Los Alamos National Laboratory

Plan to Produce 30 Pits per Year at Los Alamos National Laboratory

September 2019

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Executive Summary

In 2014, Congress established pit production requirements of not less than 30 war reserve (WR) pits by 2026 with additional requirements related to 80 pits per year (ppy). In February 2018, the Department of Defense issued the *Nuclear Posture Review*, which reinforces the need to "Provide the enduring capability and capacity to produce plutonium pits at a rate of no fewer than 80 pits per year by 2030" to maintain the nation's nuclear deterrent. In August 2018, Congress further formalized the pit production directive and implemented as the policy of the United States that "Los Alamos National Laboratory will produce a minimum of 30 pits per year for the national pit production mission and will implement surge efforts to exceed 30 pits per year to meet Nuclear Posture Review and national policy."

To achieve this requirement, the Department of Energy (DOE) National Nuclear Security Administration (NNSA) released its recommendation to pursue a two-site solution for production of 80 pits per year, for which Los Alamos National Laboratory (LANL) would produce at least 30 WR ppy beginning in 2026 and Savannah River Site (SRS) would produce at least 50 WR ppy beginning in 2030. The NNSA Administrator directed the NNSA Office of Defense Programs (NA-10) to lead this effort and provide an implementation plan to create the structure and conditions to succeed and meet pit production requirements. In February 2019, NNSA released the *Preliminary Pit Production Implementation Framework*, which laid out in more detail the two-site solution to produce at least 80 ppy by 2030. NNSA further emphasized the importance of the pit production mission to Triad National Security, LLC by including the requirement to prepare and deliver an integrated plan to achieve at least 30 WR ppy by 2026 in both the prime contract for management and operation of LANL and in the *Fiscal Year 2019 DOE/NNSA Strategic Performance Evaluation and Measurement Plan for Triad National Security, LLC*.

The *Proposed Plan for Establishing the Capability for Safe, Secure, Reliable, and Efficient Production of a Minimum of 30 War Reserve Pits Per Year at Los Alamos National Laboratory by 2026* was developed by LANL and submitted to NNSA in April 2019 and updated in May. The proposed plan presented a schedule constrained, funding unconstrained approach.

This document ("the Plan," issued in September 2019) is an update to the proposed plan issued in May 2019 and builds on the foundation established in the proposed plan and incorporates the next level of planning using requirements that are better defined.

This Plan contains the following changes to the document issued in May 2019:

- A shift from funding unconstrained to using the NNSA planning guidance for FY20 and a requirements-based budget for FY21 and beyond.
- A more detailed schedule for product realization to deliver the first production unit (FPU) in 2023.
- An updated staffing analysis that includes the "indirect" staff (i.e., funded by overhead), such as human resources, procurement, emergency services, and IT, who support the pit production mission. Including the indirect staff in the analysis does not change the budget presented in the proposed plan issued in May 2019 because the overhead budget was included in direct program cost estimates. Similarly, the planned infrastructure investments presented in the May document are adequate.
- A more detailed acquisition strategy and schedule for infrastructure investments.
- Interim mitigation strategies to address anticipated gaps in the availability of infrastructure.

This Plan retains the following elements of the document issued in May 2019:

- A LANL-specific plan to produce 30 ppy without impeding the programs of record for all of the other plutonium missions conducted at LANL.
- Appendices with detail on the actions and decisions for NNSA and LANL, basis of cost estimates, risks, pit manufacturing fundamentals, scope and schedule of the LANL focus areas, and infrastructure investments.

To develop this Plan, LANL assessed the foundational information regarding the current state of pit production and the many enabling functions across LANL. For this effort LANL compiled a comprehensive list of the infrastructure—equipment, facilities, and utilities—needed; clarified and documented site-wide interfaces and staffing needs for enabling functions (e.g., human resources, clearance processing, occupational health, waste management, procurement, etc.); and identified ways to increase operational reliability and programmatic productivity within Technical Area (TA)-55 Plutonium Facility Building 4 (PF-4).

This Plan provides NNSA and LANL with a comprehensive overview of the resources and actions necessary to establish the capability at LANL to produce a minimum of 30 ppy (b) (5) in 2026. It describes the challenges ahead and the actions that NNSA, LANL, and Lawrence Livermore National Laboratory (LLNL) must take to ensure success, and where needed, adjust current paradigms and business norms. The critical challenges and actions are summarized below.

First, get to WR FPU in 2023.

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

> **Challenge 1: Master the science and engineering required to meet the LLNL design agency (DA) specifications for pit production processes.**
>
> ***Path Forward: Build on the successful experience gained from manufacturing WR pits at TA-55 PF-4 for the W88 weapon.*** 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 research 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 facility outages are a significant risk to production following FPU. 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)

Challenge 3: Maintain and update TA-55 PF-4, a 40-year-old nuclear facility, to ensure continued compliance with safety 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, which will be performed off-shift to reduce disruption to programmatic activity during the day shift.

Finally, efficiently achieve an annual 30 ppy production rate by 2026.

To ramp up production to 30 ppy (b) (5), 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 Plan 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 (offices, parking, training, production development, etc.), which is planned through line-item acquisitions.

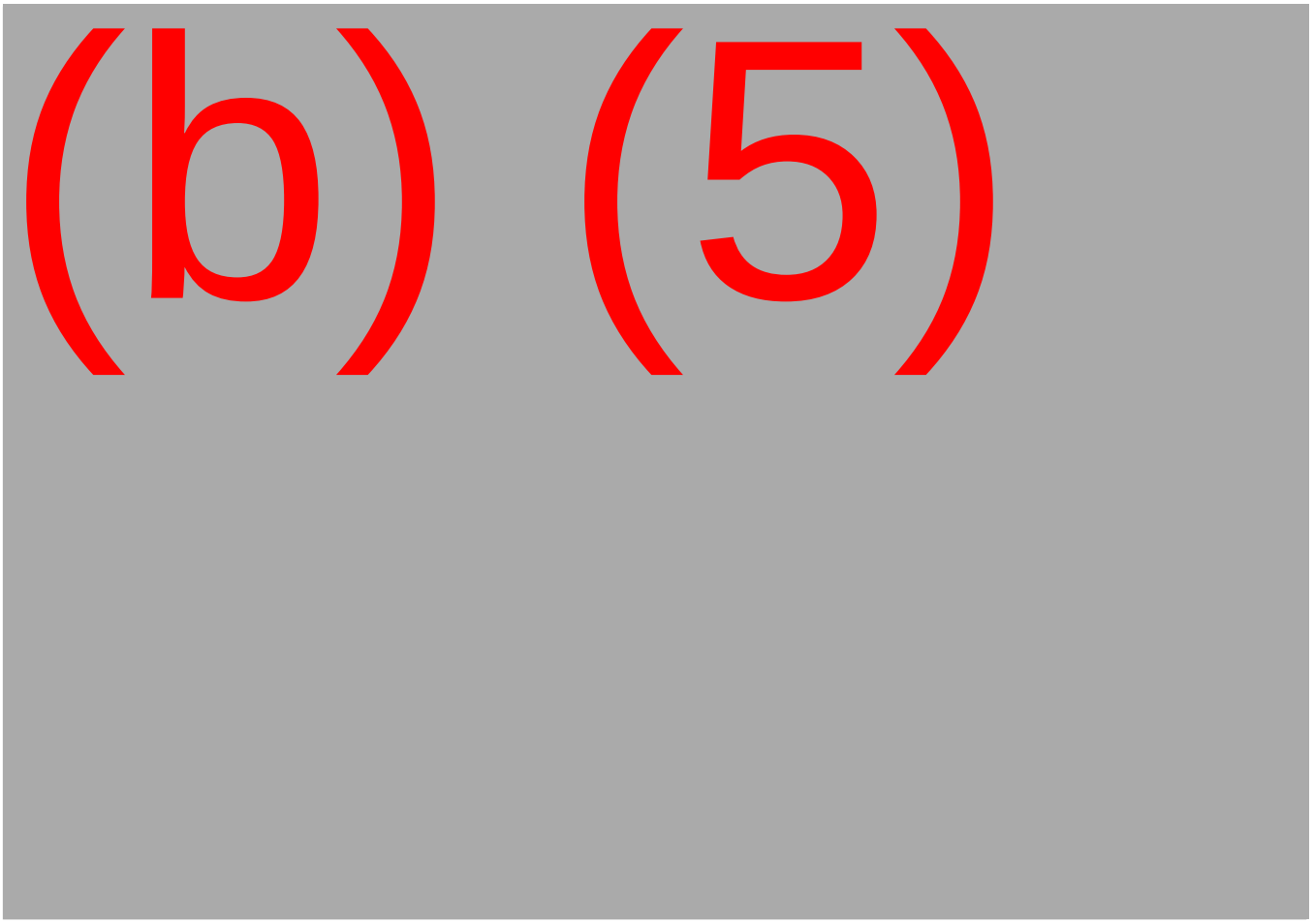
Increased staffing is necessary to produce pits; maintain and operate all facilities involved in the pit production mission; provide security for pit production activities and materials; provide the broad range of support functions; and perform small facility-related projects at a steady level of investment. The increase in the enduring LANL staff will be achieved through three overlapping objectives and is shown in the figure.

Objective 1: Increase staffing to the level required to **reliably** operate and maintain LANL's plutonium enterprise and to execute the current scope associated with pit production.

Objective 2: Increase staffing to the level required (b) (5). Objectives 1 and 2 provide the staff for a plutonium enterprise at LANL that can perform the craft work for maintenance, equipment installation, and construction (b) (5) while delivering on all current plutonium missions (b) (5). The staffing increase from Objectives 1 and 2 is required to produce 20 ppy in 2025; therefore, 2024 is the latest that this workforce can be in place. The staff must be hired 1–3 years earlier to provide adequate time to obtain clearances and complete training.

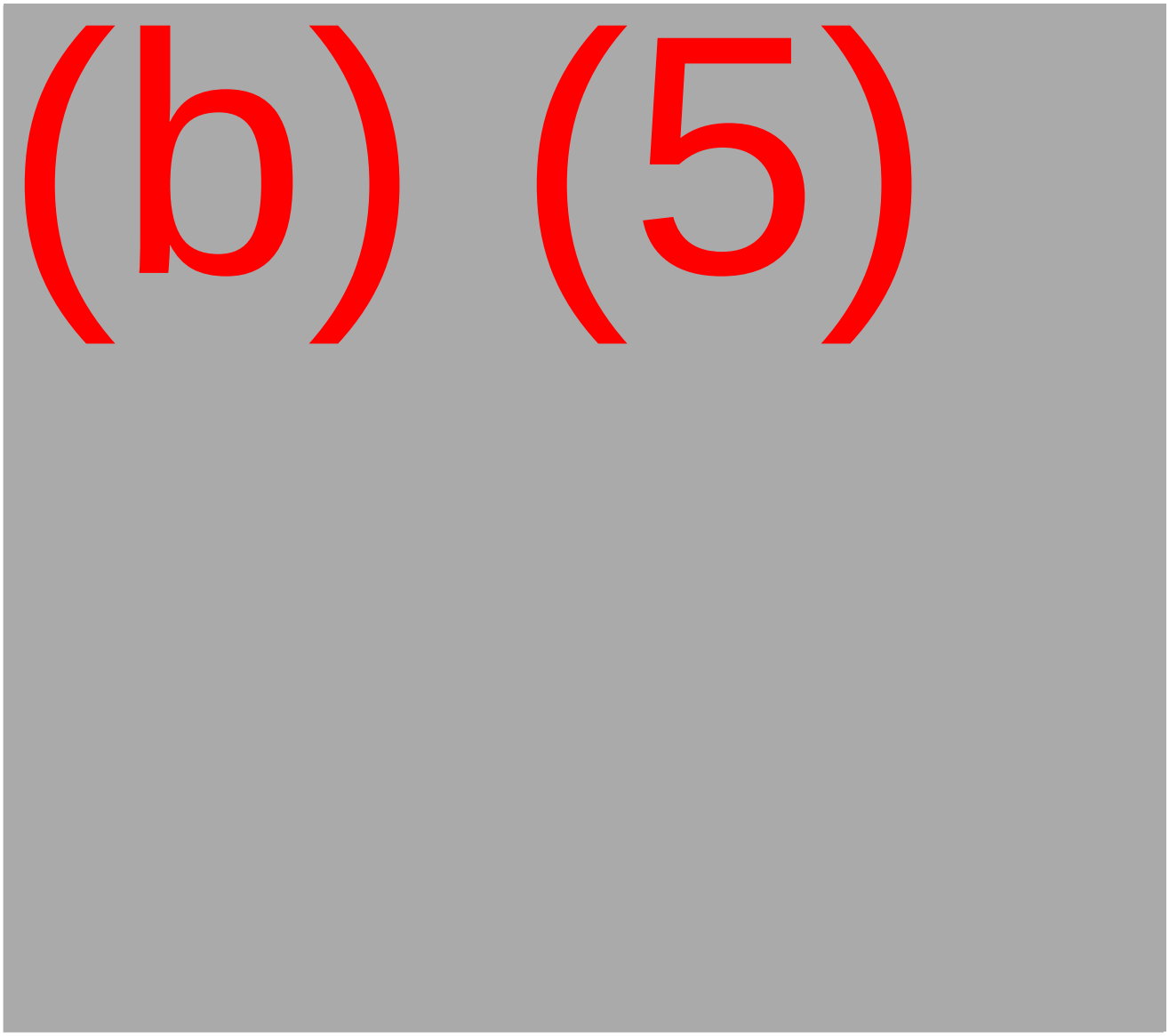
Objective 3: Increase the pit production staffing to the level required to support a sustained **30 ppy** production rate (b) (5)

Estimated Direct and Indirect Staffing Increase across LANL for the Pit Production Mission



The annual estimated cost for the required increases in enduring staffing and for one-time infrastructure investment projects is shown in the figure below. These functions are funded by programs within NA-10; the NNSA Office of Safety, Infrastructure, and Operations (NA-50); and the NNSA Office of Defense Nuclear Security (NA-70). At the direction of NNSA all costs are escalated at 3% annually. The estimated one-time infrastructure investment costs for line-item construction projects, Plutonium Sustainment equipment installation, and other small projects include all labor, materials, and overhead costs for project execution.

Estimated Costs at LANL for the Pit Production Mission



Through an in-depth analysis, LANL has increased its understanding of the site-wide needs to enable the pit production mission and developed an execution strategy. Through this effort, LANL has identified a number of actions and decisions needed from NNSA, LANL, and LLNL to enable this Plan. The most important and urgent actions to enable the success of this proposal are summarized below.

Authority	Actions
NNSA	• Request funding for the 30 ppy mission as described in this Plan. • Manage the DOE O 413.3B process and make related decisions to deliver the required infrastructure in time to achieve the 30 ppy mission. • (b) (7)(E), (b) (7)(F) •
LANL	• Recruit, hire, and train the workforce as identified in this Plan. • Assess LANL current infrastructure, staff, and programs to provide options for interim solutions to gaps identified in this Plan. • 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)
LLNL	• Finalize the pit production process qualification and pit certification requirements and establish an executable baseline schedule consistent with NNSA planned funding through the Pit PRT.
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.

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

(b) (5)

This Plan refines resource requirements and actions necessary for LANL to produce 30 ppy starting in 2026. NNSA and LANL will update this Plan annually, starting in April 2020 to support NNSA's federal budget requests.

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List of Acronyms

AC	Analytical Chemistry
ARIES	Advanced Recovery and Integrated Extraction System
B&R	Budget and Reporting Code
CAT III	Security Category 3
CBI	Capability Based Infrastructure
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
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
EIL	Equipment and Infrastructure List
EIS	Environmental Impact Statement
ES&H	Environment, Safety, and Health
FDR	Final Design Review
FPU	First Production Unit
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
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
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
MMP	Manufacturing Modernization Project
MR	Management Reserve
MR&R	Material Recycle and Recovery
NA-10	NNSA Office of Defense Programs
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
PA	Production Agency
PF-4	Plutonium Facility Building 4
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)
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
WIPP	Waste Isolation Pilot Plant
WR	War Reserve
XB	Introduction Box

1. Introduction

In May 2018, following the release of the *Final Report for the Plutonium Pit Production Analysis of Alternatives* and the *Pu Pit Production Engineering Assessment*, the Department of Energy (DOE) National Nuclear Security Administration (NNSA) recommended a two-site solution as the path forward for the nation's pit production requirements. NNSA directed Los Alamos National Laboratory (LANL) to deliver a minimum of 30 war reserve (WR) pits per year (ppy) (b) (5) starting in 2026 in support of NNSA's broader goal of producing at least 80 WR ppy starting in 2030. To provide consistency for integrating pit production planning efforts across NNSA organizations and sites, the NNSA Administrator directed the NNSA Office of Defense Programs (NA-10) to provide a framework to create the structure and conditions for NNSA to meet pit production milestones. NNSA released the *Preliminary Pit Production Implementation Framework* ("the Framework") in February 2019. In response, in April 2019 LANL issued the *Proposed Plan for Establishing the Capability for Safe, Secure, Reliable, and Efficient Production of a Minimum of 30 War Reserve Pits Per Year at Los Alamos National Laboratory by 2026*. This proposed plan, which was updated in May 2019, presented a schedule constrained, funding unconstrained approach.

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 fiscal year 2026
(b) (5)

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- Appendices with detail on the actions and decisions for NNSA and LANL, basis of cost estimates, risks, pit manufacturing fundamentals, scope and schedule of the LANL focus areas, and infrastructure investments.

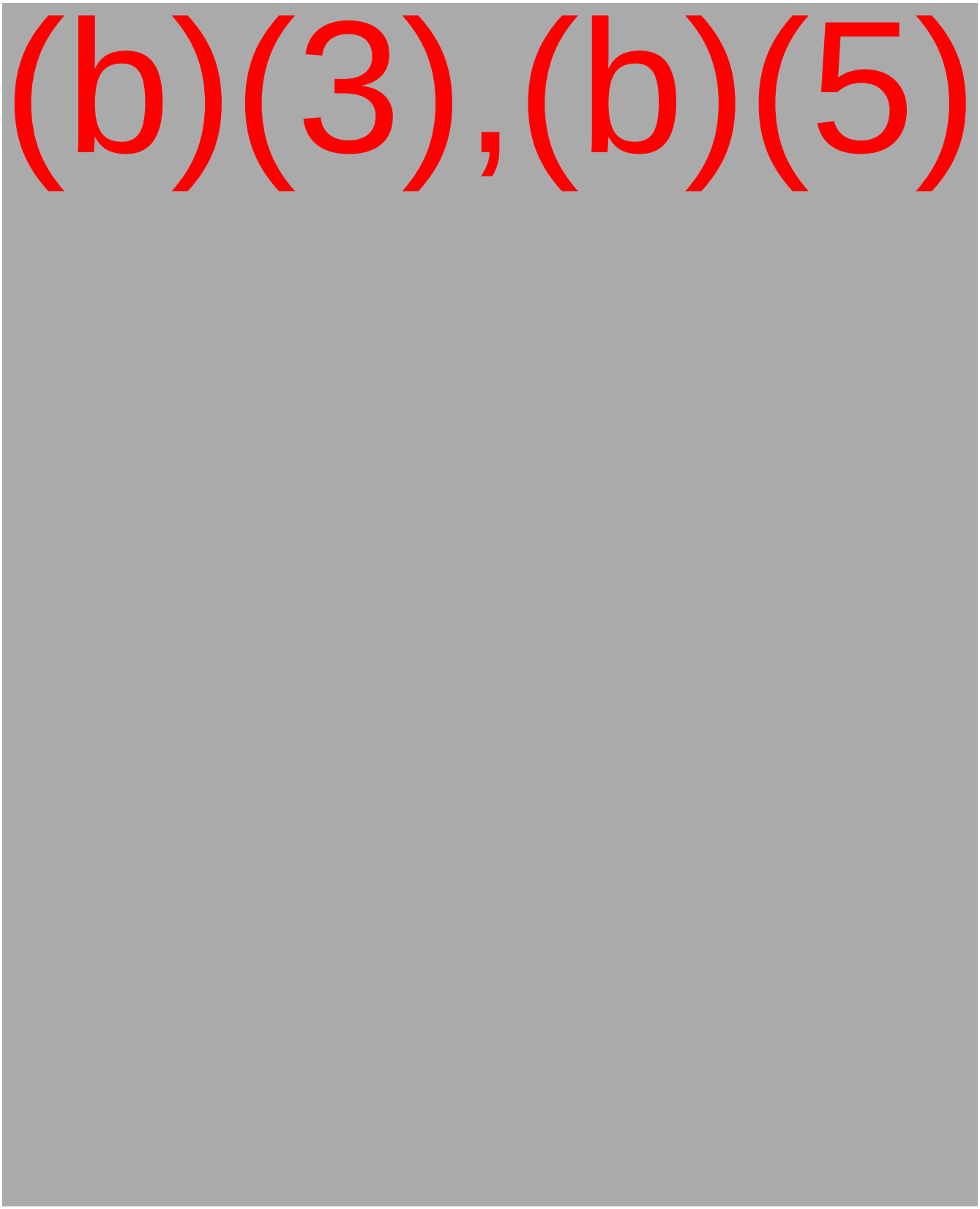
LANL recognizes and fully supports opportunities for collaboration and integration with Savannah River Site (SRS) for the successful execution of the overall mission to deliver at least 80 WR ppy by 2030; however, this Plan is specific to the pit production mission at LANL. LANL has taken significant steps to assist with the planned pit production mission at SRS, including providing current pit production process knowledge; engineering drawings and specifications for facility systems and process equipment; support for meeting National

Environmental Policy Act (NEPA) requirements; and information regarding safety, security, and quality programs. The scope and activities LANL that plans to perform in support of the 50 ppy mission at SRS are not included in this Plan. What is covered in this document is LANL's execution plan that includes developing, refining, tracking, and managing the schedule for pit production, infrastructure investments, and staffing to achieve the 30 ppy mission at LANL.

This Plan is organized into two main sections—(1) the scope and schedule for pit production, infrastructure acquisition, and staffing increases and (2) cost estimates. The appendices provide additional detail about elements of this Plan.

NNSA and LANL are committed to achieving success for all programs of record operating in TA-55 PF-4. Figure 1 provides a summary of what the programs of record require through 2026, as well as planned waste management, maintenance, and infrastructure investment projects. LANL has resource-loaded schedules in the project management software Primavera P6 for the activity in FY20 shown in Figure 1. LANL is first integrating and standardizing these schedules and will then extend them through 2026.

To execute all scope on schedule, LANL must expand the hours of TA-55 PF-4 availability for programmatic operations, maintenance, and construction activities as soon as possible. Extended hours would enable maintenance and construction work to be performed during off-shifts to free up the day shift for programmatic activity. The need to increase the hours of TA-55 PF-4 availability drives the urgent need to increase the security and facility operations workforce. (b) (5) The deliverables and milestones depicted in Figure 1 rely on an interconnected system of resources, infrastructure, and activities needed for execution of the required pit production capability and throughput at LANL. Figure 2 shows how TA-55 PF-4 will evolve to support the scope shown in Figure 1.



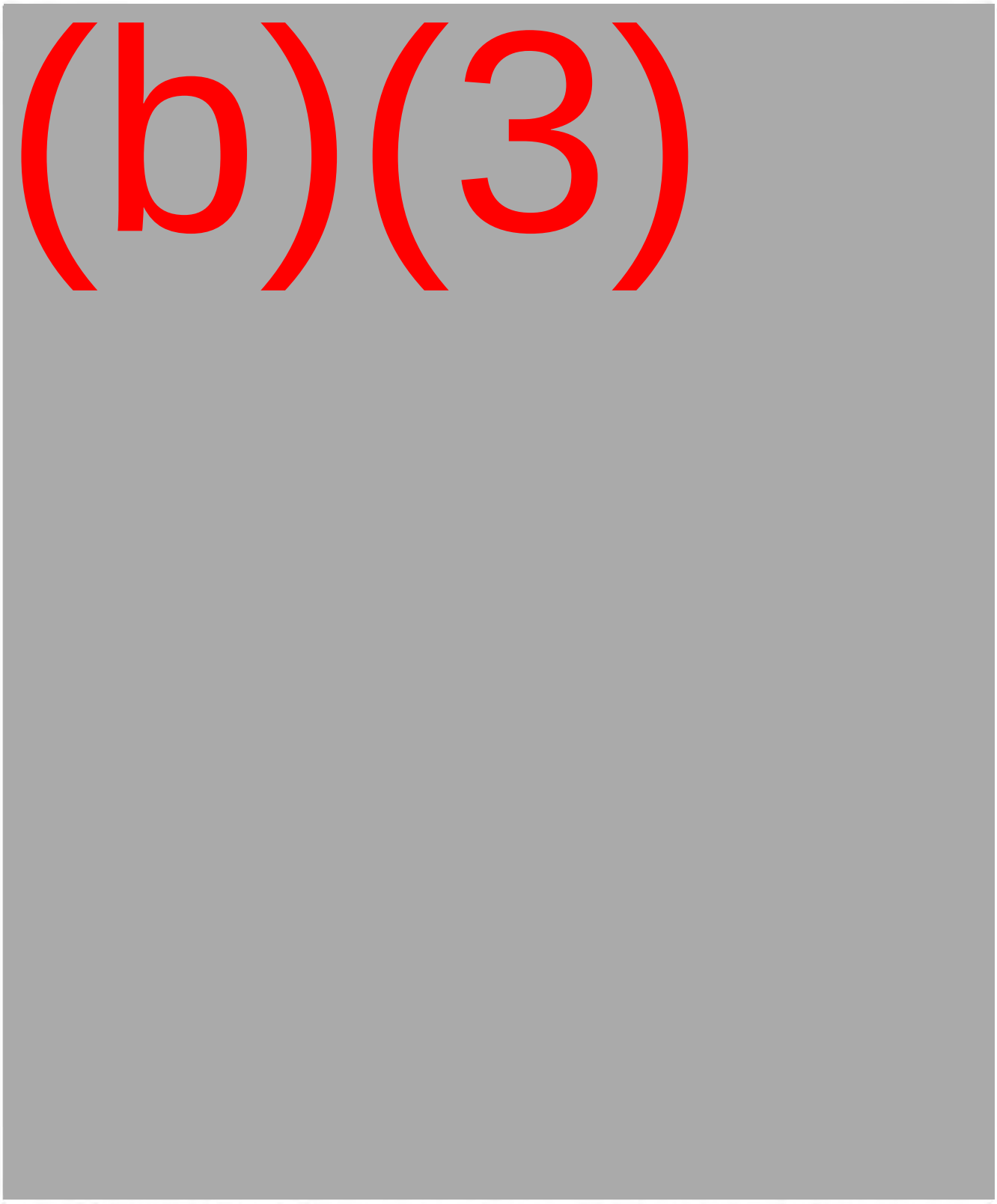


Figure 2. Program use of TA-55 PF-4 currently and in the future to accommodate the programs of record shown in Figure 1.

