA-55 and identified the additional staffing and infrastructure required to support the pit production mission. The expanded mission requires increasing the hours of operation at TA-55 PF-4 (b) (5) the ramp-up in program and construction activity combined with expanded hours of operation at TA-55 PF-4 drive the need to increase staffing for additional

- Protective force posts, patrols, and canine teams at TA-55 to support programmatic operations;
- Protective force posts, patrols, and canine teams at TA-55 to support construction project compensatory measures;
- Security systems infrastructure and expanded hours of operation;
- MC&A support for the increased handling of nuclear materials and expanded hours of operation;
- Personnel security functions, such as drug and alcohol testing, clearance and HRP processing, and badging, to support substantial increases in the TA-55 work force; and
- Vulnerability assessments (VAs) and security risk assessments necessary to support changing operations and new construction.

The ramp-up in security staffing must start in advance of other staffing increases at LANL to ensure required staff are hired, cleared, and trained in time to provide facility and post accessibility for increased activity and expanded hours of operation at TA-55.

The Physical Security team performs the VA in accordance with DOE O 470.3C, *Design Basis Threat* (DBT). This assessment includes

- Developing conceptual design VAs for infrastructure investments;
- Identifying and defining the requirements for capital projects required to implement the new DBT;
- Making adjustments to modeling to account for infrastructure changes to facilities at TA-55; and
- Implementing the new DBT.

B.5.2 Technical Approach and Solutions

Staffing Requirements and Considerations: LANL has developed a staffing plan with a detailed forecast of the protective force and canine team staff needed to support the pit production mission from FY19 to FY30. LANL is working with the protective force subcontractor to meet immediate needs for additional staff through overtime work by current protective force officers. Long-term staffing needs will be addressed by hiring additional protective force officers and the associated support staff to expedite clearances and HRP certification, training, etc.

Protective force staffing requirements were based on staffing all available entry control facilities at full capacity (b) (5) [redacted] once each of the entry control portal construction projects has been completed. If full capacity is not required once TA-55 staffing levels are established, then protective force resource levels will be reduced to reflect the actual number of protective force staff required for efficient throughput into TA-55 (this will be refined as the FY21–25 FYNSP is better understood and executed).

Increased staff are required to support vulnerability assessments, classified matter protection and control, classification guidance, MC&A functions, and protective force administrative and training needs, etc. These staff must be hired, cleared, and trained in time to support both the protective force field operations and other LANL S&S functions (badging, VAs, SRAs, clearance processing, etc.).

Extended shifts, (b) (5) [redacted], and the increase in security systems equipment will require additional staff to perform preventative and corrective maintenance, performance testing, and (b) (5) [redacted] on-call support.

Personnel Security: LANL is reducing clearance processing times by submitting all Q clearances as priority clearances and by retaining resident teams of the National Backgrounds Investigation Bureau (NBIB) investigators at LANL. LANL is investigating allowing protective force officers with an interim Q clearance or a standard Q clearance but without HRP certification to work posts outside of the TA-55 material access area (MAA) and/or protected area. The average number of days required to grant priority service cases in FY19 was 160 days; the average number of days required for processing continues to decrease due to these efficiency measures.

LANL processes clearance requests once S&S employment offers are accepted, which typically results in an interim security clearance being granted prior to the first day on the job. In FY19, the average number of days required for processing an interim security clearance was 26 days. LANL is also implementing process improvements for managing HRP requests.

Safeguards: LANL is implementing process monitoring for MC&A as a quality assurance mechanism to reduce deviations discovered during the inventory process. Fewer deviations will allow for longer inventory periods, contributing to increased operational hours for pit production.

Vulnerability Assessments for the Design Basis Threat: LANL is performing a VA based on the current TA-55 configuration to meet the current DBT as well as other requirements in the implementation plan, such as security risk and roll-up analyses. (b) (5) [redacted]. Because of the current variables in the TA-55 configuration (for example, numbers of entry control portals, infrastructure being built in and around the protected area perimeter, physical enhancements required as a result of the DBT, etc.), LANL will need to develop a conceptual VAR that will be revised to reflect the final configuration at that time and be compliant with the DBT. Security risk analyses must be conducted for facilities outside TA-55 as nuclear operations expand to support pit production. (b) (5) [redacted] In addition, a revised DBT is expected to be released in the coming months, which will drive a new implementation plan to incorporate changes and new analysis.

Infrastructure Investments: The Physical Security team is participating in the planning and design phases of security-related infrastructure investments (b) (7)(E), (b) (7)(F) [redacted] to identify project-related security requirements (compensatory measures, escorts, etc.) and the resources necessary to meet those requirements. Protective force and canine resources required for construction-related compensatory measures are not included in the staffing plan. When planning for the infrastructure investments is more mature, the additional protective force resources required to support construction will be incorporated into the overall estimates of required protective force staffing.

Expanded Hours of TA-55 PF-4 Operation with Increased Access Portals: LANL intends to continuously expand the hours of availability for routine programmatic, construction, and maintenance activities. In July 2019, LANL began utilizing the current protective force staff on overtime as a gap measure to staff a limited number of protective force posts (b) (5) [redacted] to support immediate needs for expanded hours at TA-55. LANL will gradually transition, as protective force hiring allows, to expand coverage to all current access portals during the off-shifts. (b) (5) [redacted]

Figure B-1 shows the current and proposed infrastructure in the TA-55 protected area. Figure B-2 shows the current and proposed infrastructure in the TA-55 PF-4 material access area.

(b)(3), (b)(7)(E) and (b)(7)(F)

[redacted]

(b) (5)

[redacted]

Figure B-1. Protected area infrastructure (current and proposed) at TA-55 (b)(3), (b)(7)(E) and (b)(7)(F)

[redacted]

(b) (5)

[redacted]

Figure B-2. Material access area infrastructure (current and proposed) at TA-55 PF-4

Several infrastructure investment projects will increase throughput into the TA-55 Protected Area and TA-55 PF-4 Material Access Area and are described below.

> **TA-55 East Entry Control Facilities:** The TA-55 east Entry Control Facility (ECF) is the main pedestrian entrance into the TA-55 Protected Area. It currently includes six pedestrian entry control portals and a single vehicle entry control lane (east vehicle access) that functions as a backup vehicle entry control portal when the west vehicle access is inoperable, traffic requires the opening of both vehicle portals, or in emergency situations. Two upgrade projects are under development to increase east TA-55 Protected Area

throughput. The design for the new TA-55 East Vehicle Access is under evaluation, and once more specifics are known, staffing will be updated accordingly.