2. Program Execution and Infrastructure Acquisition

LANL has identified several substantial and highly interdependent challenges to achieving the pit production goals. The execution strategy for meeting these challenges is addressed in Sections 2.1 Governance, 2.2 Product Realization and Pit Production, 2.3 Infrastructure Investments, and 2.4 Staffing. Interim solutions (Section 2.5) are proposed for elements of the infrastructure that are not expected to be available when needed.

A summary-level schedule for the LANL-wide activities associated with achieving the 30 ppy mission is shown in Figure 3.

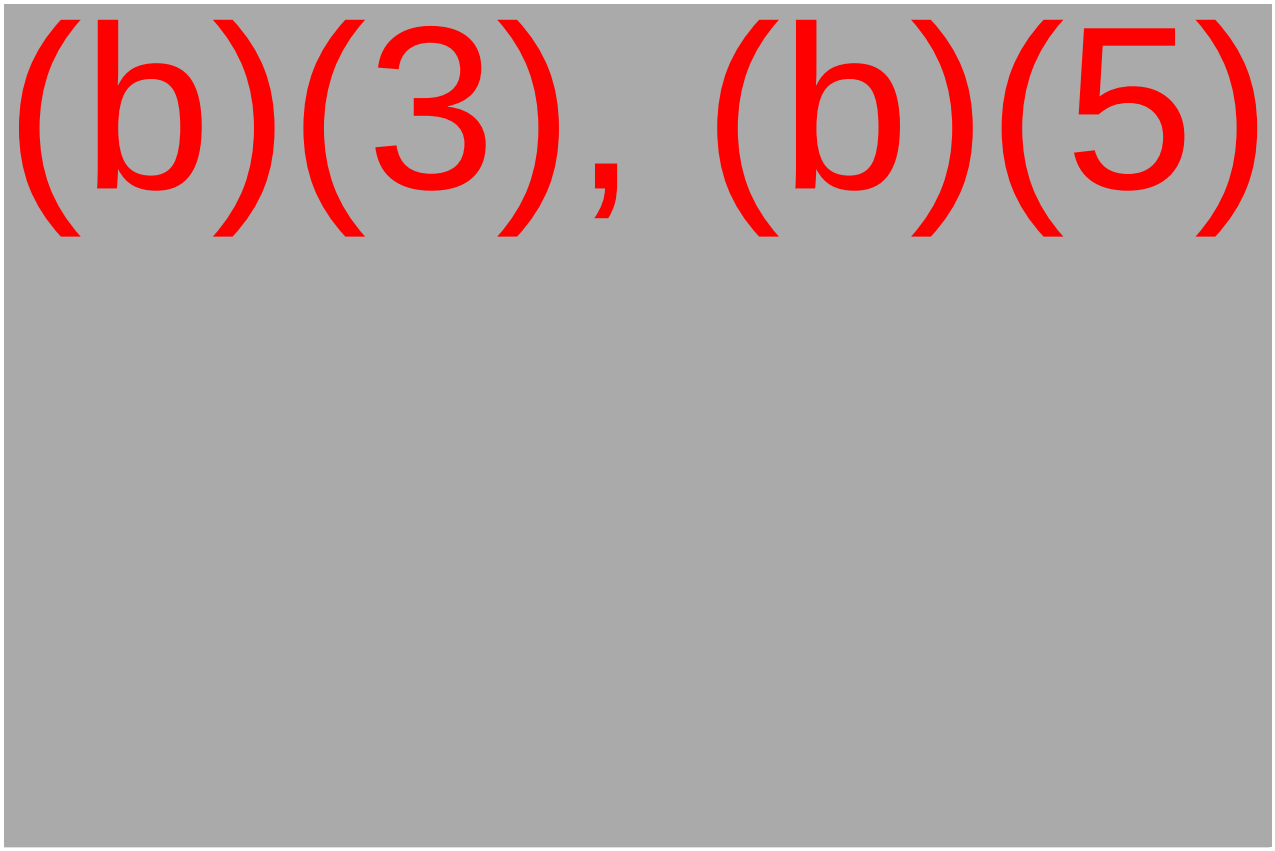


Figure 3. Summary schedule to achieve the 30 ppy mission at LANL including critical NNSA actions and decisions.

2.1 Governance

During the proposal and transition phases of the LANL management and operating contract, Triad recognized the challenges of managing the pit production mission within the existing construct where multiple organizations were responsible for, and have the ability to affect, that mission. As part of the contract transition, LANL was reorganized to improve mission execution. Among the changes was the creation of a new position, the Associate Laboratory Director for Weapons Production (ALDWP), responsible for weapons production deliverables (including pits) and for TA-55 facility operations. The ALDWP position will continue throughout execution of this Plan. The ALDWP is the member of the LANL Leadership Team with primary responsibility for development and delivery of the 30 ppy mission. Reporting to the ALDWP is a Chief Planning

Officer responsible for integrated planning across the Weapons Production directorate—particularly for plutonium missions conducted at TA-55 (with an emphasis on pit production).

To better implement this Plan, LANL established an enhanced program management model for the pit production mission and assigned a Pit Production Director who reports directly to the ALDWP. The overall organizational relationships are shown in Figure 4, and the success of LANL's pit production mission requires close coordination among all entities. The ALDWP and the Laboratory Director's Office discuss status, risks, and emerging issues associated with the 30 ppy mission at least monthly.

Although the ALDWP maintains the responsibility to deliver the 30 ppy mission, the Pit Production Director is responsible to the ALDWP for overseeing day-to-day execution of this Plan. The Pit Production Director directs a team of program managers and execution staff to plan, manage, and integrate discrete program elements in accordance with the established LANL Integrated Safety Management System (ISMS) and associated policies. The Pit Production Director and associated program managers coordinate with the execution organizations across LANL to define requirements, cost, schedule, resources, risks, deliverables, and milestones for their assigned projects. The performance baseline is evaluated weekly to identify variances above a defined threshold. If such a variance occurs, the Pit Production Director communicates to the ALDWP the details of the situation and the actions to recover.

LANL will establish a Pit Production Steering Committee, chaired by the LANL Pit Production Director, with senior leadership members from LANL, LLNL, NNSA Los Alamos Field Office (NA-LA), and NNSA headquarters. SRS may also be included as a member if it is determined that the committee is an effective mechanism for sharing lessons learned and coordinating efforts, beyond what occurs via LANL support to develop a pit production capability at SRS for their 50 ppy mission. The steering committee will be governed by a charter agreed to by all members. The steering committee will monitor Plan execution to identify issues as early as possible and facilitate their resolution. The Pit Production Steering Committee for the 30 ppy mission at LANL and the NNSA Matrixed Execution Team for the complex-wide 80 ppy mission will have common membership and work closely together. NNSA and LANL will integrate the objectives of the Pit Production Steering Committee into those of the NNSA Matrixed Execution Team.

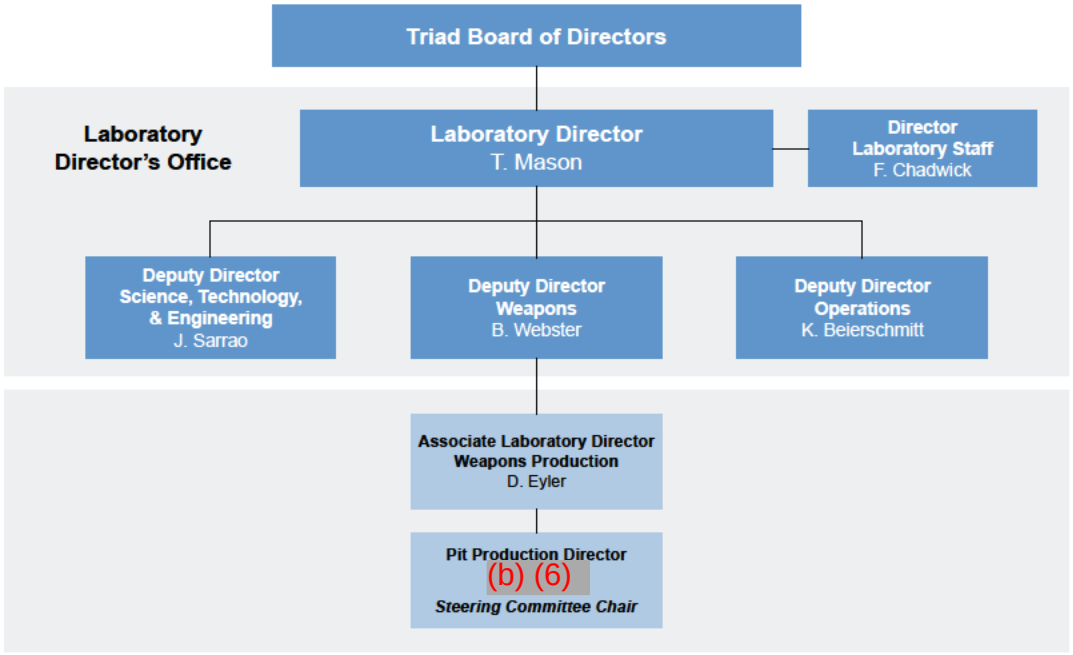


Figure 4. Organization and reporting structure for the Pit Production Director position.

2.2 Product Realization and Pit Production

The NNSA requirement for LANL to first achieve FPU in 2023 and then to 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. This section presents LANL's strategy to advance the technology and manufacturing readiness levels in time to complete LLNL DA pit certification activities and produce the WR FPU in 2023. The technical approach and required production equipment to ramp up to a steady-state production of 30 ppy is also discussed. The capability LANL will establish to make 30 ppy starting in 2026 provides the capability to produce the pits within the active stockpile, which include pits designed and maintained by both the LANL DA and the LLNL DA.

The product realization activities that LANL and LLNL will undertake and the key challenges are discussed below. For the purpose of this Plan, the pit to be produced for the 30 ppy mission ("the Pit") is a modified version of a pit currently in the active stockpile. The pit that the Pit's design is based on is referred to as the "Legacy Pit." The Pit is intended for use in an emerging nuclear weapon system to be acquired through an NNSA weapon acquisition program. This Plan addresses the actions LANL must take to achieve the pit production goals and does not discuss the activities at other NNSA sites.

The NNSA-chartered Pit Product Realization Team (PRT) established a baseline schedule for product realization 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 (EE) and other activities. A summary of the PRT's product realization schedule is shown in Figure 5. This figure reflects the Pit PRT baseline schedule, which is subject to change as the PRT updates the status, plans, and requirements associated with the product realization process. Relative to the product realization for other WR components, 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, which must be completed prior to FPU delivery in 2023. As of September 2019, Figure 5 is consistent with the planning of the EE's through the PRT. The PRT is refining the order and schedule of the EEs to support delivery of FPU in 2023.

To reduce the possibility of delays to the EE schedule, LANL is leveraging the experience gained from the production and certification of the Legacy Pit at the Rocky Flats Plant and the W88 pit at 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:

- Changing the Pit design and certification requirements by the LLNL DA;
- Swapping the date for executing the physics certification experiment at U1a with that of a later subcritical experiment in NNSA's baseline schedule for U1a experiments; and
- Performing some of the Pit certification experiments after 2023 for better alignment with the weapon's system-level testing.

As LANL executes the product realization activities shown in Figure 5, 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 product realization process to achieve FPU.

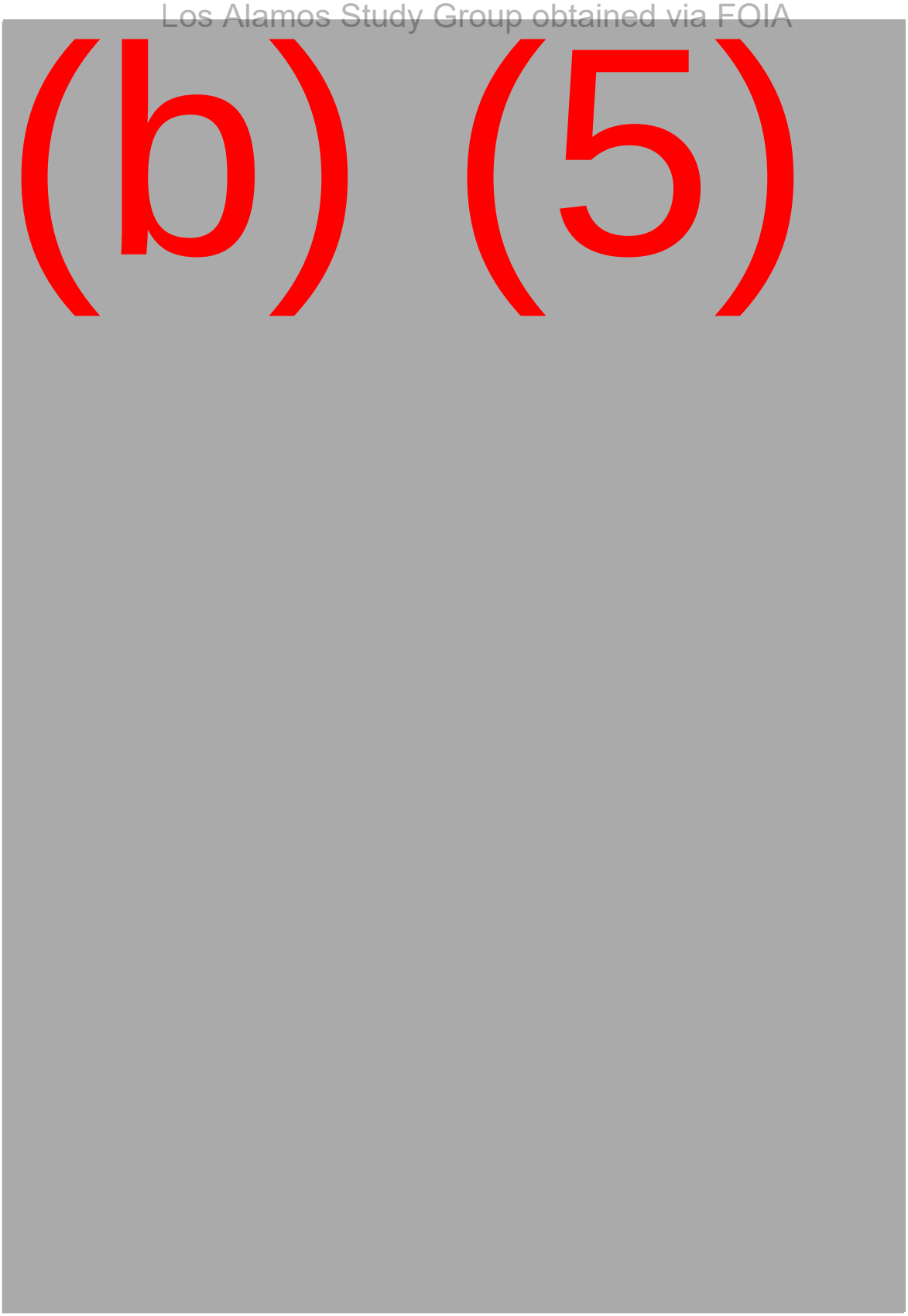
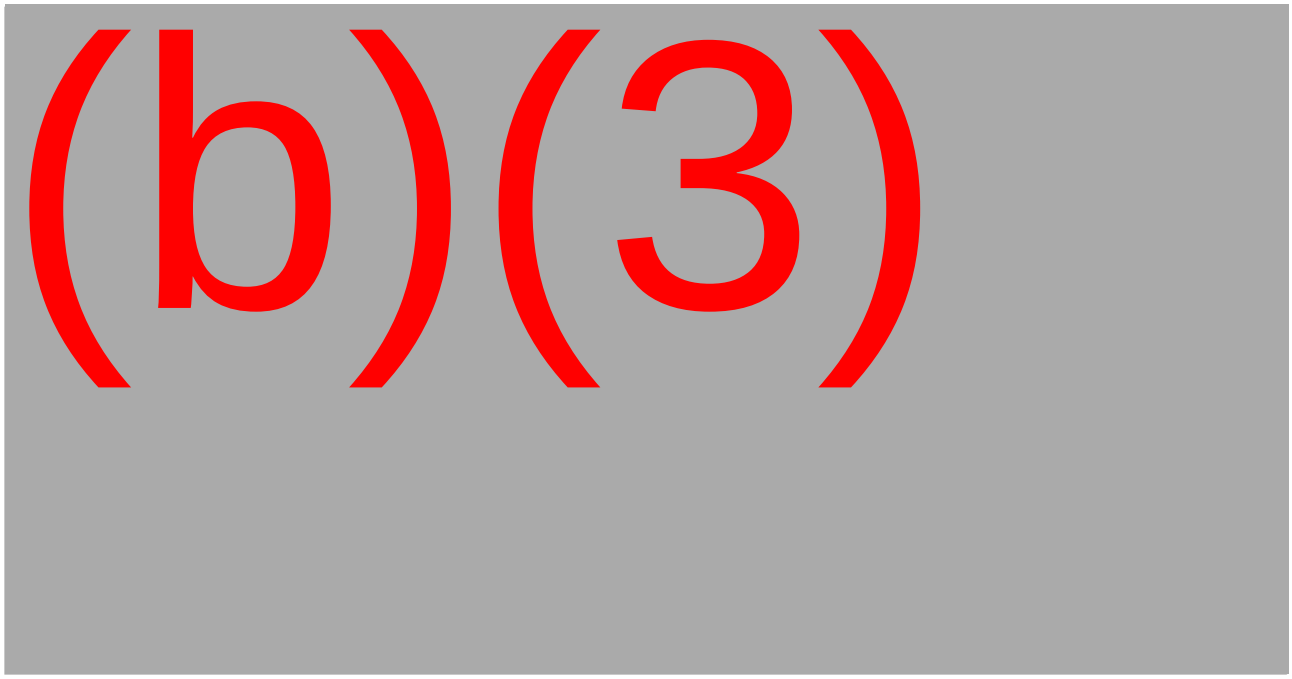


Figure 5. The Pit PRT summary-level schedule to produce FPU in 2023.

Figure 6 shows the planned final configurations (b) (7)(E), (b) (7)(F) . 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 table below shows the remaining equipment and capabilities to be installed to produce 30 ppy.

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

Concurrent with the installation, startup, and WR qualification of the equipment required to produce 30 ppy, LANL will improve pit production efficiency to reduce the time to produce one pit (b) (5) At a 30 ppy production rate, TA-55 PF-4 must be reliably available 40 weeks per year for dedicated programmatic work on the day shift (maintenance and construction will occur in (b) (5)

2.3 Infrastructure Investments

The strategy for constructing, installing, and modifying equipment, facilities, and utilities at LANL in time for pit production requirements and staffing support is discussed in this section. These extensive infrastructure investments have multiple issues that need to be resolved: the FY20–FY24 Future Years Nuclear Security Program (FYNSP) funding profile is inadequate; significant construction work must be coordinated within a small and congested location; and requirements for some of the new facilities are not fully defined. (b) (5), (b) (7)(E), (b)

LANL receives funding from many sources within NNSA to establish, upgrade, and maintain the physical infrastructure across LANL to meet the expanded pit production mission. 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 30 ppy mission, LANL has compiled all projects that support the pit production mission into a single, integrated, prioritized list—the Equipment and Infrastructure List (EIL). Specifically, the EIL (provided in Appendix G) captures the infrastructure investments, (b) (5) required to achieve the 30 ppy mission from the following:

- Plutonium Sustainment
- Chemistry and Metallurgy Research Replacement (CMRR)
- TA-55 Reinvestment Project III (TRP III)
- Transuranic Liquid Waste (TLW) Facility
- Recapitalization
- Facility Maintenance
- Material Recycle and Recovery (MR&R)
- Capability Based Infrastructure (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

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

The infrastructure investments include numerous 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. There are three categories of infrastructure investments—Plutonium Sustainment projects, line-item projects, and small projects. Execution of infrastructure investment projects follows the processes shown in Figure 7.

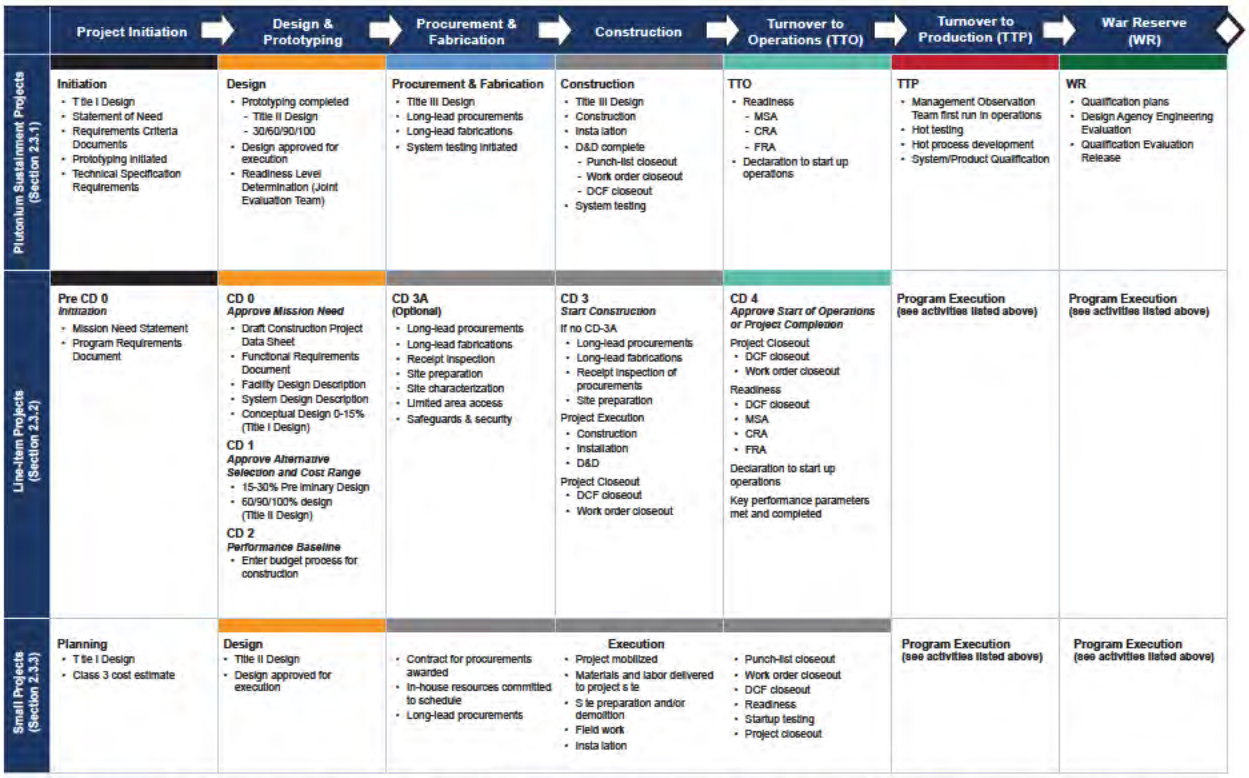


Figure 7. Process for achieving TTO, TTP, and WR with the key activities, deliverables, stage gates, and decision points by project category. Colors align with project schedules shown in later figures.

Figure 8 and Figure 9 show the program-defined TTO need dates (not planned execution dates) for the process equipment and facility infrastructure captured in the EIL. The process equipment is sorted by major process step in the pit production flow sheet (see Appendix D) and the infrastructure investments are sorted by facility. Many pieces of equipment and infrastructure are required to be completed by the same date. LANL used the prioritized EIL to develop an integrated execution strategy, which is discussed in more detail in the following sections.

Figure 8. Pit production mission defined TTO need dates (not planned execution dates) for process equipment.

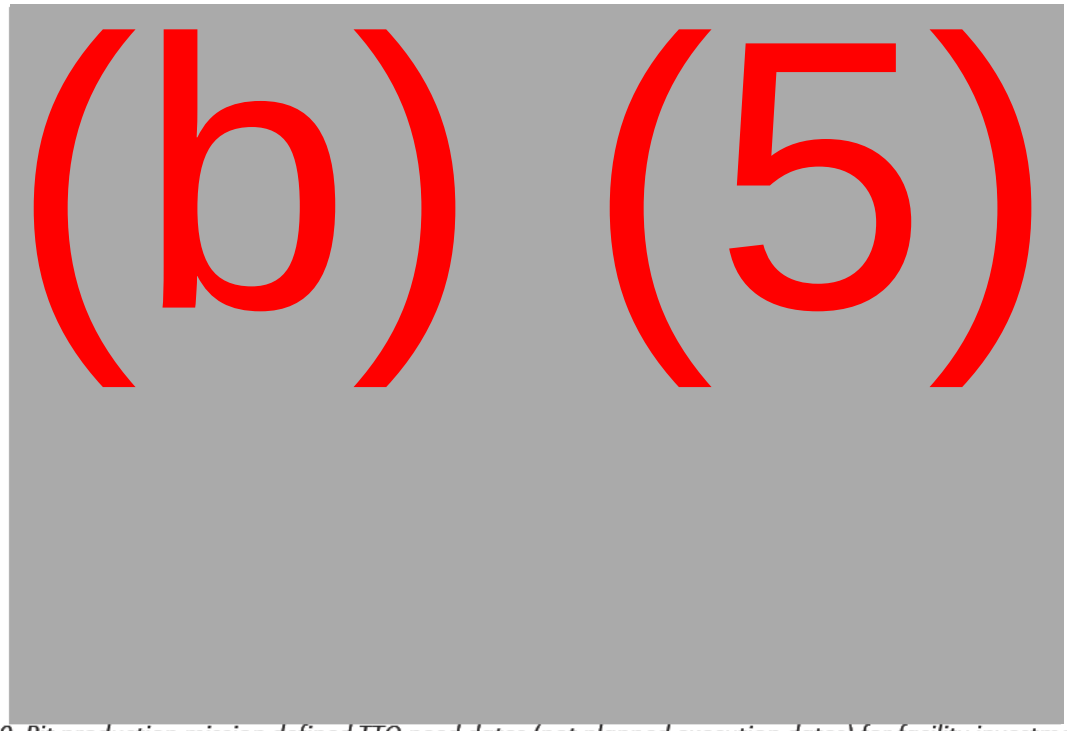


Figure 9. Pit production mission defined TTO need dates (not planned execution dates) for facility investments.

2.3.1 Plutonium Sustainment Projects

The Plutonium Sustainment program provides the funding and direction for installation of the process equipment and gloveboxes in TA-55 PF-4 required to produce 30 ppy. The projects include decontaminating and decommissioning (D&D) legacy process equipment, equipment and glovebox refurbishments, and installation of new process equipment and gloveboxes in TA-55 PF-4. Each project has a TTO need date determined by assessing when it must be available for use to support the Pit PRT schedule. (b) (5) hese TTO need dates are one year earlier than when the equipment is needed to be used for pit production to allow time after TTO to first complete TTP and then for the equipment to be approved for WR use (if required). Figure 10, Figure 11, and Figure 12 show high-level planned execution schedules, with the corresponding TTO need dates, for the projects managed through the Plutonium Sustainment program. These projects are being planned and executed according to the process described in Figure 7. Figure 13 and Figure 14 provide addition detail on the sequence and schedule for D&D and equipment installation (b) (7)(E), (b) (7)(F) .

(b) (5), (b) (7)(E), (b) (7)(F) The following measures are available to mitigate this issue:

To achieve production of 30 ppy (b) (5)

- (b) (5), (b) (7)(E), (b) (7)(F)
- Improve performance for glovebox D&D and installations.
- Use the experience gained in achieving TTP and WR for the equipment required for FPU to accelerate the TTP and WR schedule for the second and third sets of identical equipment required to produce 30 ppy.

To allow for up to 30 ppy production (b) (5)

- Improve pit production efficiency to reduce the scrap rate during 30 ppy production. This will allow LANL to produce (b) (5)
- Temporarily reduce the scope of other programs operating in TA-55 PF-4 to provide a cleared, trained, and ready workforce to support pit production. (b) (5)
- Use overtime and extended hours for the planned single-shift workforce to surge for a 1–2 year timeframe while the remaining equipment to produce 30 ppy is installed and approved for WR use.

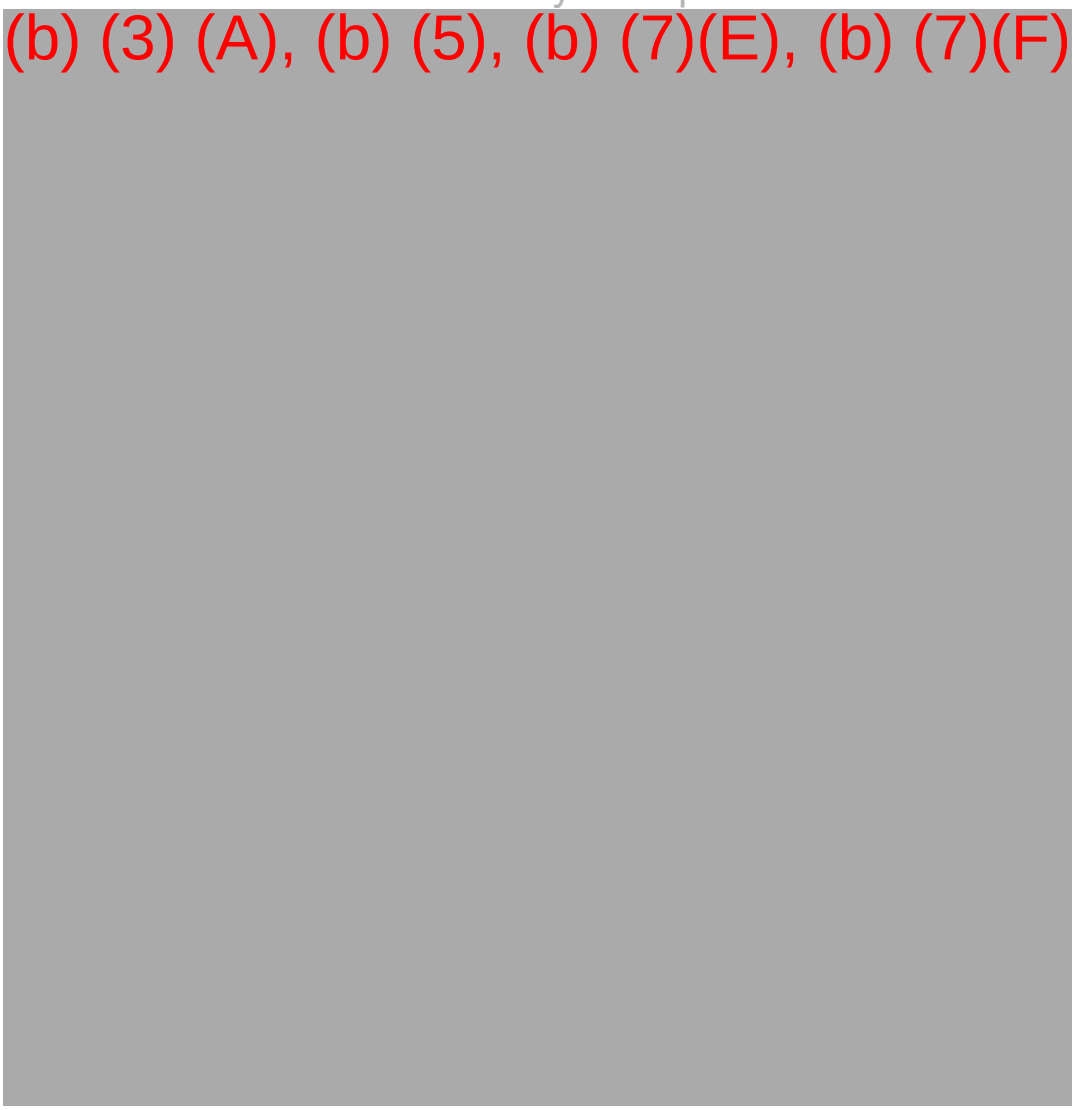


Figure 10. High-level schedules of the metal and foundry infrastructure scope associated with the Plutonium Sustainment program.

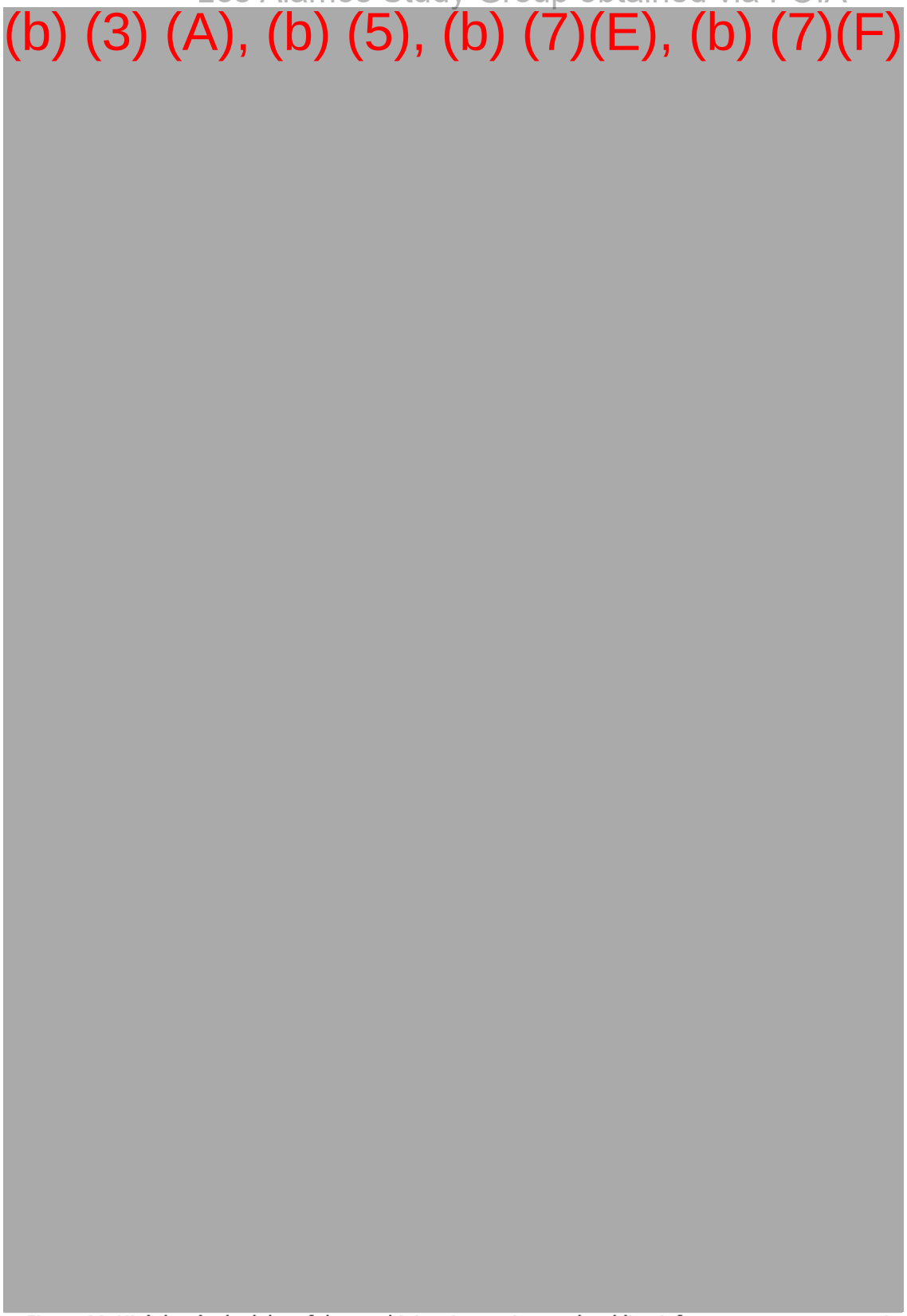


Figure 11. High-level schedules of the machining, inspection, and welding infrastructure scope associated with the Plutonium Sustainment program.

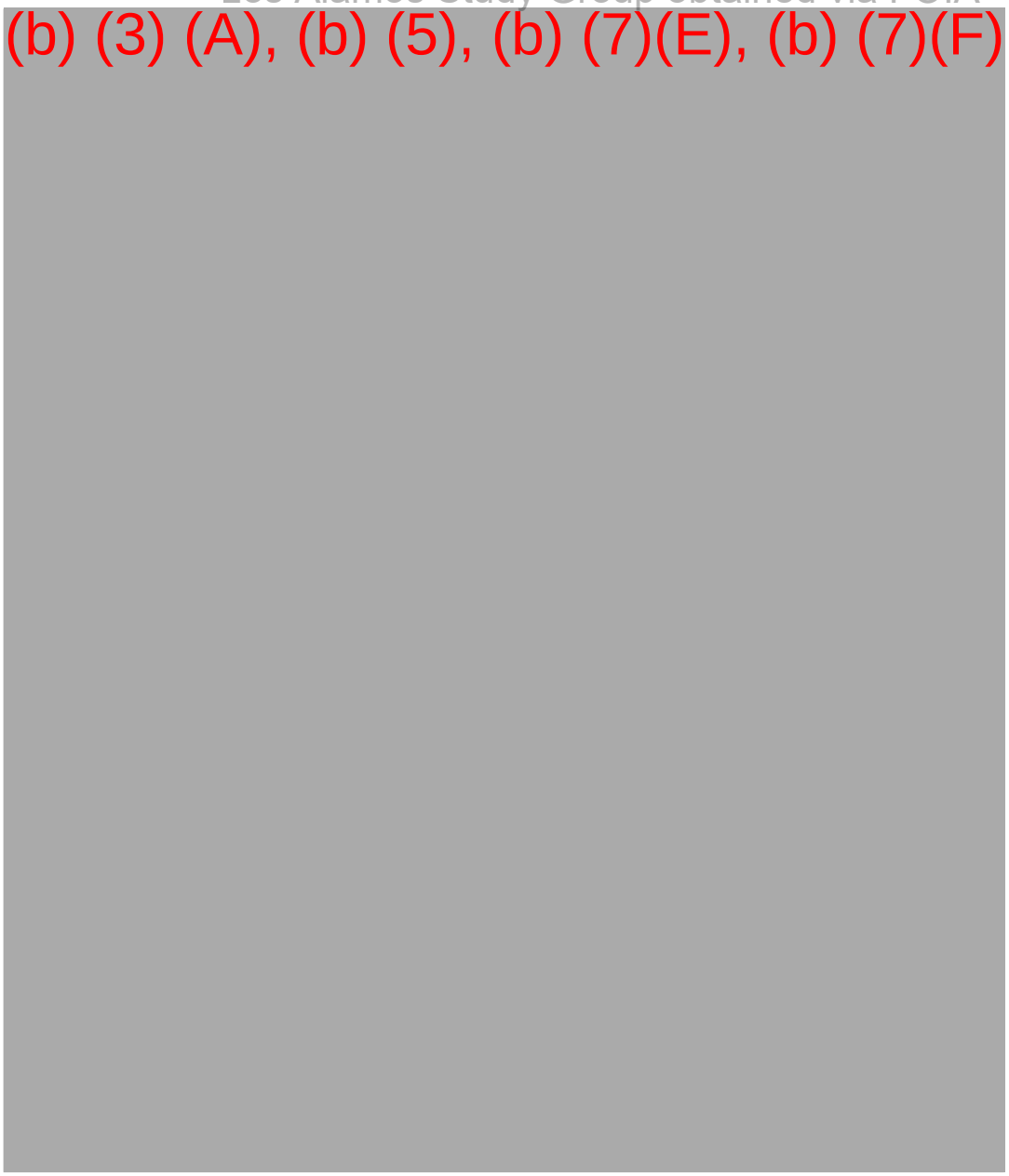


Figure 12. High-level schedules of the assembly, metallography, and support infrastructure scope associated with the Plutonium Sustainment program.

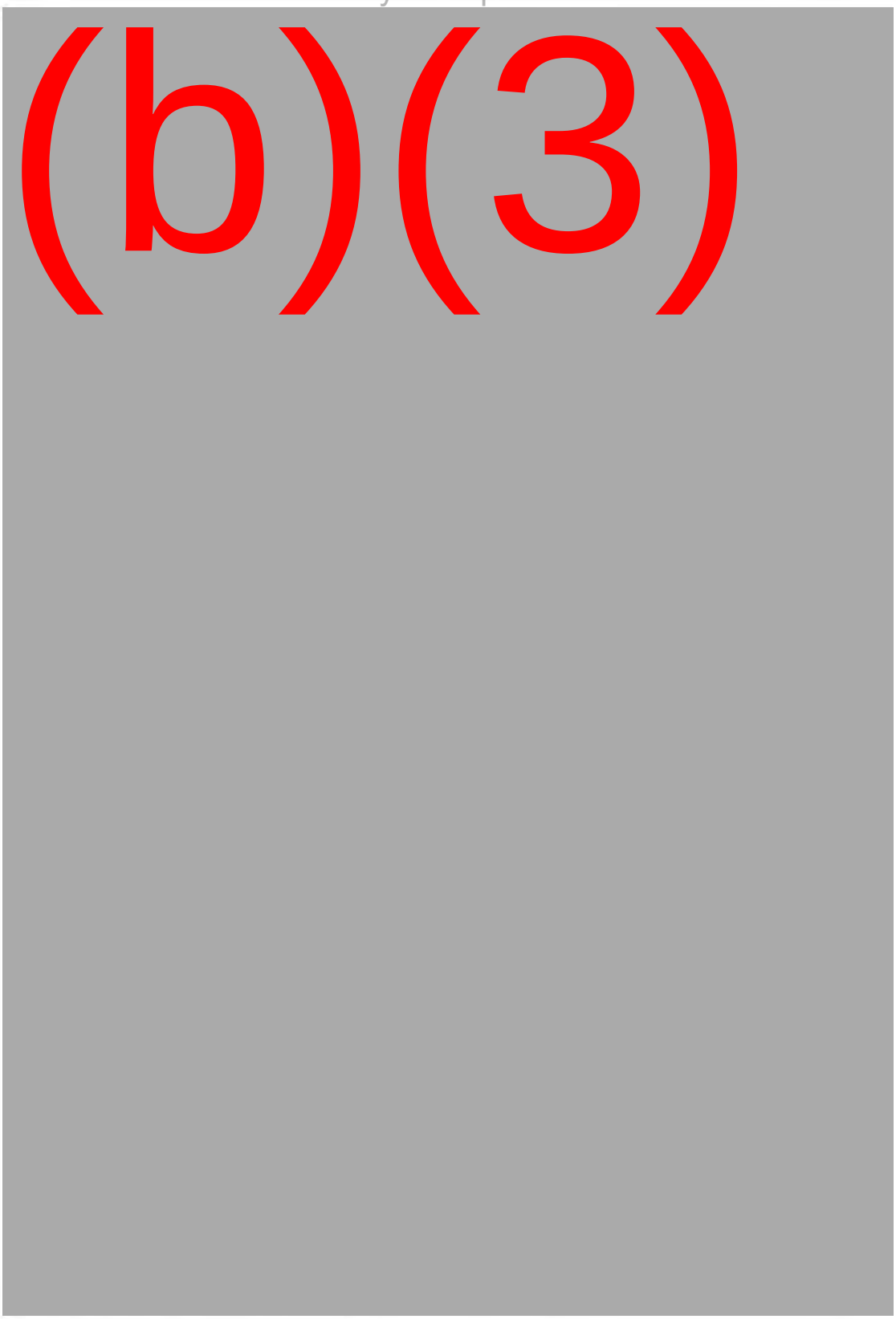


Figure 13. Time-phased D&D and installation of equipment for the (b) (7)(E), (b) (7)(F)

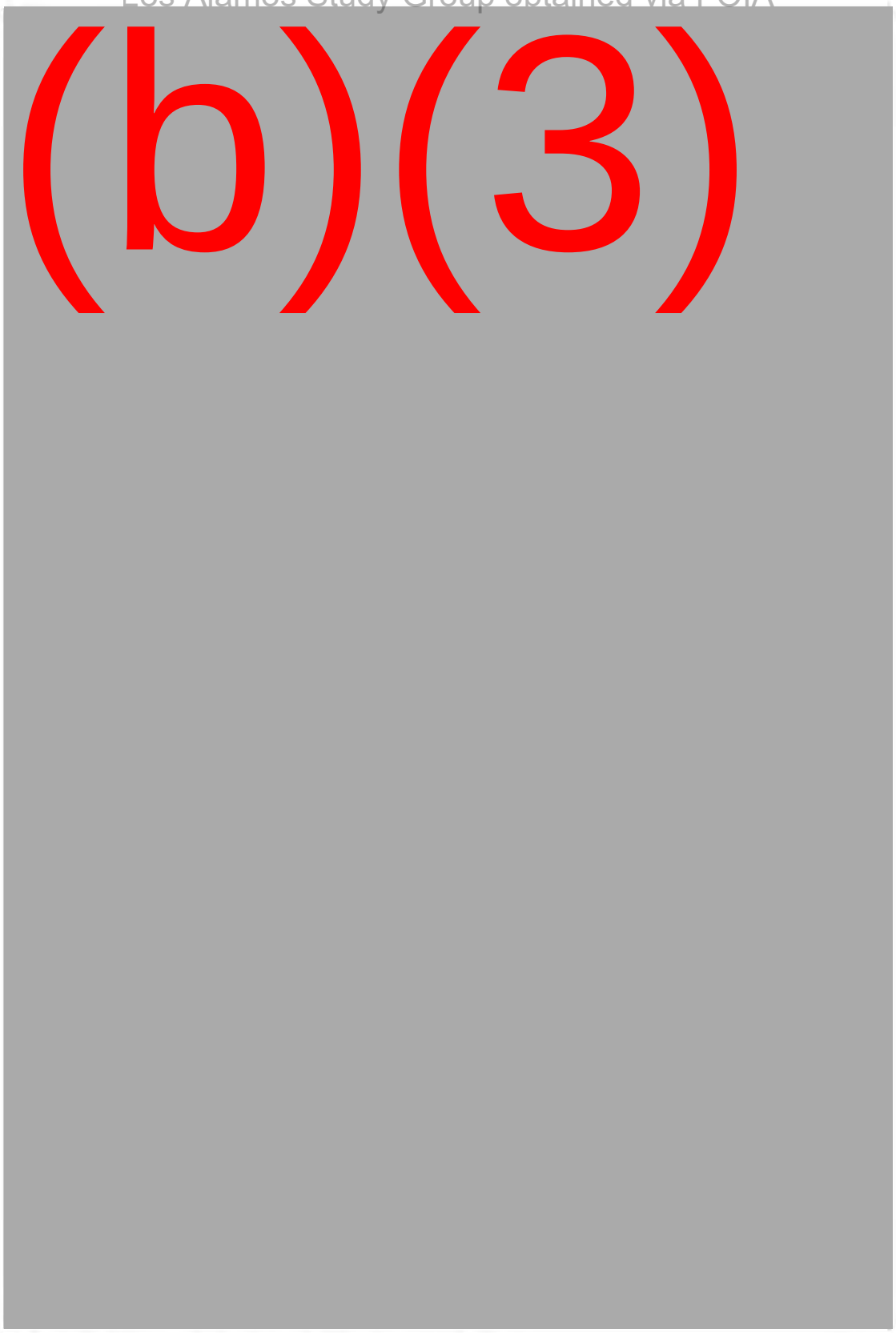


Figure 14. Time-phased D&D and installation of equipment for the (b) (7)(E), (b) (7)(F)

2.3.2 Line-Item Projects

LANL has completed seven line-item projects and has three more (CMRR, TRP III, and TLW) in progress to enable pit production and the other enduring 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 7. Many elements of the infrastructure required for the 30 ppy mission will be established along the Pajarito corridor at LANL. A map showing the conceptual design and location of some of these elements is shown in Figure 15.

To execute these projects, a significant increase in the number of craft is required. LANL's goal is for dedicated crews on multiple work fronts operating on two shifts. LANL must 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.