(b) (5), (b) (7)(E), (b) (7)(F)

[redacted]

TA-55 West Vehicle Access Facility (WVA): The existing TA-55 WVA is currently the primary vehicle entrance into the TA-55 Protected Area. Two upgrade projects are under development to increase pedestrian and vehicle throughput into the west side of the TA-55 Protected Area and provide access to the TA-55 Protected Area from new facilities to be constructed on the west side of TA-55. The design for the new TA-55 WVA is under evaluation, and once more specifics are known, staffing will be updated accordingly.

(b) (5), (b) (7)(E), (b) (7)(F)

[redacted]

TA-55 PF-4 Material Access Area Entry Control Facilities: There are currently two entry control facilities on the east side of the Material Access Area. Two upgrade projects are under development to increase pedestrian throughput into the Material Access Area.

(b) (5), (b) (7)(E), (b) (7)(F)

[redacted]

Other Infrastructure Investments requiring Physical Security evaluation and support include the following:

(b) (5) [redacted]

Current projections are that the facility and capability are required (b) (5) [redacted]. The LANL VA team is in the process of hiring subcontract VA staffing to model (b) (5) [redacted] to determine requirements for physical security upgrades (barriers, detectors, alarm systems, etc.); material transportation (convoys); the types and numbers of protective force officers; armored vehicles for the protective force; and specialized vehicles for material transportation.

(b) (5) [redacted]

RLUOB Category 3 Facility: LANL will transition RLUOB to a CAT III facility (b) (5) [redacted]. LANL is planning the physical layout for the transition to a CAT III facility and the associated security requirements (perimeter requirements, alarm systems, and protective force patrols). The planned locations for processing and storing CAT III material are large room(s) in RLUOB that do not currently meet VTR requirements. The pit production cost estimate includes staffing to enable the eight-hour patrols. (b) (5) [redacted] The risk assessment will be used to determine the actual protective force resources required to support the transition to CAT III. The overall estimate of protective force resource needs will then be adjusted accordingly.

B.5.3 Schedule for Conducting Scope of Work

(b) (5) [redacted]

(b) (5)

B.6 Facilities Operations and Maintenance

B.6.1 Summary of Work Scope

The Facilities Operations and Maintenance team addresses the operations, engineering, and maintenance functions at the enduring and planned LANL facilities that support the pit production mission. To reliably produce 30 ppy, facilities and infrastructure must be operated and maintained so that facility downtime does not interfere with pit production. The critical facilities addressed by this team include the following:

- TA-55 PF-4 (and related support facilities at TA-55)
- TA-55 RLUOB
- TA-50 RLWTF
- TA-50 LLW
- TA-50 TLW (after start-up)
- TA-54 RANT
- TA-63 TWF
- TA-3 CMR (until operations are transferred to RLUOB)
- TA-3 Main Shops

Maintenance projects and routines must be designed and executed to meet regulatory drivers, provide functional redundancy, increase reliability, and address challenges posed by aging facilities. Maintenance activities that could affect production are performed during planned outages. Outages are scheduled to maximize the number of maintenance activities performed during each in order to minimize associated downtime. Existing systems and components must be maintained in an operational status by executing planned maintenance (predictive/preventative) and efficiently executing corrective maintenance in case of component failure.

Operation of TA-55 PF-4 and related support facilities includes the functions listed below:

- Operations control center
- Safety basis
- Criticality safety
- Radiation protection
- NDA and MC&A
- Formality of operations
- Facility training
- Decontamination and waste management
- Design, configuration, and system support
- Area and project controls
- Document control, procedure writing, and regulatory compliance
- Industrial and glovebox safety, health, and regulatory compliance
- Addressing unresolved safety questions (USQs) for the TA-55 Authorization Basis

Other focus area team subsections in Appendix B discuss some of these functions in more detail.

B.6.2 Technical Approach and Solutions

The Facilities Operations and Maintenance team has been assessing overall facility health for enduring mission capacity and reliability. The team has identified and compiled a prioritized list of facility upgrades and maintenance projects required for TA-55 PF-4 and is developing processes to optimize the use of scheduled outages to minimize programmatic impacts. Systems and components are assessed and analyzed to identify the quantity of critical spare parts that must be maintained. Work instructions and associated documents for facility operations and the maintenance of critical systems and components are being updated to comply with the new DSA requirements and improve workflow.

The Facilities Operations and Maintenance team is determining the optimal utilization of staff for extended-shift(b) (5) [redacted]. Infrastructure and operations staff must be available to meet regulatory drivers and ensure continuity of operations with sufficient supervision and oversight to manage issues and events to match the operational tempo. The team is updating and implementing staffing plans to incorporate the transition to (b) (5) [redacted].

Additional efforts to increase efficiency and balance available resources include the following:

- Develop and maintain a staffing pipeline to hire, train, and certify staff for critical facility operations and maintenance functions. Implement pay and benefits incentives for critical skills: mechanical engineers, pipefitters, electricians, craft.
- Integrate schedules for maintenance and facility upgrades with program schedules for construction, D&D, equipment installation, and production.
- Utilize other plutonium facilities (such as RANT, TWF, RLW, and RLUOB) to train workers prior to qualification for working TA-55 PF-4.
- Develop integrated acquisition teams to streamline procurements.
- Use third-party dedicators to meet quality and seismic requirements.
- Use allowances in EPRI SQUG and DOE/EH-0545, *Seismic Evaluation Procedure for Equipment in U.S. Department of Energy Facilities* for seismic qualification and acceptance.

B.6.3 Schedule for Conducting Scope of Work

The table below lists many of the critical operations, maintenance projects, and minor upgrades that the Facility Operations and Maintenance team will be defining and coordinating with the Infrastructure Investments team and other teams as appropriate.

B.7 Shipping, Receiving, Staging, and Storage

B.7.1 Summary of Work Scope

The Shipping, Receiving, Staging, and Storage team supports movement of nuclear material by assessing the health of the storage and shipping container supply chain, NDA requirements for plutonium-bearing materials at TA-55 PF-4, and the respective infrastructure needed to support the 30 ppy mission. An immediate issue is the timely shipment of plutonium commodities between LANL and LLNL to support the LLNL Pit Certification Plan. This effort requires interfacing with other LANL focus area teams and engaging with the other programs that ship nuclear material to and store nuclear material in TA-55 PF-4.

The Waste Management team addresses the shipping related to waste materials.