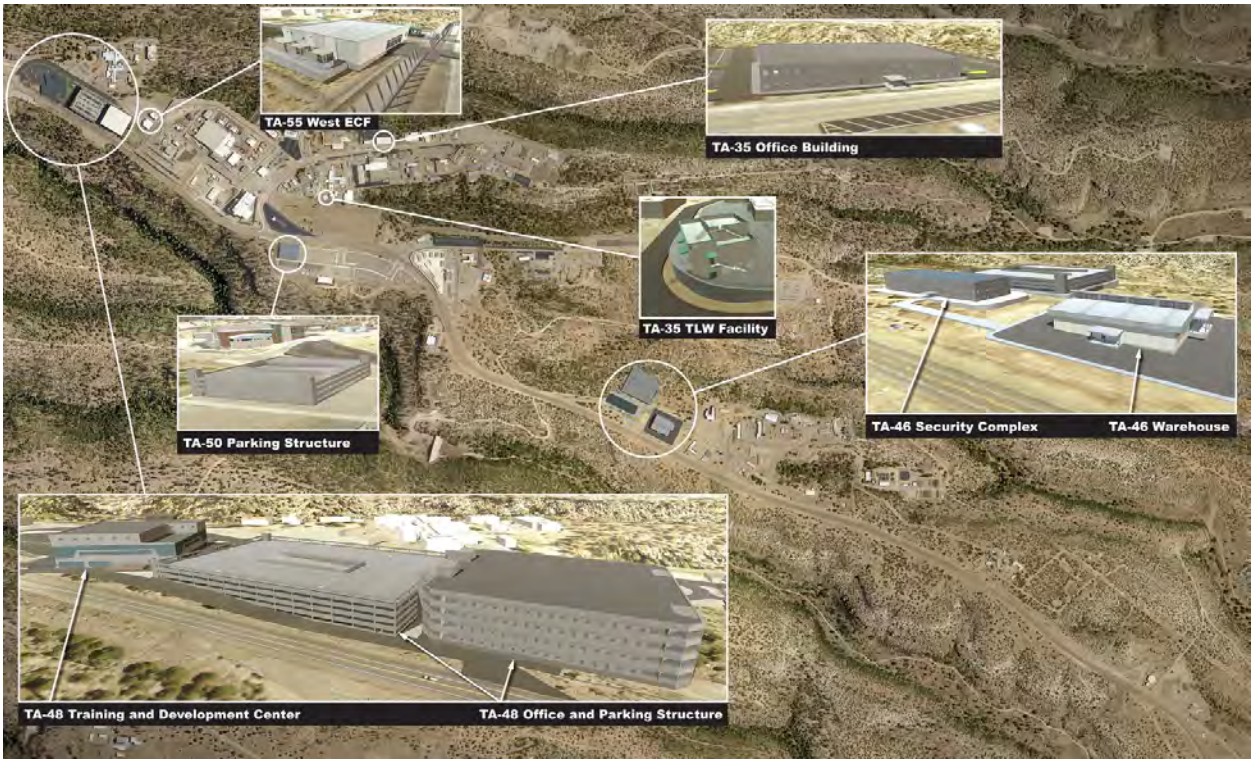


Figure 15. Infrastructure investments along the Pajarito corridor that are planned to enable the 30 ppy mission.

2.3.2.1 Chemistry and Metallurgy Research Replacement (CMRR) Project

The CMRR project establishes the infrastructure and relocates and consolidates actinide analytical chemistry (AC), materials characterization (MC), and research capabilities that support all plutonium programs at LANL. Specifically, the CMRR subprojects include upgrades to RLUOB, TA-55 PF-4, and infrastructure along the Pajarito corridor. The schedules for the CMRR subprojects are shown in Figure 16. Two CMRR subprojects are currently in the construction phase—RLUOB Equipment Installation Phase 2 (REI2) and PF-4 Equipment Installation Phase 1 (PEI1). The REI2 and PEI1 subprojects have received Critical Decision 3 (CD-3) approval and are expected to achieve CD-4 in mid-FY21, which is approximately 12 months before the CD-4 date listed in the CMRR Construction Project Data Sheet, which includes federal schedule contingency.

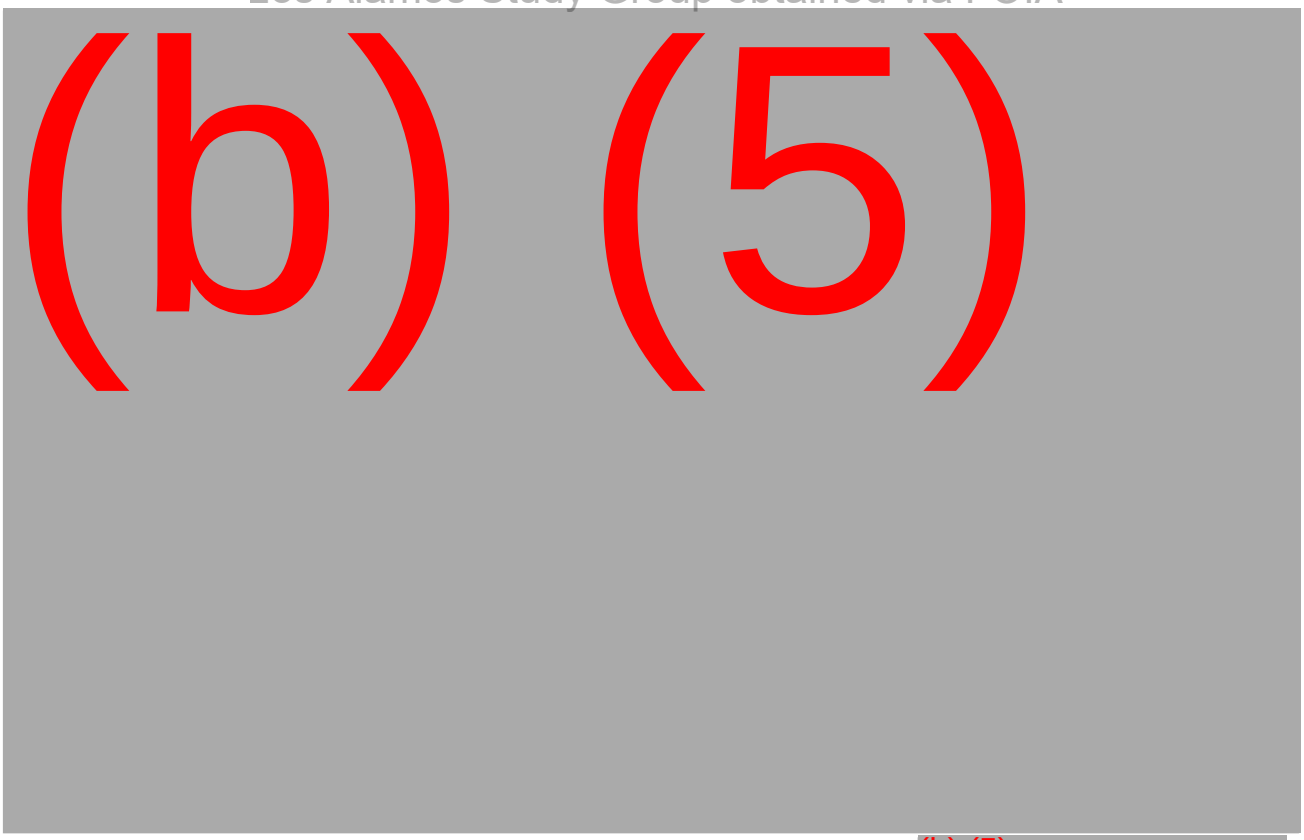


Figure 16. High-level schedules of the infrastructure scope associated with CMRR. (b) (5)

(b) (5)

RLUOB Subprojects:

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. Specific capabilities that will be installed by this subproject include but are not limited to the following:

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

REI2 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.

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

The RC3 subproject completes the build-out of AC and MC characterization equipment in RLUOB. This project includes the installation of gloveboxes, open-front hoods, and standalone equipment required for robust AC and MC operations. This subproject will be completed after the elevation of RLUOB to a Hazard Category 3 (HC-3) Nuclear Facility (limited to 400 g of Pu-239 equivalent). This increase in the material at risk (MAR) limit to 400 g will further improve the utilization of RLUOB to reliably support the AC and MC requirements for all plutonium missions. Specific capabilities that will be installed by this subproject include but are not limited to the following:

- Coulometry
- Iron spectrophotometry
- Interstitials analysis
- Ion chromatography
- Expanded staff change rooms

TA-55 PF-4 Subprojects:

PF-4 Equipment Installation Phase 1 (PEI1) Subproject

The PEI1 subproject consolidates and collocates TA-55 PF-4 processes by repurposing some existing gloveboxes for new processes, removing other gloveboxes/equipment, and installing new gloveboxes/equipment where needed. PEI1 supports the AC and MC capabilities that require the processing of larger amounts of nuclear material into small samples prior to analysis in RLUOB. Specific capabilities that will be installed by this subproject include but are not limited to the following:

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

PF-4 Equipment Installation Phase 2 (PEI2) Subproject

The PEI2 subproject will establish robust and advanced MC capabilities to support all plutonium missions and maintain LANL as the nation's Plutonium Center of Excellence. This subproject installs the MC capabilities in TA-55 PF-4 by consolidating and relocating existing capabilities, replacing existing equipment, installing gloveboxes and equipment, and D&D of legacy equipment. Specific capabilities that will be installed by this subproject include but are not limited to the following:

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

The first action is to complete the D&D and disposition of the remaining gloveboxes and pencil tanks in (b)(3) . New equipment for MC can then be installed in (b)(3) . After completion of the (b)(3) MC equipment installations, LANL will D&D the legacy MC equipment (primarily in (b)(3)).

Infrastructure Subprojects:

LANL requires the following infrastructure in and around TA-55 primarily to support the large increase in staffing for pit production.

- TA-48 Office and Parking Structure – approximately 900 offices and 1600 parking spaces
- TA-48 Plutonium Training, Support, and Development Center – multipurpose facility with training and development facilities, a cafeteria, a large auditorium, and approximately 300 offices
- (b) (7)(E), (b) (7)(F)
- TA-55 PF-3 Change Room Expansion – change rooms with approximately 600 additional lockers
- TA-55 West Entry Control Facility (ECF) – similar to the TA-55 East ECF
- TA-55 West Vehicle Access
- TA-55 East Vehicle Access
- (b) (7)(E), (b) (7)(F)
- TA-46 Security Complex – 50–75 offices with space for an additional 250–300 protective force officers and support staff to muster and perform shift change activities
- TA-55 Warehouse – approximately 60,000 sq ft warehouse for WR bonded storage, facility critical spares, and other program supplies

2.3.2.2 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 with the addition of a second alarm panel for the non-nuclear facilities at TA-55. The TRP III project 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 National Fire Protection Association or Americans with Disabilities Act compliant, 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. The

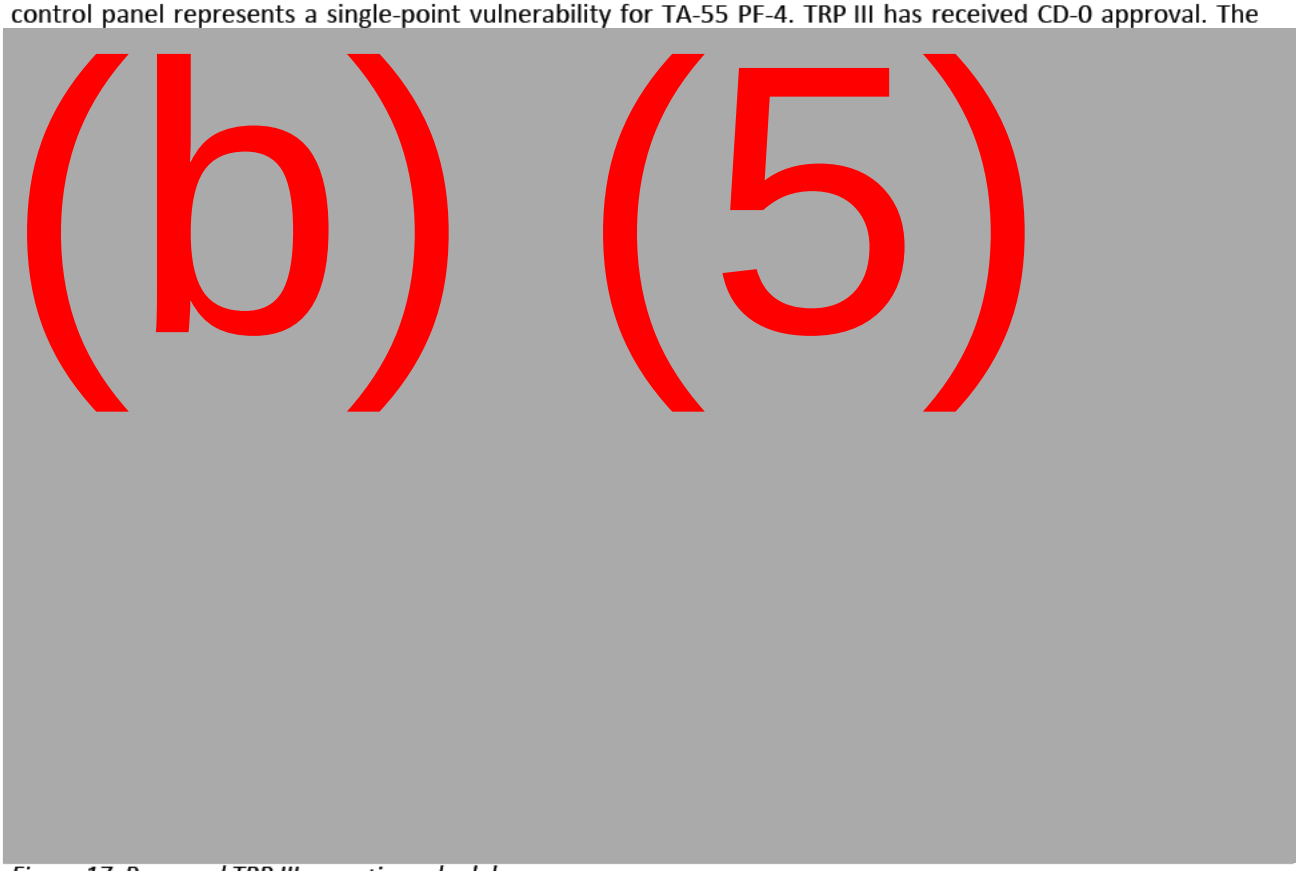


Figure 17. Proposed TRP III execution schedule.

2.3.2.3 Transuranic Liquid Waste (TLW) Facility

The TLW facility project replaces the antiquated TRU liquid waste treatment capability by establishing a more reliable TLW processing facility. The existing TRU liquid waste capability is in the Radioactive Liquid Waste Treatment Facility (RLWTF) at TA-50, which was constructed in 1963. The TLW facility will be an independent HC-3 nuclear facility designed to treat 29,000 liters of liquid TRU wastewater per year. The design capacity is based on supporting the programs of record for all plutonium-related missions in TA-55 PF-4, including pit production at a minimum of 30 ppy.

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.(b) (5)

(b) (5)

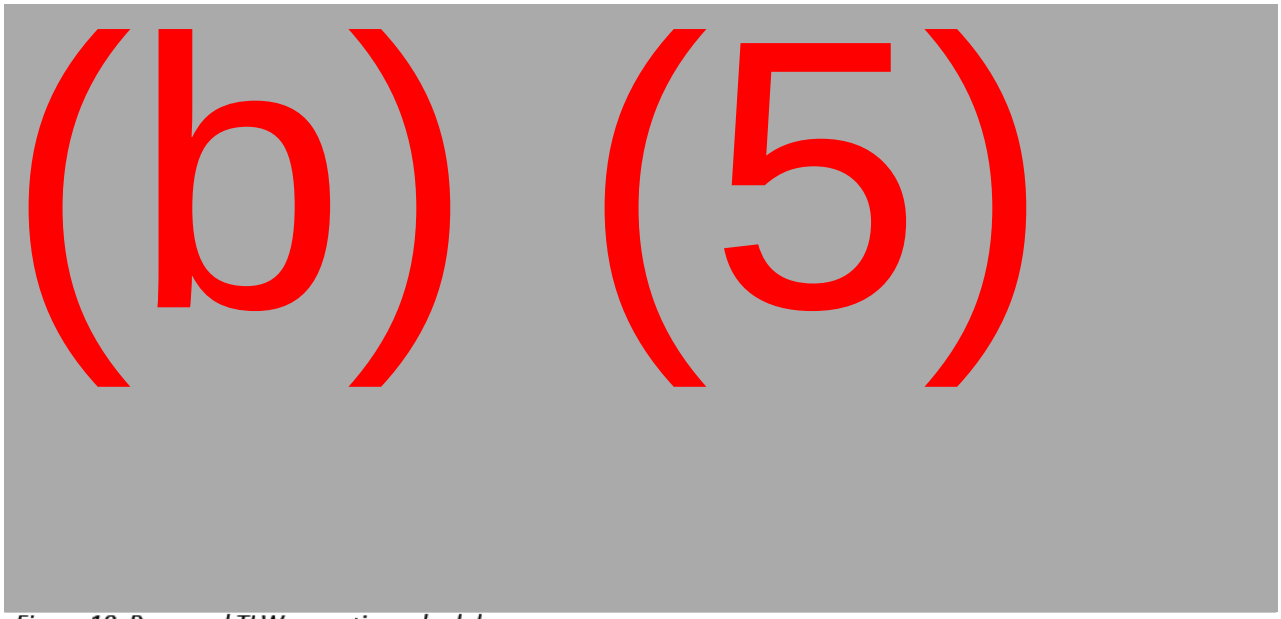


Figure 18. Proposed TLW execution schedule.

2.3.3 Small Projects

The EIL includes the small projects associated with TA-55 PF-4, RLUOB, the nuclear waste facilities, and supporting infrastructure required to support all plutonium missions. These small projects are funded by Recapitalization, Facility Maintenance and Operations, MR&R, and CBI programs as well as LANL site-support. The small projects cover a wide range of scope complexity and technical challenges (e.g., office buildings, seismic upgrades, fire water loop replacement, boiler system upgrades, etc.). Small projects ensure facilities are reliably available for programmatic work, meet federal and state requirements, and address Defense Nuclear Facility Safety Board concerns.(b) (5)

(b) (5)

(b) (5) Additional planning resources and collaboration with NA-50 will be required to improve schedule integration and project execution.

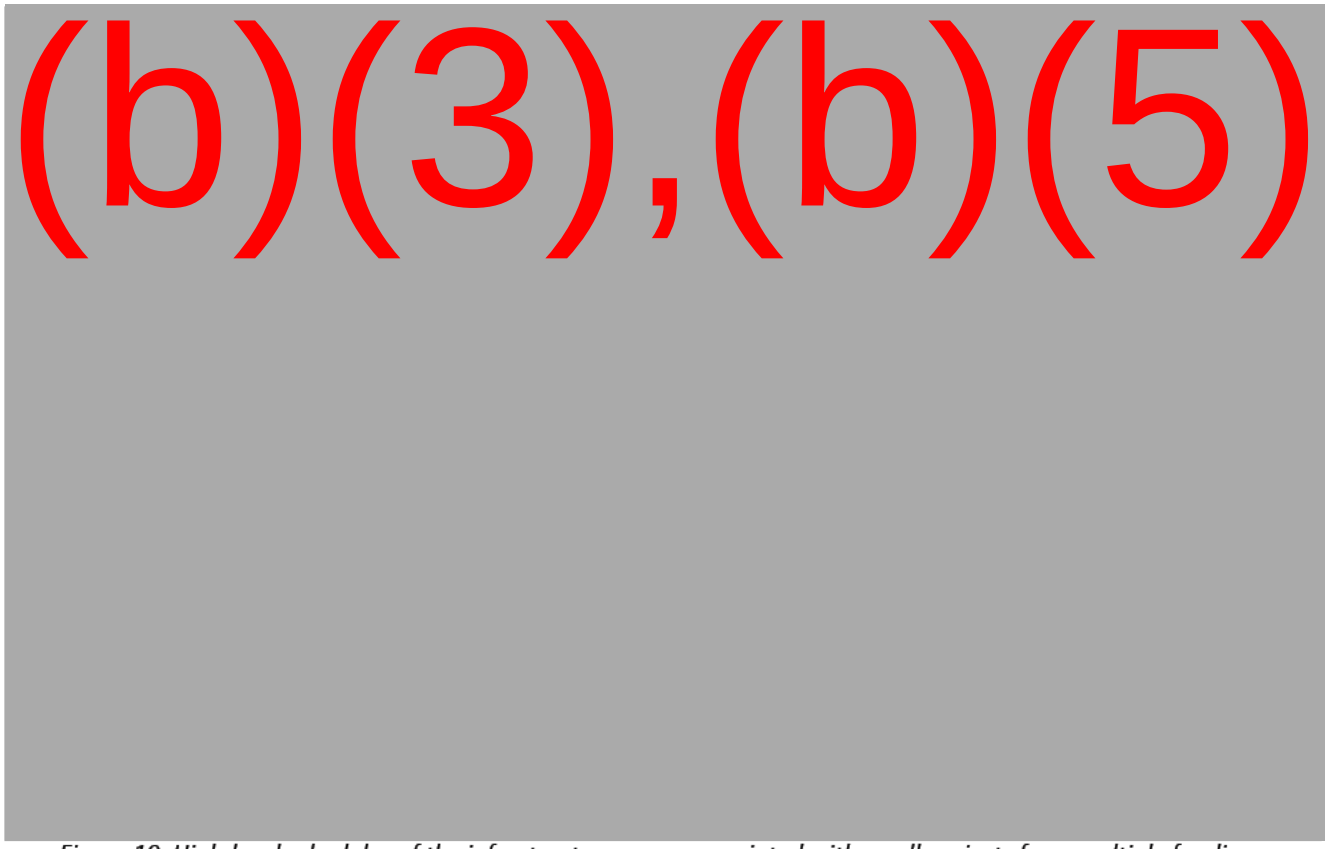


Figure 19. High-level schedules of the infrastructure scope associated with small projects from multiple funding sources.

Recapitalization

The NA-50 Recapitalization program is responsible for an extensive set of facility-based projects including the TA-55 fire water loop and the TA-55 PF-4 fire penetrations, ventilation, and seismic switch upgrades for the electrical power distribution system. In the out years, a steady-state level of funding (b) (5) is included in this Plan to support projects to be proposed by LANL for an enduring TA-55 portfolio.

Facility Maintenance and Operations

The NA-50 Facility Maintenance and Operations of Facilities programs are responsible for small projects in support of TA-55 PF-4 (and a few in RLUOB, RLWTF, RANT and TWF) facility maintenance, assessment and compliance. The Facility Maintenance projects are focused on radiological instrumentation operability, motor control center revitalization, glovebox fire suppression, instrument air system modernization, fire pumps, etc. The Operations of Facilities projects are focused on facility seismic evaluations, DSA implementation, etc. These facility systems and evaluation and compliance efforts are essential for reliable facility operations and support all plutonium programs.

Material Recycle and Recovery (MR&R)

The NA-10 MR&R program is responsible for projects focused on TA-55 PF-4 glovebox upgrades and the testing of fire-rated containers. For instance, MR&R has identified 13 gloveboxes in the TA-55 PF-4 facility to be repurposed and upgraded to process newly generated residues and dispose legacy materials from the TA-55 PF-4 vault.

Capability Based Infrastructure

The NA-10 CBI program is responsible for several small projects in TA-55 PF-4 to replace or upgrade the material conveyance system, glovebox stands, inert gas distribution, and the dry vacuum system. These facility systems are required by all plutonium programs. In the out years, a steady-state level of funding (b) (5) is included in this Plan to support projects to be proposed by LANL for an enduring TA-55 portfolio.

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.

2.4 Staffing

LANL is committed to developing and maintaining a robust workforce with the expertise and skills necessary to enable production of 30 ppy in 2026. This workforce is needed for both pit production and the support functions across LANL. LANL will identify, recruit, hire, train, and retain a workforce to

- Produce pits;
- Maintain nuclear and hazardous facilities and the associated utilities and infrastructure;
- Manage environmental protection, safety, quality, and security programs and requirements;
- Manage the disposition of waste onsite and its shipment to WIPP; and
- Provide business, IT, and other support services.

Additional infrastructure for parking, offices, training, process development, a cafeteria, and TA-55 PF-4 access is urgently needed to accommodate the increased numbers of staff. Construction of this additional infrastructure requires substantial hiring of craft, oversight staff, and project engineers. All staff must be hired 1–3 years in advance to allow time for new staff to obtain a DOE Q clearance, become certified in the Human Reliability Program (HRP), and complete training to work in high-hazard nuclear facilities and perform programmatic work.

LANL annually issues a five-year site-wide staffing plan. Developing this staffing plan requires identifying the skills and numbers of the workforce to be hired to meet the anticipated program and project demands across the institution. The plan takes into consideration expected attrition, employee movement, and funding

profiles. The five-year staffing plan developed in 2018 for 2019–2023 was modified to include a category to identify the workforce associated with the pit production mission. In 2019 LANL developed a pit production staffing plan that assessed all organizations at LANL for the staff needed to support the pit production mission. In 2020 LANL will continue to refine the staffing requirements by conducting a thorough review of the 2019 staffing analysis by division. This focused review will update and validate the requirements for the skills, quantities, and timing of increasing the staffing levels for the 30 ppy mission. The refined 2020 staffing analysis will be included in the 2021–2026 LANL five-year site-wide staffing plan.

The staffing to support all aspects of the 30 ppy mission is shown in Figure 20. The staffing levels shown include direct and indirect funded LANL staff, enduring craft, and security subcontractors. The interim workforce (LANL FTEs, craft, and subcontractors) required for the one-time infrastructure investments is not included. Figure 21 shows the high-level milestones and deliverables to recruit, train and retain the required workforce. Each of these three elements is briefly discussed below and additional details are provided in Appendix F.9.

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. LANL is also partnering with the Texas A&M University System, through the Texas A&M Engineering Extension Service (TEEX) to assess the workforce available in northern New Mexico, with a focus on RCTs and craft. TEEX completed a study in 2019 and LANL is reviewing the findings and incorporating the proposed strategies for recruiting RCTs and craft into the LANL staffing plan for pit production.

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 to include 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 TA-48 Plutonium Training, Support, and Development Center, a multipurpose building to be built immediately west of the TA-55 Protected Area.

Retention of the workforce is critical to reduce costs associated with attrition and alleviate impacts to program execution. This workforce is very diverse and includes engineers, scientists, technicians, students, and postdocs as well as security subcontractors and craft. LANL recognizes the importance of first identifying the needs and motivators and then implementing the associated policies and practices to improve the retention of different groups of workers to maintain a robust workforce for pit production. LANL is identifying, researching, and evaluating strategies for reducing attrition and will present proposals to NNSA by December 2019.