The responsibilities associated with shipping, receiving, staging, and storage include the following:

- Increasing the availability of TA-55 PF-4 vault storage space.
- Integrating program requirements for offsite shipping, onsite transfers, receiving, and storage of nuclear material.
- Completing the equipment and infrastructure upgrades including projects in the TA-55 PF-4 vault and in the shipping and receiving area.
- Executing the strategy developed with the NNSA Office of Packaging and Transportation (NA-531) for the use, availability, and replacement of WR and non-WR shipping containers.
- Coordinating the full annual maintenance of the shipping containers.
- Maintaining LANL as an Authorized User for all required containers.

B.7.2 Technical Approach and Solutions

The Shipping, Receiving, Staging, and Storage team has four main objectives:

1. Evaluate, plan, and execute the onsite transfer and offsite shipping of nuclear material for the 30 ppy mission.
2. Assess nuclear material storage requirements and capabilities and, as practicable, adjust the TA-55 PF-4 vault de-inventory activities to align with programmatic requirements.
3. Design and procure nuclear material storage containers to enable MAR reduction and meet planned storage requirements.
4. Assess NDA requirements and capabilities.

Objective 1: Evaluate, plan, and execute the onsite transfer and offsite shipping for the 30 ppy mission.

This objective ensures effective integration of shipping schedules across multiple programs and sites while informing support operations of the forecasted impacts to their respective functional areas. LANL will analyze the material supply chain requirements for shipping and receiving at LANL, material transfers within LANL for the 30 ppy mission, and other significant programs requiring the same resources. The LANL analysis will be integrated with the NA-522 analysis to develop shipping and receiving schedules for NNSA sites, develop storage requirements, and identify infrastructure improvements necessary to support the 30 ppy mission. The analysis results will include items such as infrastructure upgrades, time-phasing for functionality, logic for ensuring there are no lapses in capabilities, etc. The analysis will also address known areas of concern, such as staging capacity for empty shipping containers (e.g., active empty, expired needing maintenance, to be unloaded, and to be loaded), shipping dock improvements, and loading area upgrades.

(b) (5)

[redacted]

Efficient onsite transfer of samples from TA-55 PF-4 to the analytical laboratories (in particular, CMR and RLUOB) is not currently realized but will be needed to provide analysis quickly enough to maintain 30 ppy production rates. Current sample-movement processes will be analyzed and then process modeling used to evaluate alternatives and recommend process changes. Models of sample movements outside the TA-55 protected area but onsite within LANL will assume no new material flow channels but will allow for improved processes to expedite timelines.

Objective 2: Assess nuclear material storage requirements and capabilities and, as practicable, adjust the TA-55 PF-4 vault de-inventory activities to align with programmatic requirements.

LANL will analyze the nuclear material storage requirements for a 30 ppy mission and current capabilities. This analysis will include a time-phased assessment of the requirements for storage of nuclear materials for a 30 ppy mission, as well as scenarios involving programs outside of the 30 ppy mission with significant storage requirements (e.g., ARIES and Pu-238). The analysis will center on the TA-55 PF-4 vault and include scenarios with storage in safes, operational-floor storage, etc. The Materials Recycle and Recovery (MR&R) program is de-inventorying the legacy residues in the TA-55 PF-4 vault, which will provide storage space for pit production. The de-inventory and consolidation activities specific to the MR&R and ARIES programs will be incorporated into the model.

To prevent the need to store large quantities of pyrochemical residues (generated during metal supply operations) in the TA-55 PF-4 vault, a dedicated capability will be established to handle the logistics of residue disposition, including physical movement of the residues, post-processing, NDA, MC&A, and hand-off to waste services. To that end, a residue generation model was developed to forecast residue generation rates as a function of metal supply requirements. The residue generation forecasts were used to define the equipment and glovebox space necessary to handle these residue streams.

Options for additional storage space will be assessed, including improvements to the TA-55 PF-4 vault and significant nuclear material storage space outside TA-55 PF-4. Options being considered include relocation of Pu-238 storage to outside the TA-55 PF-4 vault, construction of an additional vault room, and reconfiguration of the TA-55 PF-4 vault.

Objective 3: Design and forecast supply chain requirements for nuclear material storage containers.

The modeling analysis will determine container needs for shipping, receiving, and onsite storage of nuclear material. The results of the analysis will be used to determine the material supply chain requirements for storage containers to support pit production goals, including safety-class containers to reduce MAR for production operations. Safety-class containers will meet criticality-based water-resistance criteria. When movement of materials is required, such as for material shipments to LLNL, the use of DOE M 441.1-1–compliant storage containers as a part of the approved Type B shipping container packaging configuration will be assessed, and the results added to the supply chain requirements for storage containers.

LANL maintains the capabilities for surveillance and life extension of safety-class containers. An increased user interface to manage operational use, training, and consultations regarding storage containers is needed. Legacy containers age while in storage and approach their design lifetime. LANL established a small team to repackage, re-shelve, and disposition the items in these legacy containers.

Objective 4: Assess NDA requirements and capabilities over time.

NDA is used to quantify the amount of SNM in TA-55 PF-4. NDA measurements are made during processing operations, as defined in the process monitoring flow diagrams, and at least annually for the entire inventory of nuclear material in TA-55 PF-4. Understanding the demand for NDA measurements versus operational throughput is key to achieving an efficient 30 ppy mission. An NDA IPT has been formed to evaluate the overall NDA process and identify changes that could be made to improve the flow of nuclear material delivered to, measured by, and retrieved from the NDA laboratory.

A value stream map will be created to develop a detailed understanding of the process steps and the time required for each step. The value stream map will identify excessive process times and non-value-added activities. In addition, equipment and NDA measurement techniques will be assessed to identify opportunities for process improvements. For example, the use of simple neutron NDA measurements for waste items would provide acceptable levels of precision and accuracy for accountability and be performed much more quickly than traditional, high-precision measurement techniques. If that technique is qualified for routine operations, additional neutron measurement NDA equipment will be installed "at line," collocated with the residue-processing areas in TA-55 PF-4.