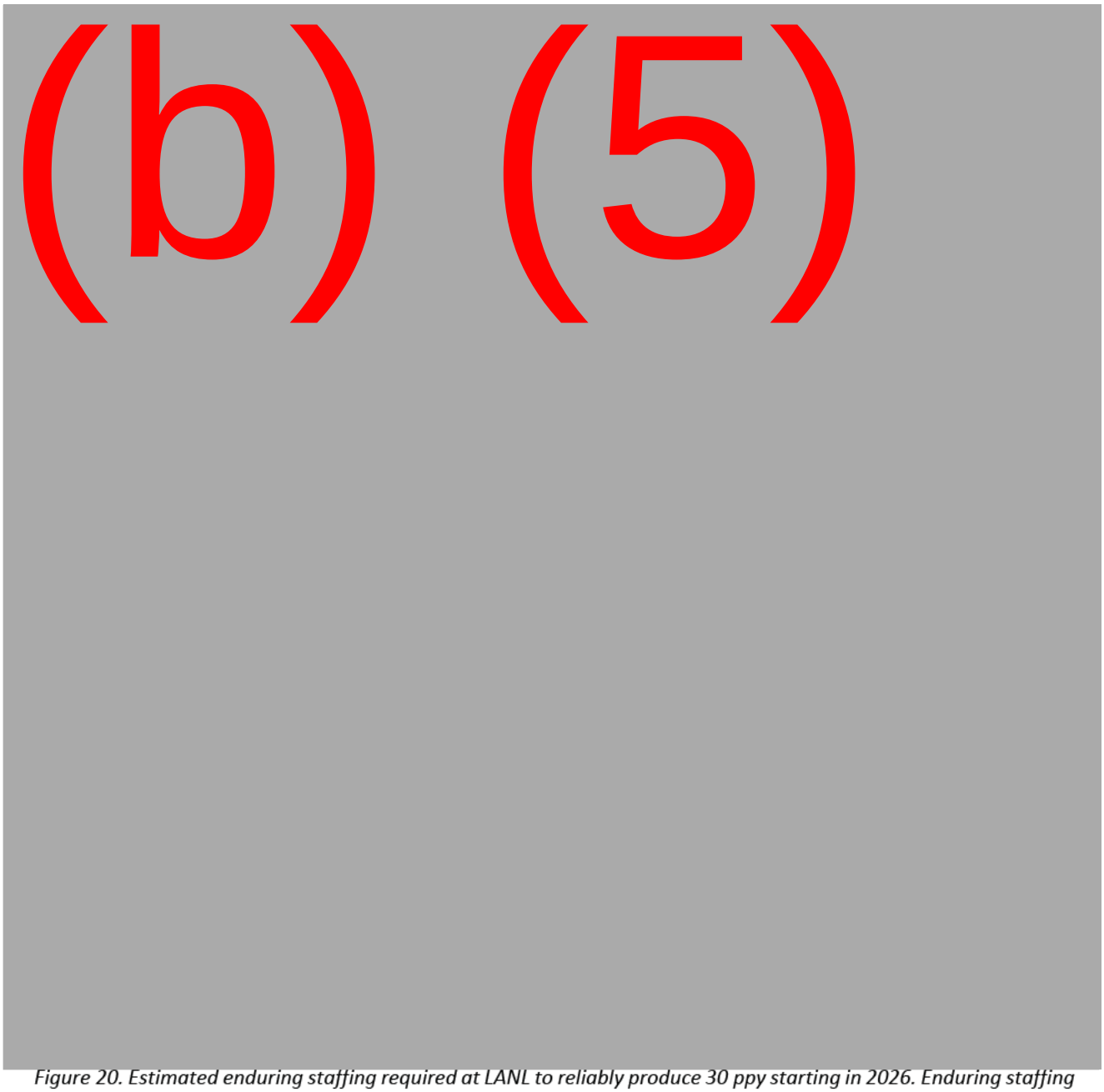


Figure 20. Estimated enduring staffing required at LANL to reliably produce 30 ppy starting in 2026. Enduring staffing includes direct and indirect funded LANL staff, enduring craft, and security subcontractors but not the interim workforce (craft, subcontractors, and LANL staff) required for the one-time infrastructure investments.

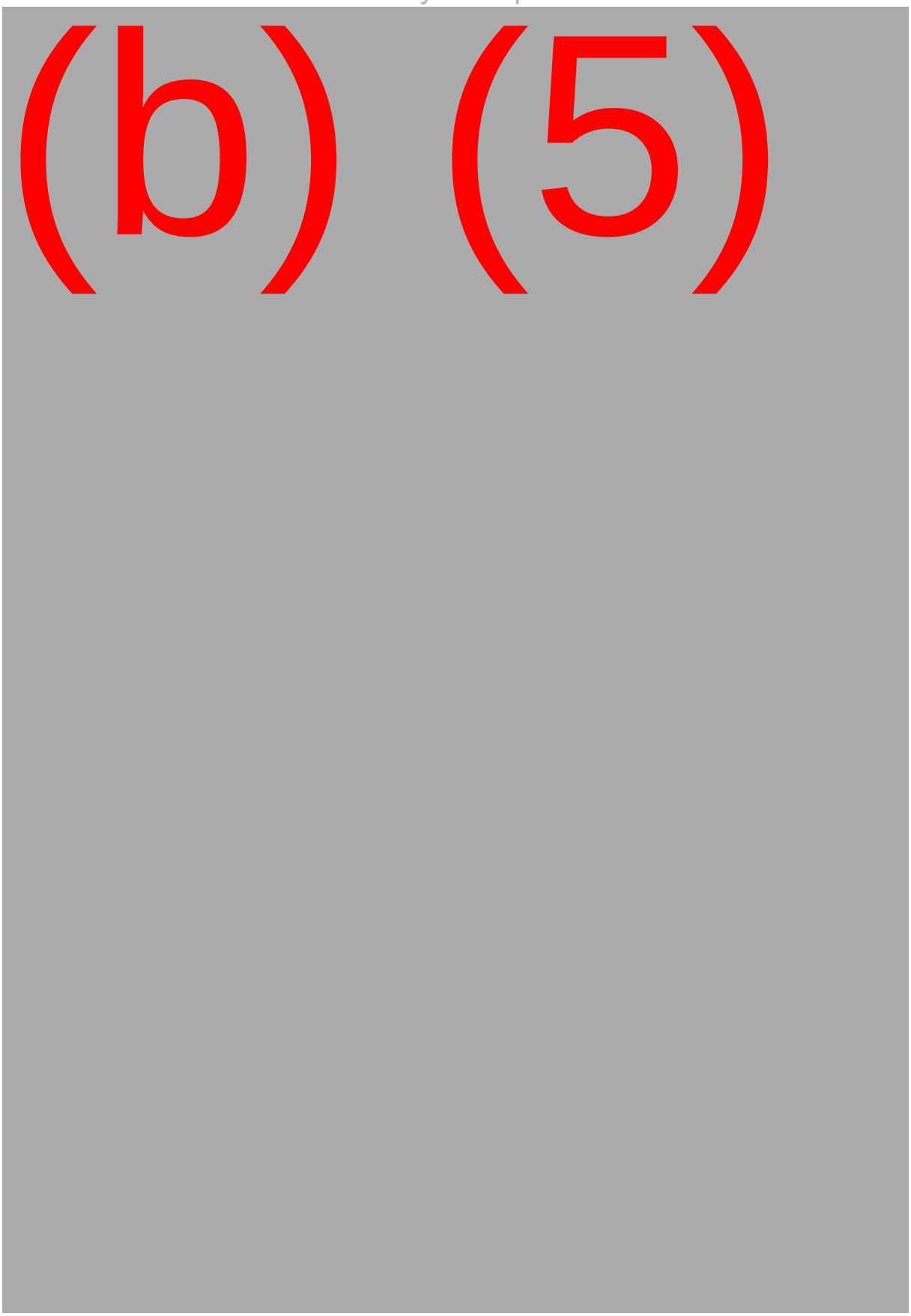


Figure 21. Recruiting, training, and retention goals and deliverables to support the LANL 30 ppy mission staffing plan.

2.5 Interim Solutions for Execution

LANL is committed to executing this Plan; however, additional actions are required to provide interim solutions for the infrastructure that is needed sooner than it can reasonably be provided. This section presents the critical elements of the infrastructure that must be urgently addressed with interim measures.

Office and Parking Space around TA-55

The office space, parking, and training facilities that support the current workforce located in and around TA-55 are currently inadequate. Space compression at TA-55 currently averages 74 square feet per person, which is significantly below the DOE office space standard of 180 square feet per person. LANL has already converted many conference rooms at TA-55 to have workstations for 10-15 personnel each, and offices designed for single occupancy are now used at double or triple occupancy. Although LANL is compressing space in the locations adjacent to TA-55 and moving staff to other locations at LANL, additional infrastructure is still urgently needed to support pit production.

The existing shortfall in infrastructure combined with the requirement to substantially increase the workforce at TA-55 creates infrastructure gaps that must be remedied through additional interim measures that can be funded and implemented quickly (e.g., leasing, providing trailers, and busing from nearby parking). Figure 22 and Figure 23 show the parking and office gaps that will remain problematic until the planned infrastructure investments are completed.

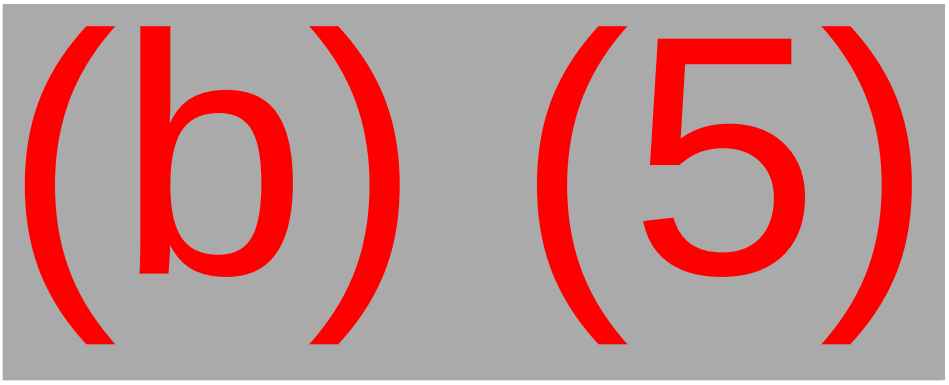


Figure 22. Additional office space required around the TA-55 area (TA-55/50/48/35) compared to the plan for increasing office space through infrastructure investments.

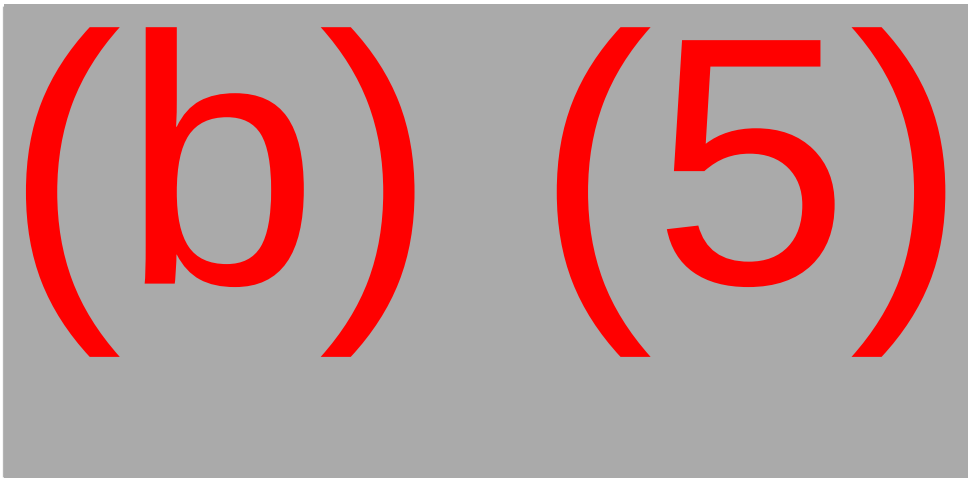


Figure 23. Additional parking space required around the TA-55 area (TA-55/50/48/35) compared to the plan for increasing parking space through infrastructure investments.

Pit production staff have offices at TA-35, which is adjacent to TA-55. Analysis of TA-35 indicates that approximately 145 non pit production staff can be relocated to other sites at LANL. Relocations could be realized in 2020 to provide some decompression of TA-55 facilities. A new 18-trailer complex is being constructed adjacent to the existing trailer complex at TA-50 and will provide approximately 114 new workstations in 2020. NA-APM had intended to use all of the 18-trailer complex occupancy but now will only use 10 workstations. LANL plans to use the remaining 104 workstations for staff supporting pit production. An additional 60 workstations could be gained for pit production staff at TA-50 by constructing a new trailer complex at TA-63 to move NA-APM and LANL capital projects staff from TA-50 to TA-63.

Office and Parking Space for Security

The security workforce (LANL staff and subcontractors) must increase substantially and at a faster pace than any other element of the workforce. This accelerated growth is necessary to make TA-55 PF-4 available (b) (5) to deconflict program activity from craft work for maintenance and construction. The current space for the security workforce is insufficient. A new security complex at TA-46 is planned (b) (5) (b) (5)

Training and Development

LANL's capacity to train the current workforce and planned new hires is inadequate, which creates substantial inefficiencies and delays in training and qualifying the workforce. 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.

The table below provides options to address infrastructure gaps identified with parking, office, security, training, and waste management.

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

3. Budget Estimates

This section provides the budget estimates to execute the 30 ppy mission at LANL. The basis for these estimates is discussed in Appendix B. The primary cost is associated with establishing and maintaining the workforce at LANL to

- Produce pits;
- Maintain nuclear and hazardous facilities and the associated utilities and infrastructure;
- Manage environmental protection, safety, quality, and security programs and requirements;
- Manage the disposition of waste onsite and its shipment to WIPP; and
- Provide business, IT, and other support services.

Figure 24 shows the budget required to meet the staffing objectives shown in Figure 20.

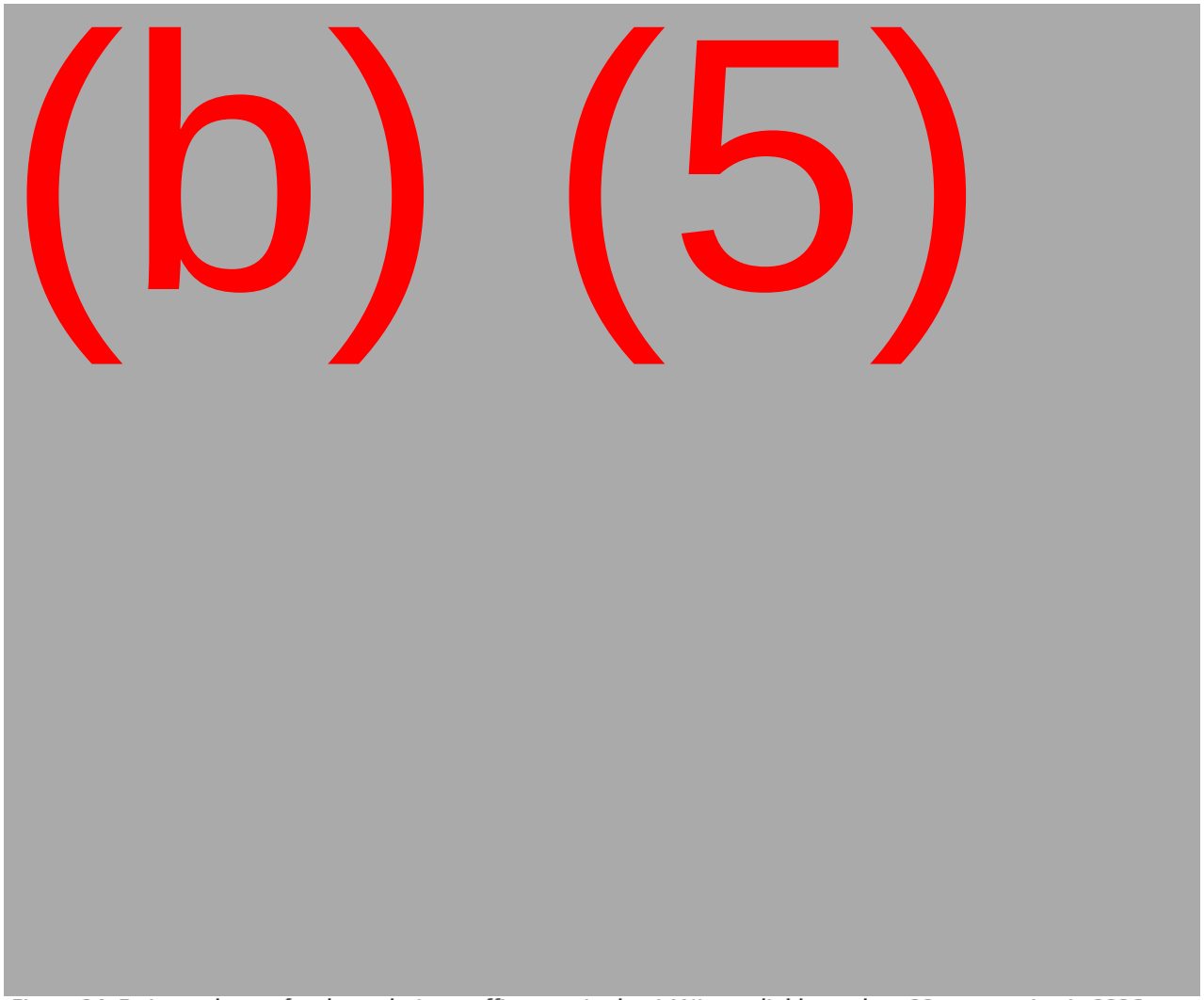


Figure 24. Estimated costs for the enduring staffing required at LANL to reliably produce 30 ppy starting in 2026. Enduring staffing includes direct- and indirect-funded LANL staff, enduring craft, and security subcontractors but not the interim workforce (craft, subcontractors, and LANL staff) required for the one-time infrastructure investments. (b) (5)

The estimated cost profiles for the line-item projects, Plutonium Sustainment program equipment projects, and other small projects are shown in Figure 25.

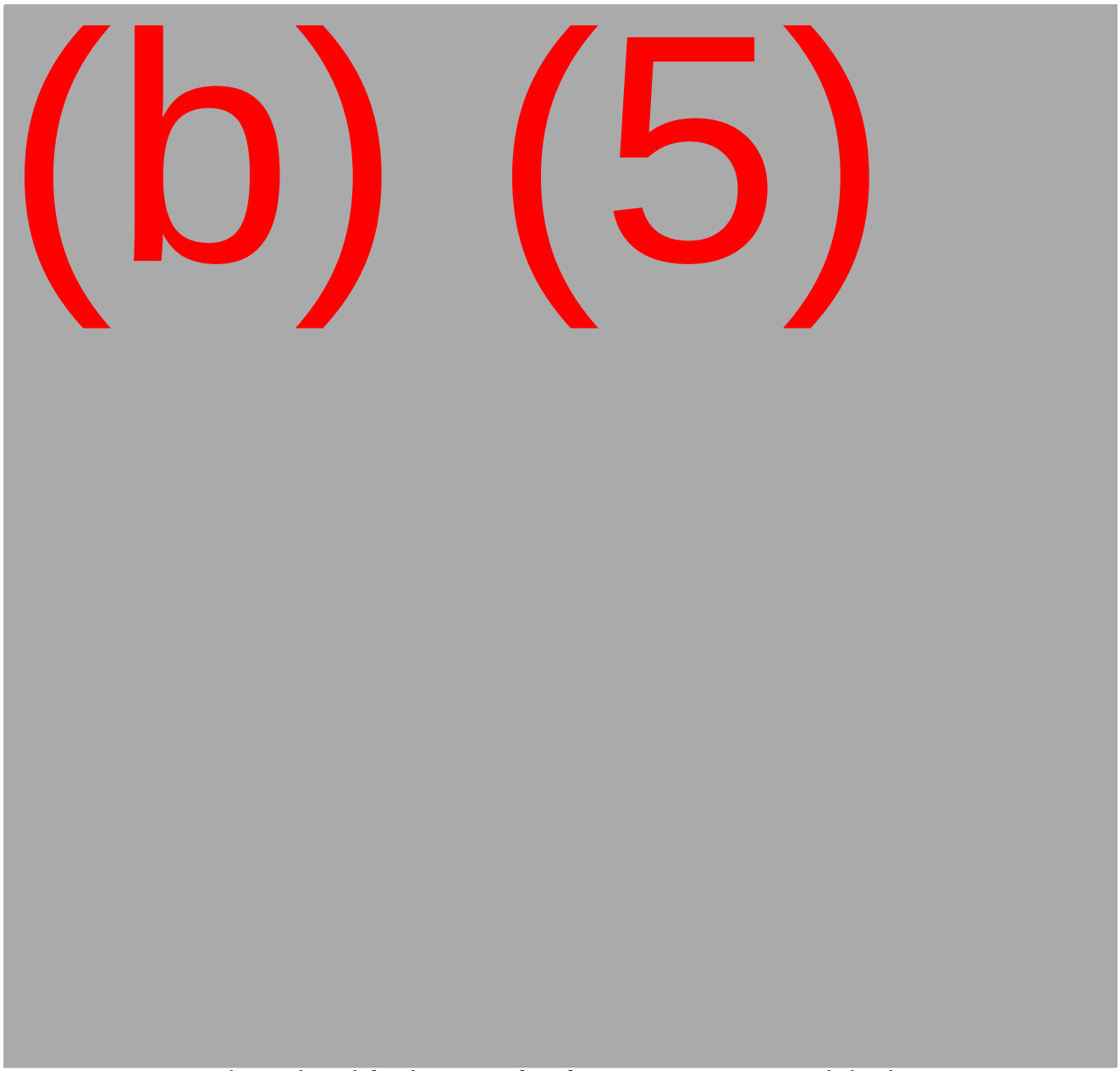


Figure 25. Estimated costs through fiscal year 2030 for infrastructure investments including line-item construction projects, Plutonium Sustainment equipment installations, and other small projects (b) (5)

(b) (5)

Figure 26 provides a summary of the staff and infrastructure investment estimated costs for the entire pit production mission at LANL through 2030. This is separated into NA-10, NA-50, and NA-70 costs. (b) (5)

(b) (5)

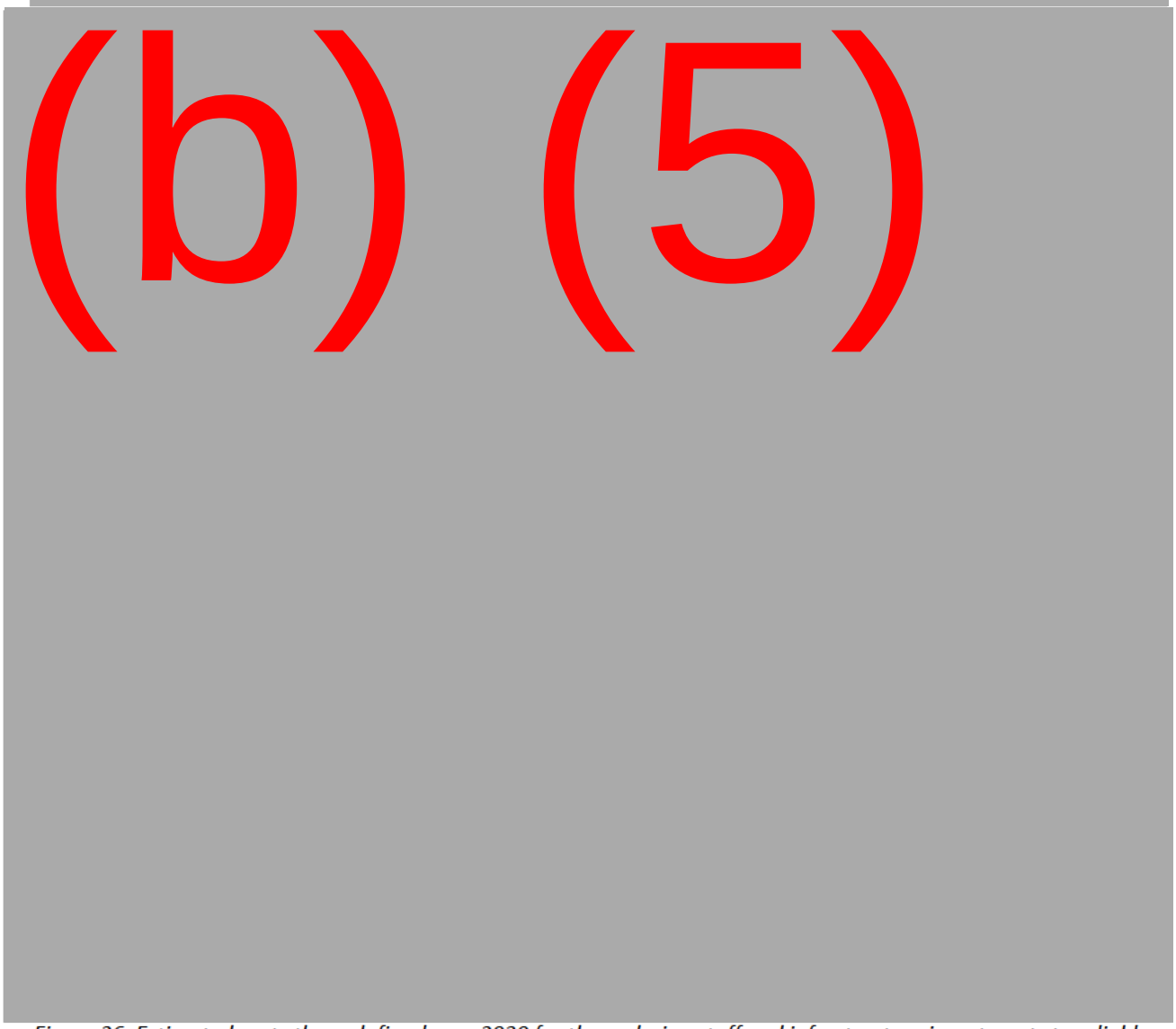


Figure 26. Estimated costs through fiscal year 2030 for the enduring staff and infrastructure investments to reliably produce 30 ppy starting in 2026. (b) (5)

(b) (5)

Plutonium Sustainment is the only program at LANL fully focused on pit production. While other programs (e.g., MR&R and Facility Maintenance) provide substantial and critical support to the pit production mission, they also fund other scope. Figure 27 shows the budget required to execute the Plutonium Sustainment program through FY25. This provides the M&O requirements budget as input to NNSA for the FY21–FY25 FYNSP. The Plutonium Sustainment program plan and other program specific documents provide the details of how this budget is aligned to the scope elements within the Plutonium Sustainment program. The basis for the Plutonium Sustainment program cost estimate is provided in Appendix B.1.

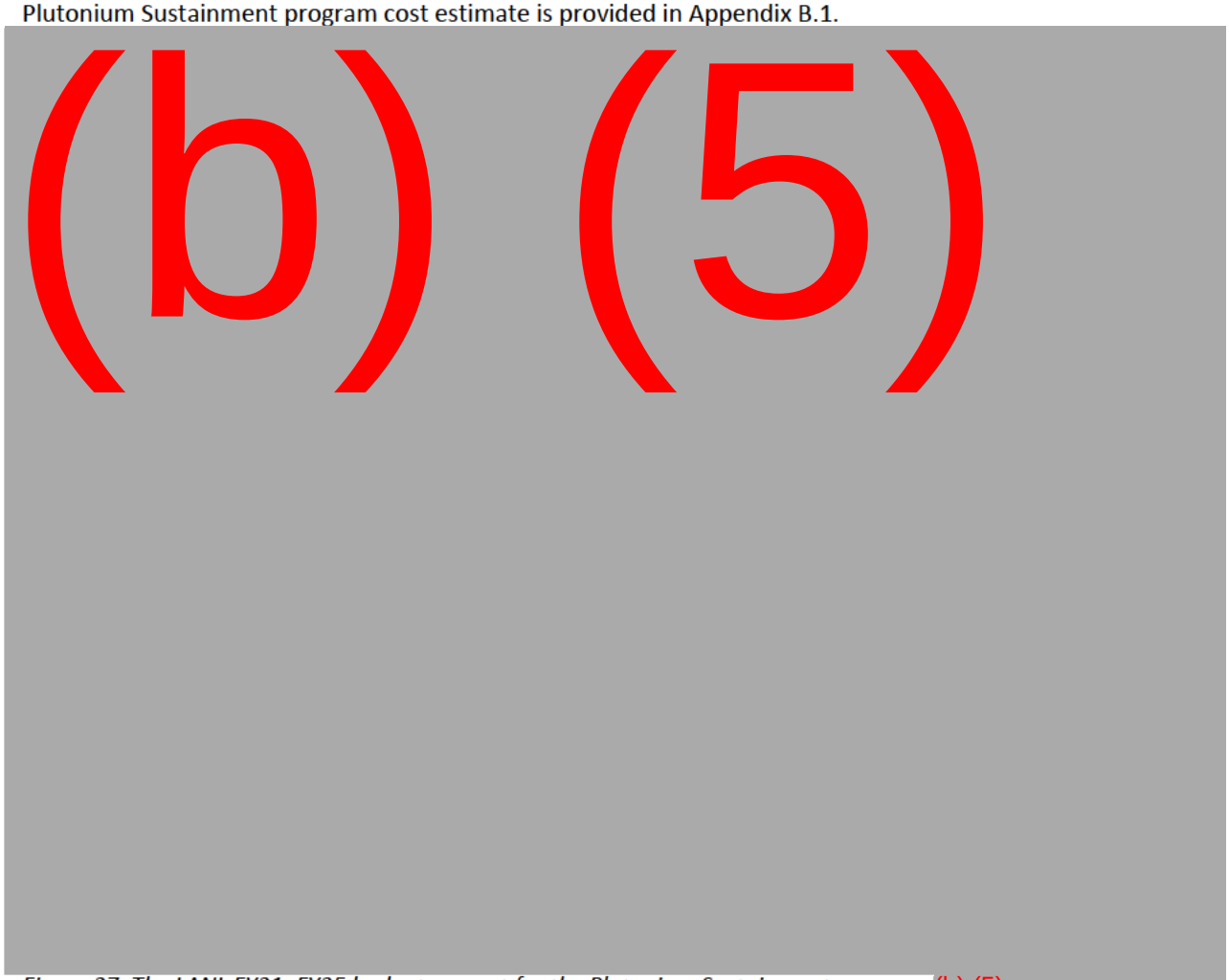


Figure 27. The LANL FY21–FY25 budget request for the Plutonium Sustainment program. (b) (5)

(b) (5)

4. Conclusion

This Plan was built on LANL's knowledge and experience acquired through a long and substantial history of working with plutonium and pits in nuclear facilities. In addition to this foundational base of plutonium expertise, LANL performed in 2019 a comprehensive site-wide assessment of enabling functions and capabilities critical to the reliable, safe, and secure production of 30 ppy starting in 2026 (b) (5) No prior study or analysis at LANL has considered this breadth of facilities, workforce, and capabilities. The process of conducting this extensive assessment has created an awareness and sense of common purpose across the organizations critical to the pit production mission.

Four major challenges came to light during the process of developing this Plan: (1) integration of the programs of record for plutonium-related missions that operate at TA-55 PF-4; (2) installation and construction of equipment, facilities, and utilities; (3) hiring and training a large workforce; and (4) maturation of pit fabrication and inspection processes. These four major challenges have complicated interdependencies that must be understood and managed to successfully deliver the Pit FPU in 2023 and 30 ppy production starting in 2026. Success also requires strong partnership between LANL, NNSA headquarters, NA-LA, and LLNL to rapidly assess complex issues and efficiently make decisions.

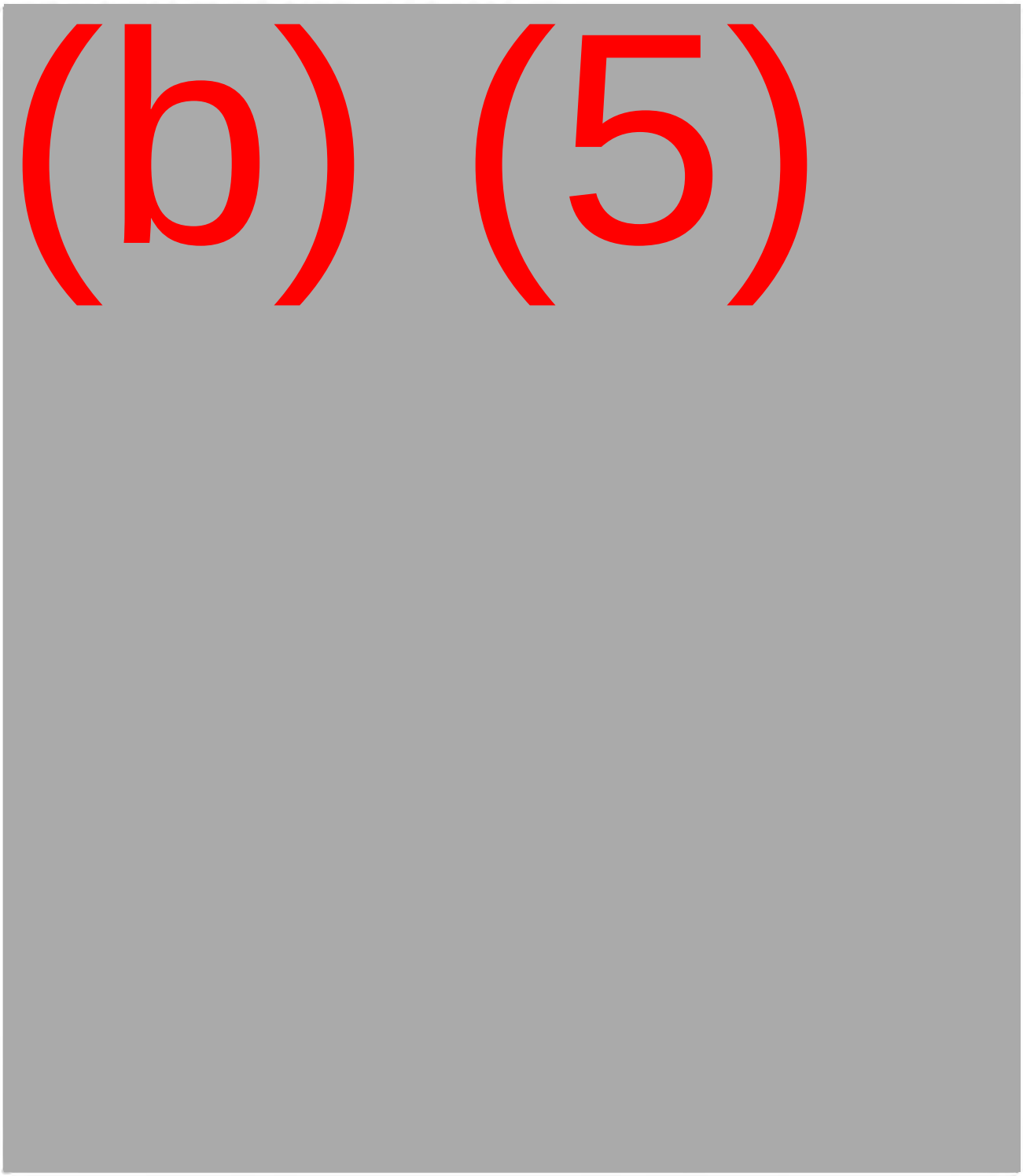
LANL will issue an annual revision to this Plan, starting in April 2020, to document progress and changes. The next revision of this Plan will

- Refine the staffing analysis presented in this Plan to better inform the NA-10, NA-50, and NA-70 budget requests;
- Refine the infrastructure investment requirements to support the increased staffing (e.g., office, parking, training, change rooms, and entry portals);
- Update the detailed sequence for completing installation, upgrades, and construction of the equipment, facilities, and utilities required across LANL;
- Review, update, and validate the models that assess the critical capabilities and systems for pit production;
- Further integrate the pit production mission with other plutonium-related programs to successfully execute all programs of record; and
- Incorporate the details of estimated cost and planned deliverables and milestones from the Plutonium Sustainment program's execution plan.

LANL is committed to the successful production of 30 ppy (b) (5) . This document captures the high-level planning and integration of activities and resources required to execute the pit production mission at LANL. Timely routine assessments of execution metrics will inform future revisions of this document to ensure the planning basis is continuously refined and actionable.

Appendix A. Actions and Decisions

LANL is partnering with NNSA and LLNL to produce 30 ppy starting in 2026. The significant actions and decisions for each partner are grouped by topic and listed below.



Appendix B. Basis of Cost Estimates

This appendix provides the basis for the cost estimates discussed in Section 3.

B.1 Plutonium Sustainment Cost Estimate

The LANL FY21–FY25 budget request for the Plutonium Sustainment program is provided in Section 3. The NNSA planning guidance for the Plutonium Sustainment program at LANL in (b) (5) ; and this Plan is constrained to that guidance for FY20. The Plutonium Sustainment budget estimate, shown in Figure 27, comprises the elements described below.

Operations

The workforce funded by Plutonium Sustainment includes non-labor expenses. The combination of the labor costs and non-labor costs form the Operations budget requirement.

Base Operations

The Plutonium Sustainment costs for scope associated with the LANL pit production mission in FY19 minus the FY19 equipment-related costs is the current base cost to execute the pit production mission. The actual cost at FY19 yearend was ~$170M. The base operations are maintained throughout the life of this program. In FY21, base operations are increased(b) (5) to include strategic planning, systems engineering and modeling, and data visualization, which are funded outside of Plutonium Sustainment in FY20. The out-year costs were estimated by escalating the $170M at 3% annually for inflation (as directed by NNSA).

Staffing Increase

The LANL staffing analysis, described in Section 2 and Appendix B.2, generated the cost to increase the staff funded by Plutonium Sustainment.

Infrastructure Investments

The Plutonium Sustainment program will direct LANL to install the equipment and systems associated with the programmatic operations for pit production, which are primarily within TA-55 PF-4. These infrastructure investments include the EIL equipment project costs, TRU waste of oversized items from construction, and support infrastructure to enable construction. In the out years, a steady-state level of funding (b) (5) is included in this Plan to support projects to be proposed by LANL to maintain a reliable and modern pit production capability at TA-55.

Equipment (EIL)

The cost estimates for the Plutonium Sustainment projects on the EIL (provided in Appendix G) were developed by the personnel responsible for the design. The Plutonium Sustainment projects in the EIL that are in design, construction, or nearly completed have cost estimates based on LANL project execution practices, which includes the *TA-55 Equipment Lifecycle Guide*.

For planning purposes, cost estimates for projects not yet in the design phase were based on parametric costs, which were defined based on the type and complexity of the project. Costs shown in the table below are in $FY20.

(b) (5)

The parametric costs are based on actual costs and lessons learned from prior TA-55 PF-4 equipment projects. As ongoing projects provide newer data for actual schedule and cost, the parametric estimates will be updated to provide more confidence in the cost and schedule project estimates. Each project cost estimate includes (b) (5) and a 3% adjustment per year for inflation. Depending on the complexity of the glovebox and equipment to be installed, (b) (5) (b) (5) Cost apportionment across these schedules is based on the actual data from prior projects that occurred in each phase of the project, as shown in Figure 7.

Oversized TRU Waste

Large items with radioactive contamination at levels that require disposition as TRU waste include gloveboxes, pencil tanks, process equipment, and utility components. LANL will level load the effort to disposition these items. Starting in FY21 a (b) (5) is estimated for the staff and associated procurements to disposition these items for past and ongoing decontaminating and decommissioning (D&D) activity. The disposition of TRU oversize waste generated by the Plutonium Sustainment equipment projects is expected to be completed in FY26. The out-year costs were estimated by escalating (b) (5) at 3% annually for inflation.

Equipment Support

The support functions and resources (e.g., warehousing, craft training, supplies, business systems) necessary to enable construction but that are difficult to projectize are estimated at 10% of the equipment cost as listed in the EIL.

B.2 LANL Staff Cost Estimate

LANL conducted a series of staffing studies and gap analyses, the results of which were used to develop the staffing estimate for the 30 ppy mission.

During 2019, managers from 42 divisions (from 11 of the 12 Associate Laboratory Directorates) at LANL were interviewed to collect staffing requirements to produce 30 ppy starting in 2026 (b) (5) .

The increase in the enduring LANL staff will be achieved through three overlapping objectives:

Objective 1: Increase staffing to the level required to **reliably** operate and maintain LANL's plutonium enterprise and to execute the current scope associated with pit production.

Objective 2: Increase staffing to the level required to operate (b) (5) . Objectives 1 and 2 provide the staff for a plutonium enterprise at LANL that can perform the craft work for maintenance, equipment installation, and construction during off-shifts while delivering on all current plutonium missions during the day-shift. The staffing increase from Objectives 1 and 2 is required to produce 20 ppy in 2025; (b) (5) . The staff must be hired 1–3 years earlier to provide adequate time to obtain clearances and complete training.

Objective 3: Increase the pit production staffing to the level required to support a sustained **30 ppy** production rate(b) (5)

The interviews also gathered data about the workspace and infrastructure, such as office space, that the future workforce will require. This data will be used to locate and design the necessary infrastructure for this workforce. Examples of the types of workspace needed are listed below.

- Office and workspace located within the protected area at TA-55, immediately adjacent to the TA-55 protected area, or another specified location.
- Classified and unclassified office space.
- Individual private offices and open (bullpen or cubicle) offices.

Many of the interviewed divisions have been underfunded, and consequently understaffed, for years and are currently working at the margin of failure. The budget estimate is based on a staffing level increase (b) (5) . As LANL continues to refine the staffing estimates and assess potential facility and operational efficiencies the required staffing level may change. The staffing levels shown in Figure 20 reflect the staffing required for the three objectives (listed above) to produce 30 ppy. To convert the staffing growth shown in Figure 20 to a budget estimate organized by budget and reporting code (B&R), the following steps were taken:

1. Capture staffing at the LANL "group" organization level by job category and level
   - Manager – Levels 1 through 6
   - Engineer – Levels 1 through 6
   - Scientist – Levels 1 through 6
   - Professional – Levels 1 through 4
   - Technician – Levels 1 through 5
2. Capture staffing by the budget and reporting codes (B&Rs) used to support the pit production mission
   - Plutonium Sustainment
   - Material Recycle and Recovery

- Storage
- Security (all of NA-70 in one grouping)
- Operations of Facilities
- Maintenance and Repair of Facilities
- Recapitalization
- Capability Based Investments

3. Distribute the staffing required to meet the three hiring objectives over time
4. Generate the cost by using average FTE costs by division and program
5. Generate a non-labor cost at the group level using historic data
6. Estimate the FY19 year-end actuals to provide the current base FTE level and cost
7. At the direction of NNSA an annual 3% escalation was applied

The results from the steps above were used to generate an annual budget at the B&R level to support the required staffing for the 30 ppy mission.

B.3 Line-Item Project Cost Estimates

The work to be executed under line-item capital projects ranges from work nearing CD-4 (REI2 and PEI1) to work that is pre-CD-2 for scope/cost/schedule definition (PEI2, RC3, TLW, TRP III, and new infrastructure projects). As such, the basis of estimates for elements of line-item projects ranges in maturity.

Transuranic Liquid Waste (TLW) Project

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

This project will design, construct, and start-up a new TLW facility to treat transuranic liquid waste generated at TA-55 PF-4. The new facility will be a Hazard Category 3 (HC-3) nuclear facility. This project was paused in 2017 after the submittal of CD-2/3 package (nearly 100% design), which proposed a performance baseline of $118M (inclusive of management reserve [MR] and federal contingency) against the approved CD-1 upper range of $95.6M. The design in 2017 included

- An approximately 3,750 sq ft cast-in-place concrete structure with two floor levels and three roof levels;
- Process equipment such as tanks, piping, a micro filter, and a drum evaporator system;
- Support areas, such as a drum preparation and storage area, change rooms, a decontamination room, and telecommunication, electrical, fire riser, and mechanical rooms; and
- Retaining walls and associated building utilities (water, sewer, electrical, telecommunication, and liquid waste) to be tied into facility utilities.

Since the pause of the TLW project in 2017, LANL has revisited the design and is nearing the end of a technical review of design improvements. The intent is to identify the design from 2017 as 60% complete and incorporate new information and lessons learned to move the design to 100%. The key design variable is centered on the nitrate treatment process. Given the design uncertainty, TLW pricing is based on a combination of the details included in the CD-2/3 submittal (a Class 2 estimate) and the upper range of the design improvements being evaluated. The assumptions and exclusions included in the submitted CD-2/3 package are still valid.

TA-55 Reinvestment Project – Phase III (TRP III) Project

TRP III upgrades the TA-55 fire protection system by installing a fire alarm system replacement for TA-55 PF-4 with the addition of a second alarm panel for the non-nuclear facilities at TA-55. TRP III encompasses more than 8 miles of conduit, 16 miles of wiring, and approximately 1,500 individual fire detection or alarm devices with more than 8,000 individual termination points. The work will be split between the TA-55 PF-4 nuclear facility and the other non-nuclear structures at TA-55. Key quantities estimated include the number of wall penetrations, linear feet of conduit and wiring, number of terminal boxes, and number of devices and terminations. After the new fire alarm system is installed, TRP III will D&D the obsolete existing system. The TRP III team submitted a CD-1 estimate in early 2019 (inclusive of federal contingency), which serves as the basis of the pricing included in the EIL. The CD-1 submittal provided quantities and pricing ranging from the number of junction boxes to linear feet of piping and cabling. A CD-1/2/3 package will be submitted in early FY21.

Chemistry Metallurgy and Research Replacement (CMRR) Project

REI2 and PEI1 Subprojects

The basis of estimate for CMRR subprojects PEI1 and REI2 is based on the projects' estimate at completion (EAC) inclusive of MR and federal contingency for the authorized work scope. The REI2 and PEI1 EACs have been updated and improved by incorporating the actual project performance achieved since CD-2/3 approval. The subproject EACs are reviewed monthly with the NNSA Office of Acquisition and Project Management (NA-APM). The PEI1 subproject is approaching 90% complete and REI2 is nearing 80% completion.

RC3 and PEI2 Subprojects

Given the maturity of the existing CMRR subprojects and the like-for-like work to be executed, pricing for RC3 and PEI2 is based on actual performance of REI2 and PEI1, respectively. Various "all-in" parametric data were developed for equipment D&D and installation based on the actual performance realized on current REI2 and PEI1 subprojects.

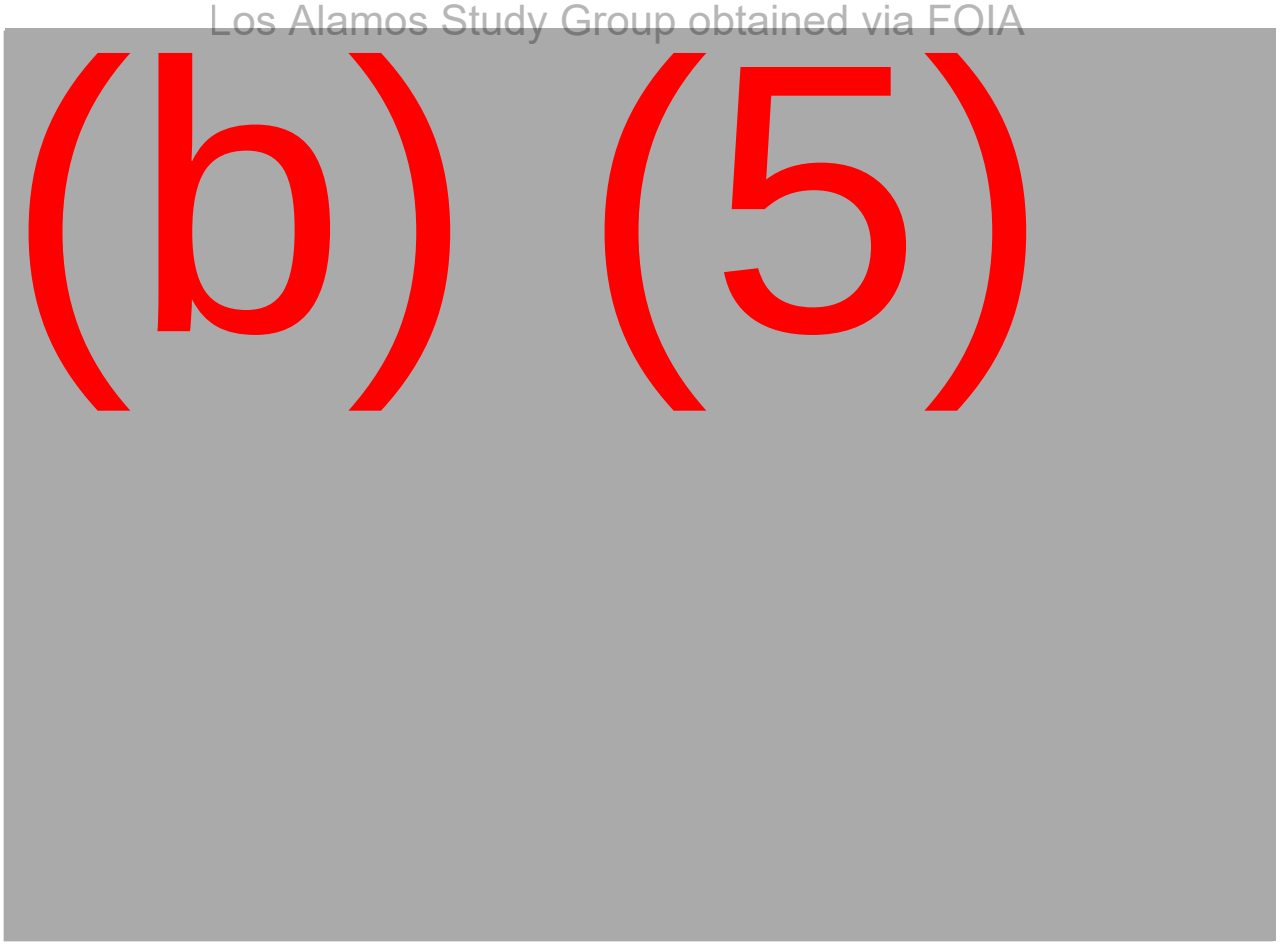
The all-in rates developed are inclusive of all project costs expected to be captured as part of DOE O 413.3 line item reporting (design, construction, and management/oversight, through TTO). Gloveboxes and enclosures were identified as the key commodity for use in benchmarking the work in TA-55 PF-4 and RLUOB. Estimates for installation of gloveboxes inside TA-55 PF-4 were binned into three levels of complexity based on previous CMRR project experience and the Plutonium Sustainment program equipment plan. Given the number of D&Ds to be executed in PEI2, only one complexity level was used for the estimate. A single complexity factor was used for RC3 based on the actual cost of similar work being completed in REI2. The tables below show the parametric data used to create estimates for PEI2 and RC3.