B.7.3 Schedule for Conducting Scope of Work

(b) (5), (b) (7)(E), (b) (7)(F)

[redacted]

B.8 Business Support Services

B.8.1 Summary of Work Scope

The Business Support Services team will improve the business processes for both production and support functions. Use of standardized systems for the management of business process data ensures consistency, reliability, and predictability of performance. Such systems include the following:

- Production planning and scheduling

- Supply chain planning, management, and control
- Production operations and shop floor control
- Product sale, production data management, and quality management
- Engineering and configuration management
- Procedure development and work authorization
- Personnel training and development

The team is defining business processes, supporting IT systems, and interfaces in order to prioritize and plan improvements. Once business processes have been identified and defined, functional requirements can be derived for the supporting IT systems. Identified gaps between functional requirements and existing IT system capabilities are used to prioritize investments. Initial areas to be addressed include the following:

- Change business processes to align with existing IT system capabilities
- Modify or extend existing IT system capabilities
- Acquire new software/IT systems
- Introduce modern, integrated end-to-end manufacturing planning, scheduling, and operations systems in support of pit production

The Cybersecurity and Information Technology team represents all cybersecurity services for LANL. Cybersecurity services require additional resources to support extended business hours and the technology must be modernized. New technologies are available but must be approved by NNSA. The most critical activities, deliverables, and milestones include the following:

- (b) (7)(E), (b) (7)(F)
- Improve computing technology in areas directly supporting pit production
- Install and maintain collaboration tools on the classified network
- Build secure video telecommunication rooms and obtain NNSA approvals
- Complete facility, infrastructure, and technology upgrades to accommodate additional users and expanded business hours, which includes
  - Investments in storage, networking, telephony, mobility, and collaboration services
  - Purchase of TEMPEST Type-1 approved equipment (rigorous emissions security analysis to eliminate electromagnetic interference)
  - Purchase of VTC equipment from the approved LANL list
  - Evaluation of audio and voice masking mitigation equipment
- Prepare and issue an Enterprise Classified Computing Roadmap to address
  - Cybersecurity protections and capability for mobile classified computing
  - (b) (7)(E), (b) (7)(F)
  - (b) (7)(E), (b) (7)(F)
  - Opportunities to introduce collaboration tools on the classified network
  - Improvement of and integration with internal LANL classified networks and NNSA-wide networks, especially to transfer large files between sites

B.8.2 Technical Approach and Solutions

Initial efforts focus on identifying and defining the business processes that require substantial and urgent improvement. Standard business process re-engineering practices are used to ensure that all functional requirements of the key business processes are captured.

Initial actions to implement improvements include the following:

- Review and update the LANL 30 ppy mission staffing plan to ensure it accurately captures the human resources, document control, training, and procurement staff needed to support to support the 30 ppy mission (b) (5) [redacted].
- Upgrade facilities, infrastructure, and technology to accommodate additional users and business hours. LANL is conducting a study of core IT infrastructure to refine the requirements for upgraded or new infrastructure to support 30 ppy, including existing datacenter, telecom, and electrical utility capacity.
- Implement the knowledge management plan to capture and make available the knowledge and expertise of experienced staff.
- Implement a digital content management plan to ensure information authenticity and to enhance availability of process data.
- Increase the project controls staff to ensure support and to develop and maintain resource-loaded schedules for infrastructure investment projects and program execution.
- Develop, issue, and maintain a roadmap to deploy modern integrated end-to-end manufacturing software.

The critical elements to implement cybersecurity support for pit production at LANL are listed below:

- Virtual desktop infrastructure team to deploy hardware and software improvements at TA-55.
- Resources to expand the information technology infrastructure for pit production.
- (b) (7)(E), (b) (7)(F) [redacted]
- Modernize information technology in the areas of desktop, server, networking, and cybersecurity at TA-55.

To ensure IT systems reliably support business processes, a maintenance routine will be developed and implemented for each IT system, which includes scheduled outages for dedicated system time to perform IT updates.

In addition to the initial actions to improve business processes, LANL must address IT-centric staffing shortages through actions such as the following:

- Identify and train staff to perform the onboarding and training of new staff.
- Increase the on-call support for off-shift operations.
- Implement alternate work models, such as telecommuting, on-call staff, etc.
- Increase staff to support the Electronic Document and Records Management System (EDRMS).
- Automate processes to reduce workload on the existing IT staff.
- Deploy touchscreen portals and monitors to provide access documents in the EDRMS.

B.8.3 Schedule for Conducting Scope of Work

(b) (5)

[redacted]

B.9 Environment, Safety, and Health (ES&H)

B.9.1 Summary of Work Scope

The Environment, Safety, and Health (ES&H) team is responsible for environmental protection, radiation protection, occupational safety and health, and elements of waste management. All workers at LANL are responsible and accountable for conducting work safely. The ES&H team's focus is to implement services and programs to ensure that work performed at LANL meets all ES&H requirements and is performed in accordance with the LANL Integrated Safety Management System (ISMS).

ES&H staff are critical for hazard identification and control, an important component of ISMS. ES&H functions required for the pit production mission include the following:

- Radiation protection
- Radiological engineering
- Occupational medicine
- External and internal dosimetry
- Health physics analysis and operations
- Industrial safety, hygiene, and equipment
- Instrumentation and calibration
- Respiratory protection
- Radioactive sealed source and radiation generating device control
- Employee assistance program
- Ergonomics
- Ventilation inspection and control
- Electrical inspection
- Environmental programs
- Wellness Center
- Training and performance assurance

An ES&H staffing plan that addresses all ES&H functions required for the pit production mission is being updated and implemented.

Increased staffing for all ES&H functions is critical and urgent, (b) (5) [redacted] Increased staffing in these areas is essential to ensure adequate coverage for swing shift workers performing maintenance and construction activities.

ES&H SMEs will be active members of IPTs for programmatic and construction activities from initiation through completion to ensure that planned work activities are reviewed and appropriate controls implemented. ES&H staff must engage with workers and management early and often during work planning, project execution, and post-job reviews.

Construction and subcontractor work present unique challenges and requirements for ensuring appropriate ES&H support and oversight. Associated work can be highly variable and complex, particularly when it involves reconfiguring equipment or when hazardous materials are involved (e.g., replacing gloveboxes and ancillary systems). Subcontractor work can be particularly challenging when resolving safety requirements and integration with LANL processes for ISMS and conduct of operations. To support successful execution of the infrastructure investments associated with this integrated strategy, LANL must ensure ES&H engagement at appropriate points in planning and execution to provide support and oversight; including SMEs for design (e.g., radiological engineers), process startup, hazard analysis and control (e.g., industrial hygienists and health physicists); ES&H staff for safe execution of work and associated follow-up (e.g., RCTs); and ES&H management for staffing and scheduling.