(b) (5)

Labor costs have risks such as pay differentials for off-shift execution and offering per diem to craft. These impacts to labor costs are expected but not fully quantified and thus included in the MR assessment. The management reserve is conservative, thus LANL does not expect these estimates to

(b) (5)

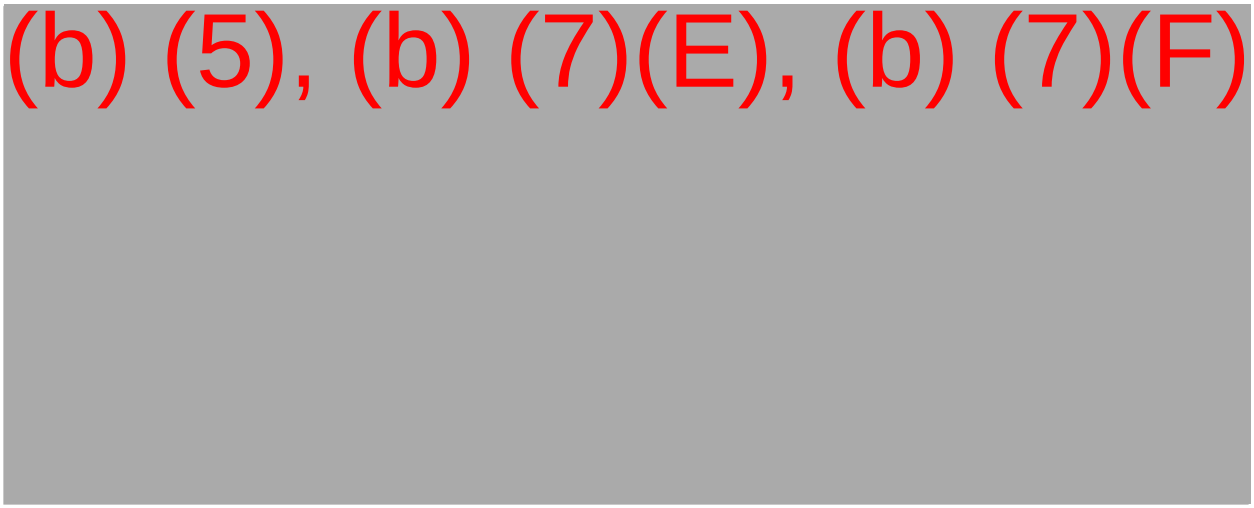
Given the timing of execution and complexity of the work this is expected to provide sufficient risk coverage.



Infrastructure

A key assumption in the ROM estimates for infrastructure is that compensatory measures required as a result of the gap between need dates and execution dates will not be part of the line-item cost (i.e., institutional funding pays for leased space prior to permanent facilities being completed). Additionally, any upgrades to corridor utilities (power, water, sewage, gas, etc.) are covered outside of the project.

The table below shows the base ROM values as well as MR and contingency for each of the CMRR Infrastructure subprojects. The basis of estimate for each infrastructure project is discussed below.



TA-48 Office Building

Given the maturity of the scope definition for the TA-48 office building the estimate was based on high-level parametric data. Parametric data were used to develop a cost per square foot estimate for the office building (approximately 900 workstations). A suite of benchmarking data was analyzed. The primary benchmark used for parametric development was the National Security Science Building (NSSB) project completed in 2006 at LANL. The NSSB was selected as the primary benchmark over the DOE ABQ building, which is currently in construction. A key reason for selecting the NSSB over the DOE ABQ building was that the ICE review in 2016 indicated a cost of $745 per square foot, and the NSSB historical was deemed more appropriate due to the D&D and parking lot scope in the DOE ABQ facility. The historical information from NSSB was adjusted to reflect the current construction conditions for similar work (escalation, site conditions, LEED requirements, etc.). The resulting NSSB-based parametric estimate is (b) (5) The facility sizing and requirements of the new structures at TA-48 are based on a pre-conceptual design. In addition to the included MR, federal contingency and other direct costs were included at (b) (5) (b) (5).

TA-48 Parking Structure

For the new parking structure (approximately 1560 spaces), a parametric was developed based on the contract awarded for the TA-50 parking structure currently under construction, which has a cost of approximately (b) (5) for all in cost per parking space after burdens and design and oversight are included.

TA-48 Plutonium Training, Support, and Development Center

The pre-conceptual design for this multipurpose building has floors designated for specific uses, which include training and development classrooms and laboratories, office space (approximately 300 workstations), conference rooms, a large auditorium, and a cafeteria. The cost estimate includes equipment for the training and development laboratories, at an amount of $30M. The table below shows the pricing basis. This multipurpose building is referred to as the TA-48 Plutonium Training, Support, and Development Center throughout this and other documents.

(b) (5)

TA-55 PF-4 (b) (7)(E), (b) (7)(F) Expansion

Improvements to the TA-55 PF-4 (b) (7)(E), (b) (7)(F) were based on the original (b) (7)(E), (b) (7)(F) estimate that was included in the 2014 CMRR CD-1 approval. This estimate was updated to reflect current options under consideration. The values included in this plan are indicative of the increased scope being considered. Once final configuration and capacity requirements are defined the estimates will be revised accordingly.

TA-55 PF-3 Change Room Expansion

There are multiple pre-conceptual designs that address the TA-55 PF-3 change room scope. The purpose of the proposed change room improvements is to expand the change room capacity in TA-55 PF-3 by approximately 600 lockers. For purposes of this plan, the estimate is based on demolition and/or retrofit (b) (7)(E), (b) (7)(F) in TA-55 PF-3. In addition, it is anticipated that retrofits of the existing change room(s) will also be performed.

TA-55 West Entry Control Facility

The scope of the TA-55 West Entry Control Facility is based on the existing TA-55 East Entry Control Facility (building, PPIV booths, etc.). The estimate is based on the actual cost for similar work performed on the Nuclear Material Safeguards and Security Upgrade Project Phase 2 (NMSSUP II) project.

TA-55 East and West Vehicle Access

Similar to the TA-55 West ECF, the TA-55 East and West Vehicle Access cost estimates are based on the portion of NMSSUP II project with similar scope. The current scenarios being evaluated for both vehicle access portals will require cutting into the existing PIDADS. Once final configuration and requirements are known the estimates will be revised accordingly.

(b)(3)

TA-55 Warehouse

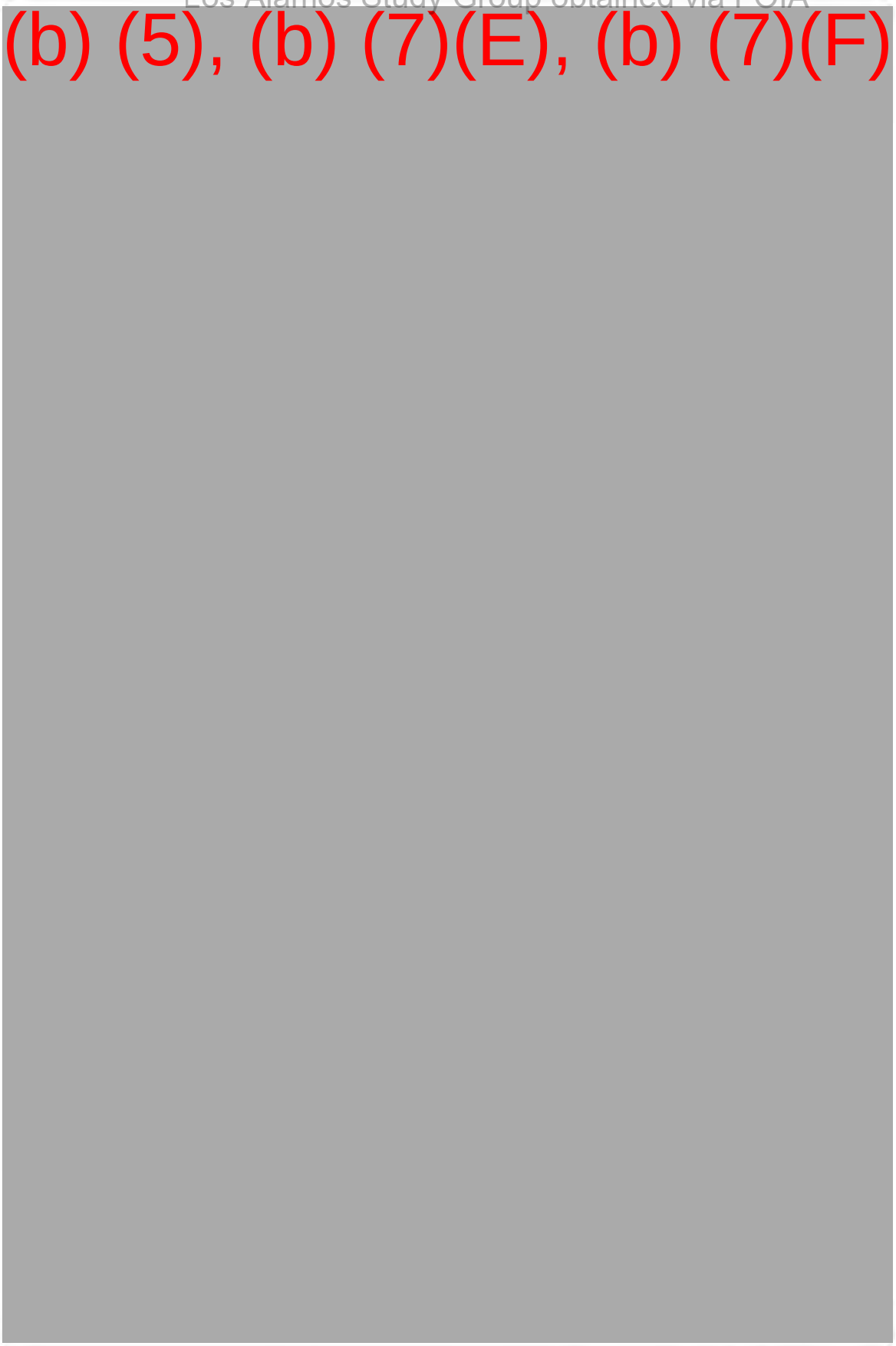
The basis of the warehouse pricing included in the EIL is the new warehouse (30,000 sq ft) being built at TA-46. Given scope uncertainty, a 60,000 sq ft structure has been priced.

B.4 Facility Operations and Maintenance

Successful execution of the 30 ppy mission relies on reliable facility operational availability. LANL infrastructure improvements and modernization efforts are improving the condition of TA-55 PF-4 and supporting facilities, but a significant increase in staffing and maintenance projects is required to ensure these facilities support a reliable pit production program. LANL will perform maintenance activities during the off-shifts (b) (5) Enduring facility operations and maintenance staffing costs were developed as part of the staffing analysis and parametric estimates discussed in Appendix B.1.

The schedule below is representative of the recurring required technical safety reviews over a one-year period for TA-55 PF-4. Additional risk reduction maintenance activities include upgrades to fan safety, fire protection issues, the public address system, the fire suppression water line, and power and communications systems. Data from completed and ongoing maintenance projects provide high-fidelity cost estimates for projects with various levels of complexity and were therefore used as the basis for the parametric non-labor costs for maintenance projects.

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



B.5 Security

The resources and associated cost estimates for the safeguards and security (S&S) functions required to securely execute the pit production mission were developed by S&S and weapons program SMEs and management. Costs associated with S&S are largely attributed to staffing needs, and were thus calculated by applying labor and non-labor costs to the expected staffing growth needed for the pit production mission. The increase in S&S staffing is required for the pit production mission (b) (5) (b) (5) and also to support the associated growth in overall LANL staffing (security clearance processing, HRP certification, etc.).

Growth in staffing levels within the following S&S functions were used to estimate the NA-70 cost for security:

- Protective force
- Security systems
- MC&A
- Supervision for protective force officers
- Vulnerability assessment (VA)
- Personnel security (e.g., clearances, badging, etc.)
- Information security (e.g., classification guidance)
- Program management
- Training

The cost estimate was developed according to staffing type—LANL regular staff, P2S subcontractors, and protective force subcontractors—in order to appropriately account for the differences between pay structure and labor and non-labor costs for the different LANL staff and subcontractor costs.

The growth in protective force staffing shown in Figure 28 is based on the expectation that all TA-55 posts (current and planned) will be staffed (b) (5) (b) (5) The protective force subcontractor growth was estimated (and timed for hiring to allow time for clearances and training) to provide the security functions to operate infrastructure investments at the planned TTO execution dates. Overtime is needed to fully support TA-55 through 2022. A reduction in overtime FTEs will be realized in 2023 as new posts come online and new protective force staff are trained and qualified. The cost estimate was derived using standard rates by labor type (security police officer I, supervisor, etc.), which is established within the protective force subcontract and are consistent with the rates reported to NNSA on a quarterly basis. Out-year costs were estimated by escalating at 3% annually for inflation (as directed by NNSA).

The cost estimating process described in Appendix B.2 was used with the following modifications:

- Generate the cost informed by planned FY20 FTEs and costs for the same or similar FTE job category, labor cost, and band.
- Generate a non-labor cost by staffing type using historic data.

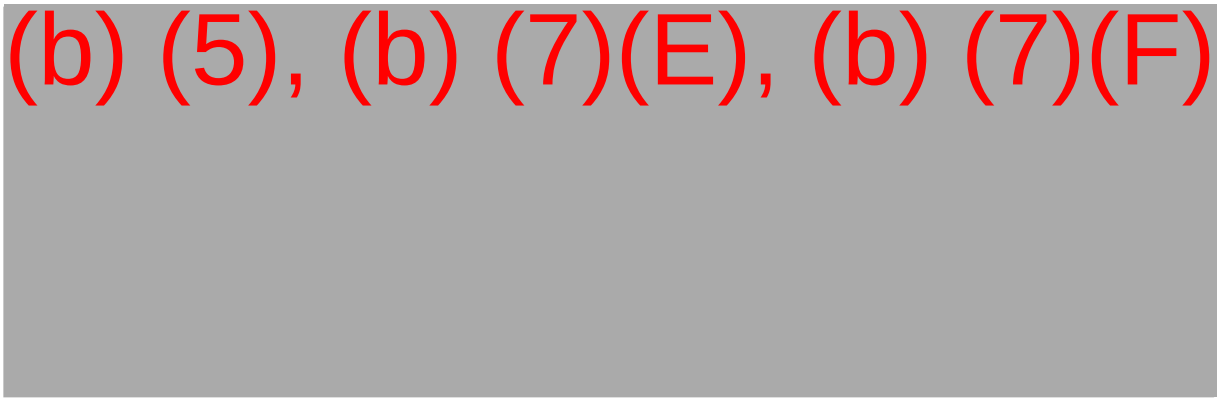


Figure 28. Estimated S&S staffing increase (does not include the base) for the 30 ppy mission.

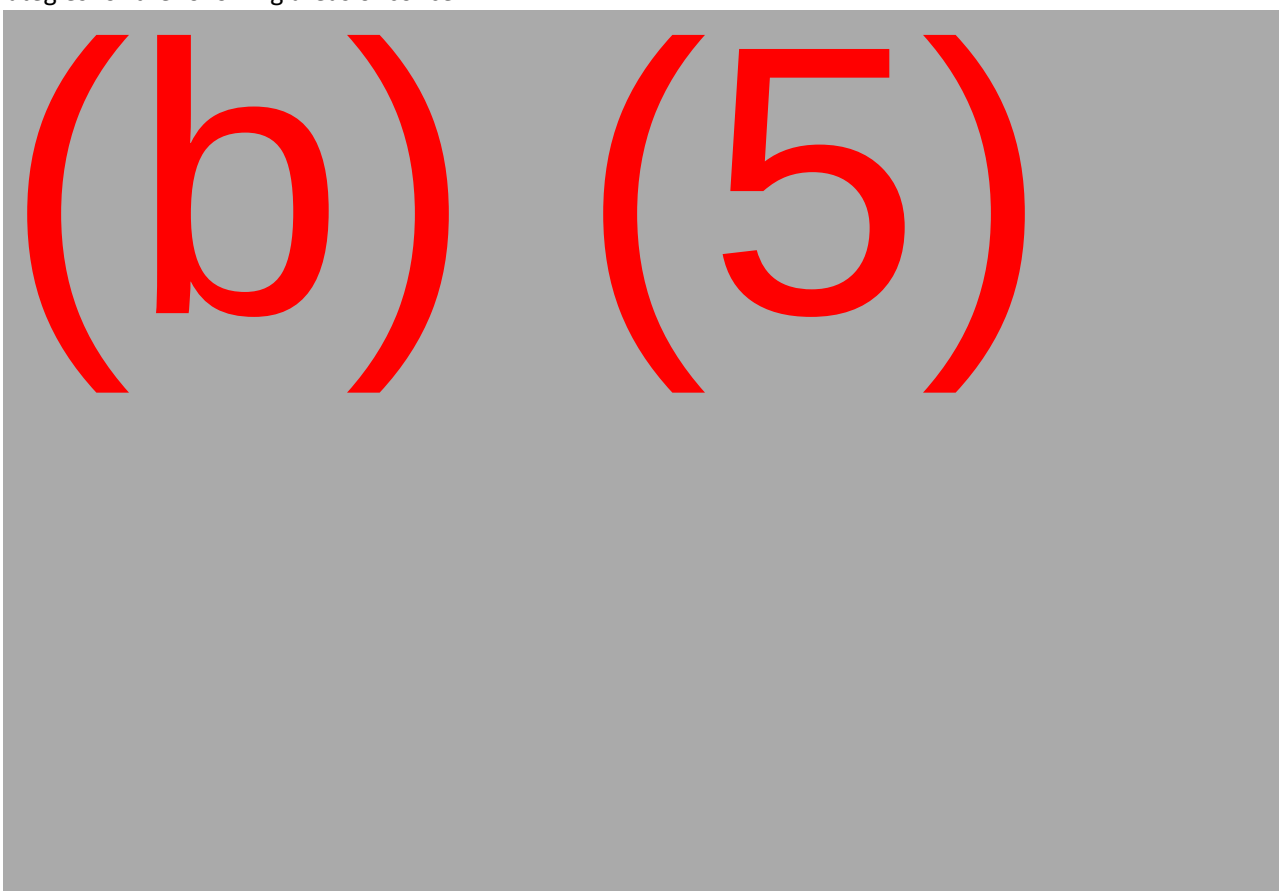
Appendix C. Risks and Opportunities

LANL has historically operated two risk management programs to support pit production, one for on-site risks to the Plutonium Sustainment program and the second for the Pit PRT to manage the risks between the Pit PRT partner sites (LANL, LLNL, and Kansas City National Security Campus [KCNSC]). Each risk management program is governed by a Risk and Opportunity Management Plan. The plans for LANL's historical risk management programs are essentially identical except for customized scoring guidance, additional roles and responsibilities for Pit PRT partner sites, and program-specific approval structures.

Risks were identified by the focus area teams, SMEs, and LANL management and captured by risk managers as formal risk statements. The risk statements were structured as standard "If/Then" summaries identifying the event that initiates a risk and the risk's impact on project objectives. The risks are scored by focus area leads and other SMEs to determine the likelihood of the risk event occurring and the severity of the consequence. These scores are used to determine the initial risk level (high, medium, or low) using the risk matrix shown in Figure 29.

Handling plans are developed for each risk that include accepting, mitigating, or avoiding the risk. The most common handling plan is mitigation of the risk through actions to reduce either the likelihood of risk occurrence or the impact of the risk if realized. Each risk is then rescored to determine the final risk level. Risks are tracked and regularly reevaluated until they are realized (thereby requiring a response plan) or have not occurred (and are therefore retired).

LANL continuously communicates and manages the risks identified for the pit production mission directly with the responsible NNSA program. The April 2020 update to this Plan will discuss the significant risks and handling strategies for the following areas of concern:



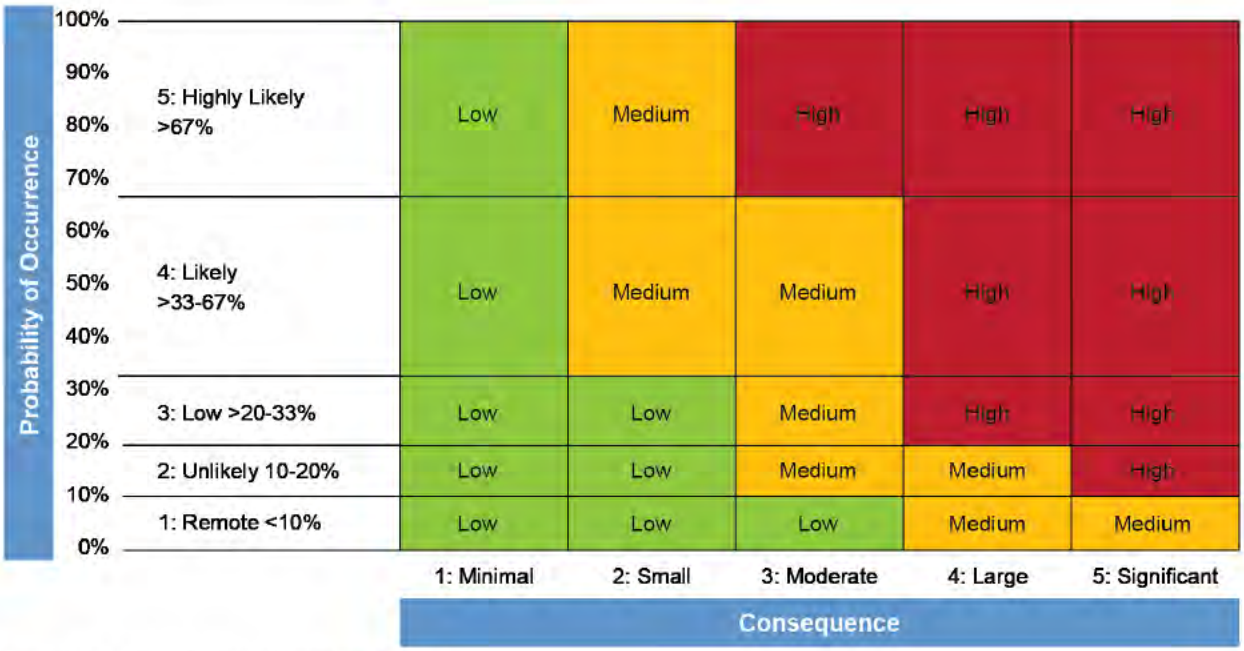


Figure 29. Risk level determination matrix.

The criteria used to evaluate the consequence of a risk to cost and schedule are in the two tables below.

Cost Impact		
Cost Consequence	Cost Range	Description
1	(b) (5)	Virtually no cost impact, may involve a transfer of funds within the project or below, but budget estimates are not exceeded.
2		Cost impact handled within the Program (cost account).
3		Cost impact is handled within major project budget and is less than 10% of total budget.
4		Additional funding required from site budget authority or project budget is between 10% and 20% of total budget.
5		Major funding required from the customer (greater than 20% of total budget).

Schedule Impact		
Schedule Consequence	Delay (weeks)	Description
1	0–4	No immediate impact on internal schedule.
2	4–12	Schedules can be adjusted to accommodate changes to meet milestones or deliverables. (Enough float)
3	12–26	Schedules must be adjusted with minor impact to milestones or deliverables.
4	26–52	Schedule must be significantly adjusted with serious impact to milestones or deliverables.
5	52+	Major impact significantly impacting high-level integrated milestones or deliverable; may require additional negotiation with customer.

Appendix D. Interfaces with the Pit Flow Sheet 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 30). This section addresses how the LANL system of facilities, capabilities, and workforce support pit production. Figure 31 shows a high-level flow sheet of pit production operations.