B.9.2 Technical Approach and Solutions

ES&H support for pit production requires a rapid and substantial increase in staffing. Current staffing shortfalls limit the ES&H support available to efficiently and reliably execute programs, complete construction, and perform maintenance. Expanding the hours of operation in TA-55 PF-4, which is necessary to execute other required elements of the 30 ppy mission, further increases the gap between needed and available ES&H resources.

Newly hired ES&H staff must obtain a clearance, be fully trained, and acquire enough work experience to be able to complete assigned tasks independently. Interim security clearances are submitted for required positions upon hiring.

The ES&H staffing plan prioritizes the hiring of RCTs to support activity at TA-55 PF-4. To recruit and hire qualified RCTs, LANL expanded the existing RCT pipeline in 2019 by increasing class size from 10 to 40 and running two classes concurrently at the Northern New Mexico Community College.

Because many of the ES&H staff needed to support the pit production mission require a significant amount of training, qualification, and experience, accelerated hiring with efficient training and mentoring programs is essential to mission success. To expedite the training and qualification of newly hired staff, a new training and mentoring program will be established that specifically addresses the needs of the decontamination team, waste management coordinators, and other radiation and environmental protection workers at TA-55 PF-4. The training for this moderate- and high-hazard radiological work will eventually be conducted in the planned training facility at TA-48.

Additional efforts to increase efficiency and balance available resources include the following:

- Developing radiological service authorization agreements to transfer from ES&H staff to programmatic staff and craft the ability to perform low- or moderate-hazard radiological protection services.
- Increasing resources for the facility decontamination team to conduct housekeeping efforts more frequently, which will reduce unexpected contamination in TA-55 PF-4, thereby increasing room availability for programmatic operations.
- Reviewing all radiological work permits to optimize RCT coverage. Initially ES&H staff will work with programmatic staff to determine if full-time RCT coverage can be reduced to intermittent coverage for specific activities where dose rates are constant.
- Leveraging processes for on-call coverage rather than full-time onsite coverage, where feasible, to improve efficiency.
- Formalizing mentoring during on-the-job training for new RCTs working in TA-55 PF-4.
- Establishing an occupational health clinic in the planned office building at TA-48 to ensure effective and efficient occupational medical services are available.

B.9.3 Schedule for Conducting Scope of Work

[redacted] (b) (5)

(b) (5) [redacted]

B.10 Technology Maturation and R&D Support

B.10.1 Summary of Work Scope

The Technology Maturation and R&D Support team evaluates LANL's existing and planned pit production and support capabilities, design agency (LLNL and LANL) Pit specifications and certification requirements, and input from other focus area teams to identify opportunities to draw on RFP's historical efforts and LANL's scientific and engineering expertise and resources to make improvements. (b) (7)(E), (b) (7)(F) [redacted]. Prioritization of additional technology maturation and R&D efforts is based on the most cost-effective means to improve the pit production efficiency and reliability as well as the best available technologies for use within a nuclear facility.

Improperly implementing new technologies can disrupt pit production operations and impose significant delays. There are several non-pit production programs that use similar production capabilities within TA-55 PF-4; disruptions in the pit production are reduced by maturing new technology that is similar but independent from production capabilities. The greatest risks to the successful execution of the concepts described below are funding and the availability of independent capabilities that can be used for technology development.

B.10.2 Technical Approach and Solutions

Proposed improvements for pit production processes, support functions, and associated infrastructure are described below. LANL will utilize the Sigma facility and existing and planned AC/MC capabilities to develop these proposed improvements. Sigma is a fully integrated manufacturing facility with casting, welding, machining, and prototyping capabilities directly applicable to pit production.

(b) (7)(E), (b) (7)(F) [redacted]

(b) (7)(E), (b) (7)(F)

[redacted]

Safeguards – Process Monitoring

Investigate methods for unattended and remote process monitoring to improve meeting MC&A inventory requirements. Changes to safeguards processes will require coordination with NA-LA.

B.10.3 Schedule for Conducting Scope of Work

(b) (5), (b) (7)(E), (b) (7)(F)

[redacted]

B.11 Institutional Quality

B.11.1 Summary of Work Scope

The Institutional Quality team is responsible for verifying that LANL's policies and programs meet regulatory and contractual requirements and for ensuring that equipment, work processes, and procured items are compliant. As operational and construction activities increase at LANL facilities, the scope of procurement activities, quality oversight, issues management, nonconformance reporting, audits and assessments, supplier evaluations, risk management, occurrence investigations, and trending of these activities will also increase. Similarly, as operating schedules are extended, the need for inspections on consumables such as glovebox gloves, HEPA filters, and bag-out bags will increase.

B.11.2 Technical Approach and Solutions

LANL is updating procurement, inspection, and documentation processes to improve efficiency and reduce potential delays in the availability of materials and equipment. Updates include developing new tools that integrate procurement and inspection requirements to clarify procurement requirements for users and suppliers. Improvements are also being made to institutional issues management and oversight processes and to tools for addressing nonconformance issues.

B.11.3 Schedule for Conducting Scope of Work

(b) (5) [redacted]

B.12 Emergency Management

B.12.1 Summary of Work Scope

The primary mission of the Emergency Management team is to protect the workforce, public, property and critical infrastructure, and environment through integration of emergency preparedness, response, recovery, mitigation, and readiness assurance, in accordance with DOE O 151.1D, *Comprehensive Emergency Management System* and other regulatory requirements. Emergency Management staff include qualified incident response commanders/incident commanders and 24/7 Emergency Operations Support Center operators, hazardous materials and devices teams, and emergency preparedness coordinators.

Emergency Management maintains readiness to respond to all hazards with qualified first responders as well as to activate an Emergency Operations Center to manage and coordinate large-scale incidents.

Increases in plutonium-related work and hours of operation at TA-55 PF-4 (b) (5) [redacted] require additional emergency management resources to ensure full support for all aspects of emergency preparedness and response to emergencies, abnormal conditions, and other unique, significant events that require incident coordination and time-urgent notifications.

B.12.2 Technical Approach and Solutions

To support preparedness activities and ensure compliance with applicable DOE Orders, additional qualified personnel are needed to efficiently and effectively respond to emergencies, support IT systems used 24/7 and during incident responses, provide hazardous material response support, and on-call support across LANL. Specific staff required include

- **Emergency Operations Support Center** watch officers to allow incident response commanders to respond more quickly to the field and facilitate better integration with other agencies through the incident command system. Time-urgent life-safety decisions and actions can be taken while the incident response commander is en route to the scene. The Emergency Operations Support Center is the primary location for all incident notification and reporting and incident coordination across LANL.

- **Abnormal conditions/operational drill coordinator** to standardize implementation of abnormal condition/operational drill development and conduct for all operations staff across all facilities and support a site-wide abnormal conditions drill program.
- **Emergency response personnel** to provide flexible scheduling of resources (e.g., on-call) based on emergency and non-emergency call volume metrics to ensure support from both LANL and national response teams.

B.12.3 Schedule for Conducting Scope of Work

Hiring, training, and qualification of new personnel must be completed prior to expanding the hours of operation at TA-55 PF-4.

B.13 Other Regulatory Challenges

B.13.1 Summary of Work Scope

The Other Regulatory Challenges team evaluates the compliance requirements relevant to conducting plutonium mission activities at LANL. Environmental and other regulatory laws protect the public and environment by

- Regulating the handling, transportation, and disposal of materials and wastes;
- Regulating impacts to biological and cultural resources and air, soil, and water; and
- Requiring analysis of the environmental impacts of new and modified operations.

The goal for evaluating the compliance requirements is to identify potential opportunities for an integrated approach and to implement innovative solutions for achieving compliant pit production and other plutonium missions. The team identifies regulatory and permitting requirements for LANL to increase pit production and to support other plutonium missions by using a comprehensive web-based integrated review tool (IRT). The IRT identifies any regulatory issues and challenges based on input from the other focus area teams and specific projects regarding

- Site selection;
- New facility construction;
- Upgrades, modifications, and expansions to existing facilities;
- Changes to established processes;
- Outdoor activities;
- Facility shutdown, decommissioning, and demolition; and
- Modification of land use.

B.13.2 Technical Approach and Solutions

Compliance with environmental laws, regulations, and policies is an integral part of the mission at LANL and demonstrates a continued focus on sustainability and environmental stewardship. LANL uses the comprehensive Permits and Requirements Identification (PRID) tool within the IRT for project planning to facilitate coordination between project/program owners and technical SMEs. The PRID tool enables SMEs to identify related requirements and indicates when a requirement may be applicable to a project or activity. LANL SD 400, *Environmental Management System*, defines the process for conducting project and activity reviews.

The IRT provides a cost-effective and time-efficient review process that reduces redundancy from the use of different tools, increases communication between users and SMEs, and increases compliance with institutional and regulatory requirements. The IRT is the mechanism to provide compliance feedback to project managers. Proper and timely use of the IRT reduces unanticipated impacts to project cost, scope, and schedule.

B.13.3 Schedule for Conducting Scope of Work

The regulatory requirements reviews conducted under the IRT are an ongoing effort through the life of the 30 ppy mission and other ongoing plutonium missions. In accordance with LANL policies, project and program owners are required to enter descriptions of activities, including requirements for new facilities, facility and equipment modifications, and increased staffing requirements into the PRID tool. The entries must contain sufficient detail to facilitate a technical analysis to determine applicable permit requirements and regulatory constraints. PRID entries can be updated as project planning progresses to refine details and requirements.

Appendix C. Estimated Staffing by LANL Organization

This appendix provides a brief description of most divisions and offices that support the LANL mission to produce a minimum of 30 ppy during 2026. The table shows the number of FTEs in each organization, the number supporting pit production, and planned or potential growth, will be analyzed in further detail during FY21). Hiring to replace expected attrition is not reflected in the table.

Full Organization – The total number of FTEs in an organization as of October 2019

Pit Production – Staffing that supports pit production and pit production enabling functions

Direct – Direct-funded staff

Indirect – Indirect-funded staff

Planned Growth – Additional staff (above the existing staffing as of October 2019) that are required for the pit production mission to production to produce a minimum of 30 ppy during 2026

Potential Growth – Indicator that an indirect-funded organization is anticipated to increase its staffing in order to support the pit production mission. For this table, potential growth is limited to the staff performing work in that organization, not the indirect-funded management.

The staffing data shown for Production Agency Quality (PAQ) division is discussed as an example of how to interpret the table. PAQ division provides the quality engineering and assurance and some inspection for all of the activities performed at LANL by the Associate Laboratory Directorate for Weapons Production, which is responsible for WR production and surveillance of pits, detonators, and RTGs, as well as work for other DOE and NNSA missions. (b) (5) [redacted]

Deputy Director for Weapons

Division/Office	Relationship to the Pit Production Mission	(b) (5) [redacted]
Associate Laboratory Directorate for Weapons Production		[redacted]
Actinide Material Processing & Power [redacted]	• Supports TA-55 PF-4 vault clean out • (b) (7)(E), (b) (7)(F) [redacted] • (b) (7)(E), (b) (7)(F) [redacted] • Performs SAVY-4000 container surveillance to meet requirements for use in storage of SNM	[redacted]

Deputy Director for Weapons (continued)

Division/Office	**Relationship to the Pit Production Mission**	(b) (5)
Nuclear Process Infrastructure (NPI)	• Compliant waste management • Non-nuclear material support • Hazardous material management • Shipping of radioactive materials • TA-55 PF-4 vault operations • Non-destructive assay (NDA)	[redacted]
Operational Readiness Implementation (ORI)	• Readiness and conduct of operations support • Event investigation and issues management • MES/MRP and resources allocation management • TA-55 criticality safety program management • Warehousing and controlled storage • WR material management • Acquisition and procurement services • Worker training programs	
Production Agency Quality (PAQ)	• Quality engineering, inspection engineering, and product inspection • Quality assurance expertise including requirements management, procurement quality, vendor and supplier evaluations, receiving inspection and acceptance, and software quality assurance • Product verification and submittal • Verification inspection and acceptance stamping	
Pit and Production Program Office (PCPO)	• Negotiates milestones, deliverables, and budget with NA-10 • Develops a resource-loaded baseline schedule • Tracks program status against the baseline • Reports program status to NA-10 • Manages change control to the program baseline • Assesses and manages programmatic risk	
Prototype Fabrication (PF)	• Fabrication and inspection capability to produce non-nuclear components, tooling, and fixtures	
Pit Technologies (PT)	• Performs all DA required pit production flowsheet activities except dimensional inspection (PAQ Division) and analytical chemical analysis (C Division) • Provides assistance to E Division to perform low-energy and high-energy radiography • Product engineering and production planning/logistics	

Deputy Director for Weapons (continued)

Division/Office	**Relationship to the Pit Production Mission**	(b) (5) [redacted]
TA-55 Facility Operations (TA-55 FOD)	• Ensures safety basis requirements for TA-55 PF-4, RLUOB, and the waste facilities are met by performing surveillances and maintaining quality surveillance documentation • Operations Center and equipment operations teams for operational support, laboratory availability, and systems functionality • Comprehensive and integrated maintenance program supporting process equipment for TA-55 PF-4, RLUOB, and the waste facilities	
Associate Laboratory Directorate for Weapons Engineering		
Engineering Technology and Design (E)	• Mechanical and thermal engineering support for process equipment and glovebox development, procurement, assembly, cold testing, and post-installation troubleshooting • Decision support and engineering analyses, including risk management support, major process modeling, and systems engineering analyses • Design, development, and field support of automated systems, data acquisition systems, process control systems, machine control systems, and safety systems, • (b) (7)(E), (b) (7)(F) [redacted]	
Associate Laboratory Directorate for Weapons Physics		
Weapons Research Services (WRS)	• Classified libraries and collections (pit manufacturing baseline and real-time documentation on new builds) • (b) (7)(E), (b) (7)(F) [redacted] • Knowledge and experimental data management (nuclear fundamentals orientation, streaming of PF-4 process training videos, curation of materials for specialized degree programs, and pit surveillance data management tools)	

Deputy Director for Science, Technology, and Engineering

(b) (5)

Division/Office	Relationship to the Pit Production Mission	[redacted]
Associate Laboratory Directorate for Chemical, Earth & Life Sciences		
Chemistry (C)	• Analytical chemistry for – pit certification and production monitoring – bio-assay in support of worker health and safety • Chemical certification and material compatibility studies	
Associate Laboratory Directorate for Physical Sciences		
Materials Science & Technology (MST)	• Evaluates materials properties, microstructure, and other material science phenomena as required by the PA or DA for process development, qualification, and certification or to investigate pit production issues	
Sigma	• Fabricates, coats, and inspects graphite molds • Develops non-nuclear component processes • Advances manufacturing technology	

Deputy Director for Operations

Division/Office	Relationship to the Pit Production Mission	[redacted]
Associate Laboratory Directorate for Capital Projects		
Project Integration (PIO)	• Project management and construction management resources for infrastructure investment projects	
Program Performance Services (PPS)	• Project controls, project management technical solutions, records management solutions, and coordinates procurement with ASM	
Associate Laboratory Directorate for Facilities and Operations		
Engineering Services (ES)	• Safety systems engineering, maintenance of key engineering processes and systems, and technical support for safety basis • Facility design authority representation for facility technical baseline, technical accuracy and acceptability of designs and design changes, support safety basis documentation development, USQ process support • Cognizant system engineering for configuration management, operability, and performance management for vital safety systems • Conduct of engineering documentation and activities • Project engineering, and design engineering for conceptual and detailed designs and fit for purpose • Procurement engineering for technical goods and services, Commercial Grade Dedication, NQA-1 procurements, and quality assurance reviews and acceptance	

Deputy Director for Operations (continued)

Division/Office	**Relationship to the Pit Production Mission**	(b) (5) [redacted]
Infrastructure Programs Office (IFPROG)	• Institutional support for infrastructure planning, project initiation, facility data including GIS, indirect project planning and funding, space planning, furniture design, procurement, and reuse	
Logistics (LOG)	• Craft and craft training services for maintenance and construction work • Maintenance superintendents for work performed by MSS Division • Cafeteria, custodial, and transportation services • Maintenance and operations subcontract management Craft subcontractors	
Maintenance and Site Services (MSS)	• Preventive and corrective maintenance for programmatic equipment • Maintenance services and a compliant nuclear maintenance program to sustain mission-ready facilities and site infrastructure	
Nuclear Criticality Safety (NCS)	• Documented nuclear criticality reviews of all processes, storage locations, and configurations of nuclear material used within a CAT I/II nuclear facility	
Readiness, Packaging, and Transportation (RPT)	• Business support to ensure execution of readiness, formality of operations, document control, and compliance with applicable regulations • Infrastructure asset management to improve utilization and performance, reduce capital costs, reduce asset-related operating costs, and extend asset life • Operates the Standards and Calibration Laboratory to calibrate measuring, inspection, and test equipment	
Safety Basis (SB)	• Evaluates work processes, identifies and analyzes nuclear and high hazard accident scenarios, and develops controls under DOE requirements • Prepares LANL's Documented Safety Analyses (DSAs)	
Associate Laboratory Directorate for Environment, Safety, Health, Quality, Safeguards, and Security		
Deployed Environment, Safety, and Health (DESH)	• Facility-specific implementation of ESH requirements to include industrial hygiene, industrial safety, radiation protection and environmental compliance • Field ESH support for work planning and execution for maintenance, construction, and programmatic work • Abnormal event response and corrective action development	(b) (5) [redacted]
(b) (5) [redacted]		

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Deputy Director for Operations (continued)

Division/Office	**Relationship to the Pit Production Mission**	(b) (5) [redacted]
Environmental Protection & Compliance (EPC)	• Expertise and implementation assistance regarding compliance with applicable laws, regulations, DOE Orders for water resources and air quality, state and federal requirements for biological, cultural resources, and implementation of NEPA, the Pollution Prevention Act, and DOE Order 458.1, Resource Recovery and Conservation Act (RCRA), waste management and TRU waste management, Consent Order sites, and waste characterization • Manages and operates the institutional sample management office, Green Is Clean, non-destructive assay program, chemical management, and the Waste Compliance and Tracking System • Environmental Management System, Integrated Project Review, and the Annual Site Environmental Report	[redacted]
Institutional Quality & Performance Assurance (IQPA)	• Institutional quality and performance assurance programs • Receipt inspection, suspect/counterfeit item coordinators, software quality assurance and procurement quality expertise, institutional and project quality program development and maintenance, reviews LANL policies and programs against regulatory and contractual requirements, nonconformance tools, and construction quality oversight • Ensures compliance with quality requirements (e.g., NQA-1, DOE 414.1D, and SD330), the Contractor Assurance System (CAS) in accordance with DOE Order 226-1B and Order 232-2A, and provides independent oversight of weapons Quality programs (NAP-24A)	[redacted]
Occupational Safety and Health (OSH)	• Industrial hygiene and safety services including respiratory fit-testing, ventilation testing, and electrical inspections • Industrial hygiene and safety technical support through qualified subject matter experts (SMEs) • Occupational medicine services including injury/illness treatment, medical and behavioral health services, ergonomics, health and wellness services, and health information management	[redacted]

Deputy Director for Operations (continued)

(b) (5)

Division/Office	Relationship to the Pit Production Mission
Radiation Protection (RP)	• Implement applicable policies and requirements through procedures and training for radiological workers and radiological control technicians (RCTs) • Radiological engineering design and review for engineered exposure controls • Instrumentation calibration and maintenance of radiation and contamination detection instruments • Sample analysis (e.g., air sampling, contamination monitoring, spill investigation) and emergency response measurements (e.g., nose swipes, wound, in vivo) • Worker external and internal dosimetry services
Safeguards (SAFE)	• Identifies classified and controlled unclassified information, • Establishes and implements protection and control of classified material, operations security, and export control • Applies graded levels of control for accountable nuclear material and special nuclear material based on the type, quantity, and form • Performs vulnerability and risk assessments, emergency planning, and hazards analysis
Security (SEC)	• Enrolls staff for badging, clearance processing, and HRP • Provide comprehensive security briefings for staff receiving clearances • Technical support and troubleshooting for access control systems • Incident investigations and processing • Manage protective force subcontract and provide oversight • Protective force provides physical protection of LANL assets and facilities
	Security subcontractors (protective force)
Associate Laboratory Directorate for Business Services	
Acquisition Services Management (ASM)	• Project-based procurement of goods and services, including contract services, staff augmentation support, and infrastructure investments
Controller (CNTL)	• Corporate and payroll/benefits accounting • Disbursements and travel • Financial systems support
Finance (FIN)	• Financial products and services • Business process and systems support

Deputy Director for Operations (continued)

Division/Office	**Relationship to the Pit Production Mission**	(b) (5) [redacted]
Human Resources (HR)	• Recruiting, benefits, compensation, workforce analysis, and diversity and strategic staffing • Employee and labor relations • Institutional training and organizational development	
Network and Infrastructure Engineering (NIE)	• Computing, datacenter, and telecommunication infrastructure administration • Network services including unclassified and classified institutional computing, storage, and operating systems support • Security for network infrastructure	
Software and Applications Engineering (SAE)	• Software development, commercial off-the-shelf application implementation, and support services	
eXperience IT (XIT)	• Computer and software purchasing and support • Project storage • System administration and encryption	

Appendix D. Equipment and Infrastructure List

D.1 NA-19 Los Alamos Plutonium Operations

NA-19: Los Alamos Plutonium Operations

(b)(3), (b)(5), (b)(7)(E) and (b)(7)(F)

NA-19: Los Alamos Plutonium Operations (continued)

(b)(3), (b)(5), (b)(7)(E) and (b)(7)(F)

[redacted]

NA-19: Los Alamos Plutonium Operations (continued)

(b)(3), (b)(5), (b)(7)(E) and (b)(7)(F)

[redacted]

NA-19: Los Alamos Plutonium Operations (continued)

(b)(3), (b)(5), (b)(7)(E) and (b)(7)(F)

[redacted]

NA-19: Material Recycle and Recovery

(b)(3), (b)(5), (b)(7)(E) and (b)(7)(F)

[redacted]

D.2 NA-19 Capability Based Investments

NA-19: Capability Based Investments

(b) (5)

D.3 NA-12 Stockpile Systems

NA-12: Stockpile Systems Pit & RTG Surveillance

(b)(3), (b)(5)

D.4 NA-10 and NE-3 Pu-238 Programs

NA-10 and NE-3 Pu-238 Programs

(b)(3), (b)(5)

[redacted]

NA-10 and NE-3 Pu-238 Programs (continued)

(b)(3), (b)(5)

[redacted]

NA-10 and NE-3 Pu-238 Programs (continued)

(b)(3), (b)(5)

D.5 NA-23 Plutonium Disposition

NA-23: Plutonium Disposition

(b)(3), (b)(5)

[redacted]

NA-23: Plutonium Disposition (continued)

(b)(3), (b)(5)

[redacted]

NA-23: Plutonium Disposition (continued)

[redacted]

(b)(3), (b)(5)

D.6 DOE-SC Americium Oxide Production

DOE-SC: Americium Oxide Production

(b) (5)

[redacted]

D.7 NA-50 Recapitalization

NA-50: Recapitalization

(b) (5)

[redacted]

NA-50: Recapitalization (continued)

(b) (5)

NA-50: Recapitalization (continued)

(b) (5)

[redacted]

D.8 NA-50 Operations of Facilities and Maintenance and Repair of Facilities

NA-50: Operations of Facilities

(b) (5)

[redacted]

NA-50: Maintenance and Repair of Facilities

(b) (5)

[redacted]

D.9 NA-10 Line-Item Projects (TRP III, TLW, CMRR, LAP4)

NA-10: Line-Item Projects

(b) (5)

[redacted]

NA-10: Line-Item Projects (continued)

(b) (5)

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NA-10: Line-Item Projects (continued)

(b) (5)

[redacted]

NA-10: Line-Item Projects (continued)

(b) (5)

[redacted]

NA-10: Line-Item Projects (continued)

(b) (5)

[redacted]

NA-10: Line-Item Projects (continued)

(b)(3), (b)(5)

[redacted]

NA-10: Line-Item Projects (continued)

(b)(3), (b)(5), (b)(7)(E) and (b)(7)(F)

[redacted]

NA-10: Line-Item Projects (continued)

(b)(3), (b)(5), (b)(7)(E) and (b)(7)(F)

[redacted]

NA-10: Line-Item Projects (continued)

(b) (5), (b) (7)(E), (b) (7)(F)

[redacted]

NA-10: Line-Item Projects (continued)

(b) (5), (b) (7)(E), (b) (7)(F)

[redacted]

NA-10: Line-Item Projects (continued)

(b)(3), (b)(5), (b)(7)(E) and (b)(7)(F)

[redacted]

NA-10: Line-Item Projects (continued)

(b)(3), (b)(5), (b)(7)(E) and (b)(7)(F)

[redacted]

NA-10: Line-Item Projects (continued)

(b)(3), (b)(5), (b)(7)(E) and (b)(7)(F)

[redacted]

NA-10: Line-Item Projects (continued)

(b)(3), (b)(5), (b)(7)(E) and (b)(7)(F)

[redacted]

NA-10: Line-Item Projects (continued)

(b)(3), (b)(5), (b)(7)(E) and (b)(7)(F)

[redacted]

NA-10: Line-Item Projects (continued)

(b)(3), (b)(5), (b)(7)(E) and (b)(7)(F)

[redacted]

D.10 LANL Site Support

LANL Site Support

(b) (5)