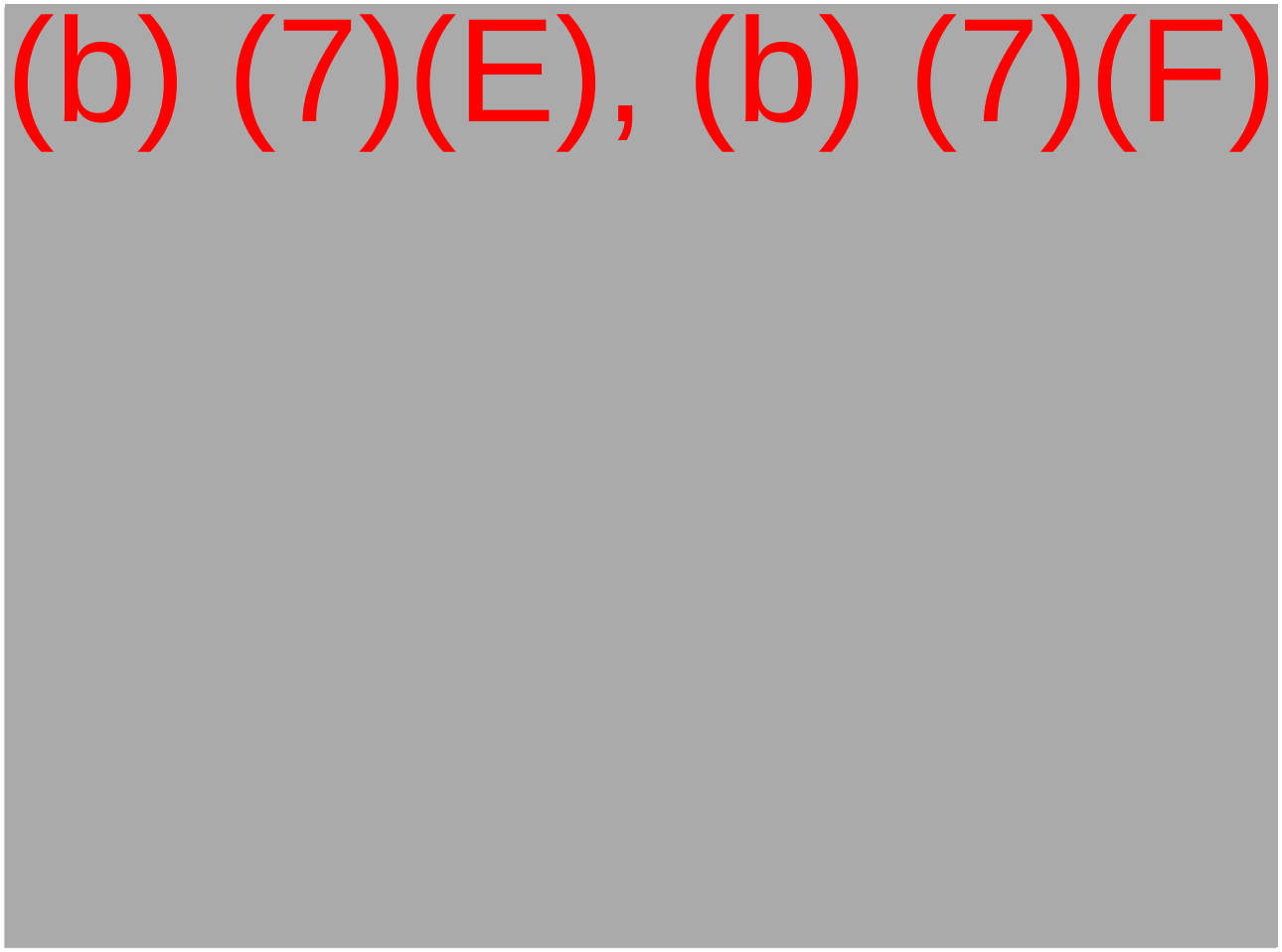


Figure 30. Systems diagram showing the facilities at LANL and other sites and the interfaces for pit production.

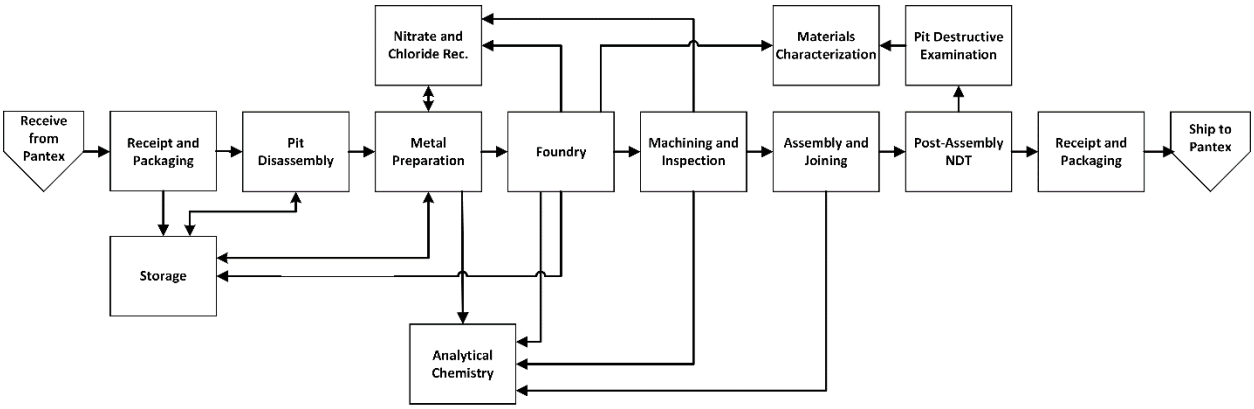


Figure 31. High-level pit production process flow sheet. Solid and liquid TRU and low-level waste are generated throughout the flow sheet.

D.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) program, 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. A model is being developed to inform the required NDA equipment and process investments needed to produce 30 ppy.

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.

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

Multiple processes in the pit production flow sheet 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. A model is being developed to determine if the planned equipment is adequate to produce 30 ppy using a single work shift.

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. Models are being developed to determine if the planned equipment is adequate to produce 30 ppy and the other programs that require MC using a single work shift.

D.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.

D.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 32 provides a summary flow sheet of plutonium supply and purification operations.

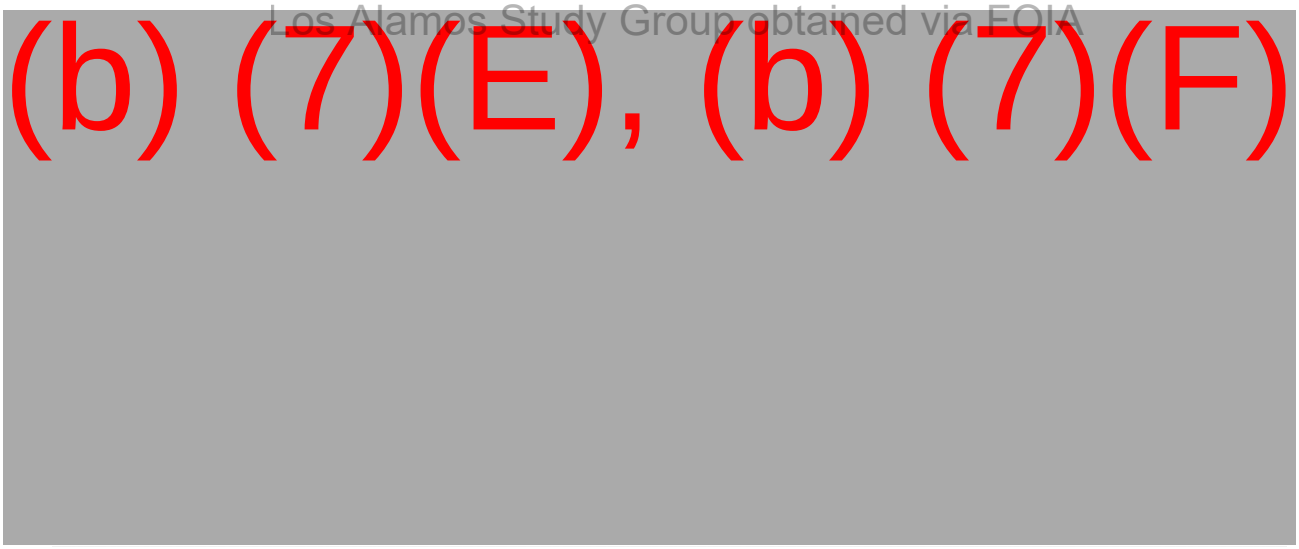
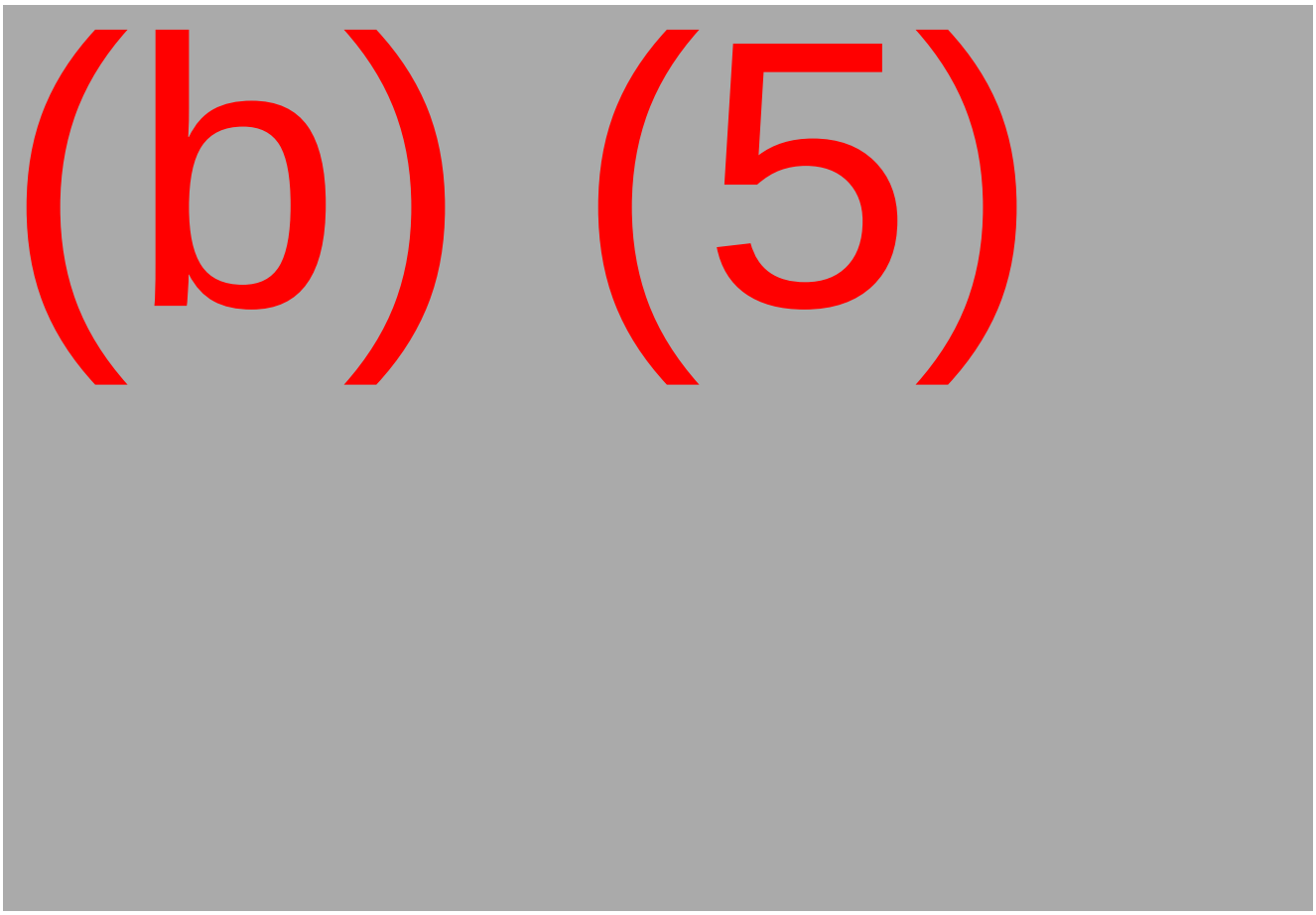


Figure 32. Simplified plutonium supply and purification flow sheet. Solid and liquid TRU and low-level waste are generated throughout the flow sheet.

D.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.



(b) (5) [redacted]

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. Upgrades to aqueous operations and related material transfer systems 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.

D.4 Manufacturing Operations

In general, pit manufacturing consists of foundry, machining, welding and assembly, and 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.

D.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 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 flow sheet of the pit-fabrication operations is provided in Figure 33.

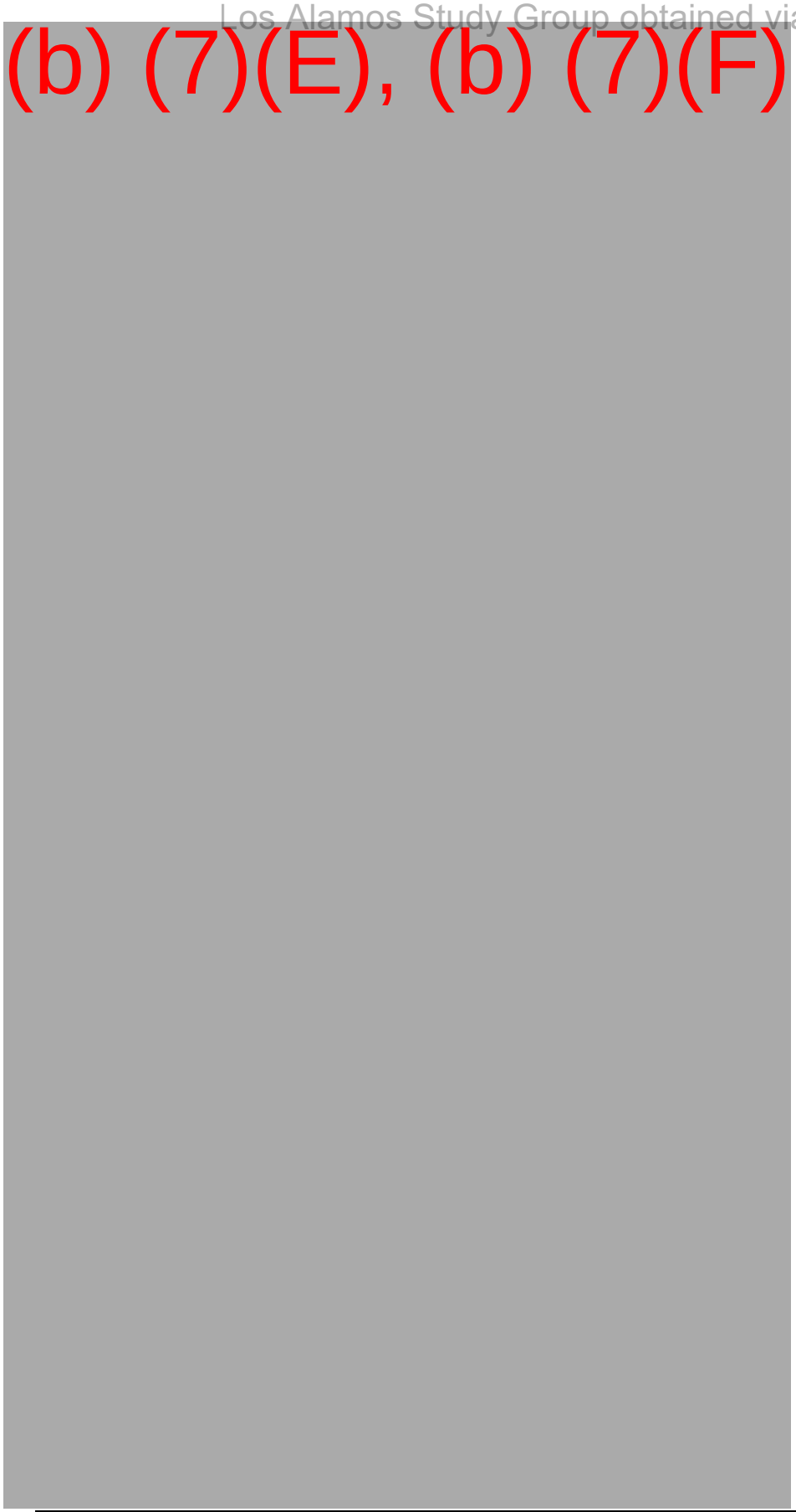


Figure 33. Simplified pit fabrication flow sheet. Solid and liquid TRU and low-level waste are generated throughout the flow sheet.

D.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. Increased staffing for radiation protection support functions, including RCTs, is essential for expanded pit production operations.

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 facility infrastructure. 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)

Technology maturation and R&D: Although many pit manufacturing processes have been used for years, development of new processes or process features could increase throughput and/or efficiency, reduce dose, or support changes to DA specifications.

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 E. Program Interfaces

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 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. Key programs and associated program-specific interfaces are discussed below.

Pit Surveillance: LANL evaluates pits returned from the stockpile to provide data to the LANL and LLNL DAs for their assessment of the stockpile. The equipment and staff at TA-55 PF-4 for pit surveillance are also used to evaluate newly fabricated pits. The critical equipment and process interfaces include lathes for pit disassembly; milling machines to extract samples; high-precision lathes to machine components for experiments; MC; and full-scale testing. The scope and schedules for pit surveillance, pit production process development, and pit certification must be integrated, baselined, and controlled to be successful. Modeling may suggest additional equipment and workforce are required to execute all scope on schedule. This will be addressed in the April 2020 update to this Plan.

Plutonium Science and Subcritical Experiments: As the nation's Plutonium Center of Excellence, LANL performs a wide range of research on plutonium and associated components. This research relies on the capabilities essential for pit production. Equipment and process interfaces include metal purification, casting, machining, assembly, coring, metallography, AC, and MC. The research-driven activities to evaluate plutonium and experimental components must be integrated with the evaluations required for pit surveillance, pit certification, and process development for pit production. Modeling may indicate that additional equipment and staff are required to execute all scope on schedule. This will be addressed in the April 2020 update to this Plan.

Because plutonium research and pit production rely on the same capabilities and resources, there are benefits to be realized by incorporating research activity into TA-55 PF-4. Scientific work is often more technically challenging than production work, requiring a deeper understanding of the equipment, processes, and materials used. Consequently, producing pits becomes more straightforward if the materials and processes are thoroughly understood. The opportunity for staff to work on complex, unique experiments also improves workforce morale, which in turn can reduce attrition.

Advanced Recovery and Integrated Extraction System (ARIES) Oxide Production: The ARIES program converts weapon-useable plutonium (primarily extracted from pits from retired weapons) to oxide for disposition in a form that is not viable for use in weapons. The program is processing a large amount of plutonium stored in the TA-55 PF-4 vault, thereby making vault space available for other programs. ARIES is also processing unwanted turnings from Defense Programs machining operations in exchange for bulk metal that the Plutonium Sustainment program processes to provide feed metal for casting operations.

In general, the ARIES pit disassembly and plutonium oxidation operations are independent (i.e., use different processes and space in TA-55 PF-4) of pit production. However, as with all TA-55 PF-4 programs, there are natural interfaces in the common infrastructure such as vault storage, NDA, and shipping/receiving and shared support workforce. ARIES and the Plutonium Sustainment program are jointly funding shipping/receiving upgrades to increase capacity, and ARIES is investing in additional NDA capability to reduce reliance on shared NDA resources. Vault interfaces have been minimized by dedicating a limited portion of vault space to the ARIES program.

Materials Recycle & Recovery (MR&R): The MR&R program primarily dispositions legacy and excess Defense Program materials no longer needed for programmatic use. This provides vault space usable by all programs. Additionally, the MR&R program prepares salt residues from the plutonium metal purification operations 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. Given that the MR&R program addresses waste from pit production, the resource interfaces are mutually beneficial.

Plutonium-238 (Pu-238): The Pu-238 programs are examining options for removing material from the TA-55 PF-4 vault to make vault space available for other programs. (b) (5)

The Pu-238 operations are the first adopter of the new system delivered by the Manufacturing Modernization Project (MMP) to enable automated, electronic collection of data for WR product acceptance.

Americium Production: The Americium Production program uses the metal chlorination salts from metal purification as feed to produce americium oxide for use in other industries. Extraction of americium from the salts reduces TRU waste. The Americium Production program uses the aqueous chloride operations used to recover plutonium from salts generated by the plutonium supply operations. If additional space for aqueous chloride operations is needed, there could be competition between pit production and americium production (b)(3) . This will be addressed in the April 2020 update to this Plan.

Appendix F. LANL Focus Areas

To capture and integrate all site-specific inputs, resources, and requirements to successfully execute the 30 ppy mission, LANL used a tailored approach based on the Framework to develop this Plan. The table below provides a crosswalk of the NNSA-identified management focus areas (MFAs) from the Framework with the LANL-identified focus areas. Teams formed for each LANL focus area continue to meet regularly to develop and manage the plan for their team's support for the 30 ppy mission. The focus area teams are discussed in the subsections below.

NNSA 80 ppy Production Framework Management Focus Areas	LANL 30 ppy Plan Focus Areas
NEPA Strategy	NEPA Strategy
30 pits per year at LANL	Pit Fabrication, Inspection, and Certification
50 pits per year at Savannah River Site	Provide LANL knowledge and experience to SRS
Safety Basis Planning	Safety Basis
Quality and Certification	1. Product Quality 2. Certification (LANL Peer Review)
Criticality Safety Planning	Criticality Safety
Physical Security	Physical Security
Cybersecurity and Information Management	Cybersecurity and Information Management
Federal Resources – Budgeting & Human Capital	Not Applicable
Recruiting, Hiring, and Training Contractor Workforce at LANL & SRS	LANL Staffing
Facilities Infrastructure and Maintenance	1. Facilities Operations and Maintenance 2. Infrastructure Investments
Update to Lifecycle Cost Estimate	Not Applicable
Shipping, Receiving, Staging, and Storage	Shipping, Receiving, Staging, and Storage
Waste Management	Waste Management
Other Regulatory Challenges	Other Regulatory Challenges
None	Business Support Services
None	Environment, Safety, and Health (ES&H)
None	Technology Maturation and R&D Support
None	Institutional Quality
None	Emergency Management

This Plan is specific to the pit production mission at LANL, so not all NNSA-identified MFAs are addressed in this document. For example, the 50 ppy at Savannah River Site MFA is specifically focused on the activities necessary for SRS to be successful. LANL recognizes and fully supports opportunities for collaboration and integration with SRS to deliver at least 80 WR ppy starting in 2030. Accordingly, LANL has taken significant steps to assist with the planned pit production mission at SRS, including providing current pit production process knowledge, engineering drawings and specifications for facility systems and process equipment, NEPA support, and information regarding safety, security, and quality programs.

F.1 National Environmental Policy Act (NEPA)

NNSA is conducting a NEPA review of the proposal to produce at least 80 ppy. This proposal includes, but is not limited to, production of a minimum of 30 ppy at LANL and a minimum of 50 ppy at SRS, associated activities at other NNSA sites, and associated transportation and waste activities.

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 is re-examining the potential environmental impacts associated with the proposed restructuring of pit production capabilities and operations, 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 will conduct a NEPA analysis before making an agency-level decision on authorizing 30 ppy at LANL.

Throughout the NEPA review process, NNSA will be sensitive to the impacts a proposal may have on other NEPA analyses and documents. NNSA will also be 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.

F.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 a Supplement Analysis to the 2008 Complex Transformation Supplemental Programmatic Environmental Impact Statement (Complex Transformation SPEIS); a Supplement Analysis to the LANL 2008 Site-Wide Environmental Impact Statement (LANL SWEIS); and an Environmental Impact Statement (EIS) addressing pit production at the proposed Savannah River Plutonium Processing Facility (not addressed in this document).

Overall implementation of this strategy will be 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 will be 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 451.1for each of the NEPA documents associated with the strategy. NA-GC will assign 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. NA-GC has provided NA-10 with a draft Performance Work Statement and Task Plan for use in placing a contract. 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 begins with a Supplement Analysis (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. Reviewed activities include, but are not limited to, various activities at SRS, LANL, Pantex, Nevada National Security Site, and Y-12. Other NEPA analysis 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 will inform 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.

No final decision has yet been reached regarding the type of NEPA document needed to support an NNSA ROD for LANL to move from the currently authorized production level of 20 ppy to 30 ppy with an allowance to surge to the analyzed limit. However, for the purposes of this Plan, it is assumed that the NEPA analysis at LANL would be an SA to the 2008 LANL SWEIS because prior NNSA sensitivity analysis suggests that expanded pit production is expected to be bounded by previous analysis. (b) (5) ontracted 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 2008 LANL SWEIS analyzed environmental impacts for production levels of approximately 80 ppy at LANL; the ROD for the 2008 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 reevaluate existing NEPA coverage and issue an amended ROD authorizing increased production levels.

With respect to site-specific NEPA analysis at LANL, LANL support for an SA to the 2008 LANL SWEIS requires the following:

- Completing a review and final draft SA to the 2008 LANL SWEIS.
- If appropriate, preparing a draft amended ROD that would publicly announce NNSA's decision to increase pit production levels at LANL.

F.1.2 Technical Approach and Solutions

LANL will 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 Plan and has preliminarily determined that no additional NEPA analysis would likely be required for a majority of the items reviewed. 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 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 2008 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.

F.1.3 Schedule for Conducting Scope of Work

The NEPA team has been working with other LANL focus area teams to develop information needed to complete the analysis required for the LANL SA. LANL's understanding is that NNSA plans to complete and sign the SA for the Complex Transformation SPEIS in 2019. Additionally, NNSA plans to have a draft SA to the 2008 LANL SWEIS under review in 2019. Depending on the comments and the NNSA review processes, NNSA may complete the final SAs by September 2019. If, based on the analysis, NNSA determines that no further NEPA documentation is required, NNSA would be able to proceed immediately with an amended ROD in 2019 [redacted]

F.2 Pit Fabrication, Inspection, and Certification

F.2.1 Summary of Work Scope

The Pit Fabrication, Inspection, and Certification team identified the production, inspection, and certification activities and schedules needed to conduct the NNSA-required product realization process (PRP) associated with delivering a WR FPU in 2023. This team represents the core purpose of this Plan. All other teams must be aware of what this team plans to do and ensure that their activities are completed in time to support this team's efforts which include the following:

- Develop the pit production processes to enable transition from development (DEV) to process prove-in (PPI) (b) (5)
- Provide acceptable components and support for the experiments and evaluations specified by the LLNL DA in the Pit Certification Plan.
- Identify the equipment and systems to be installed, modified, or upgraded required to first deliver FPU and then to expand to a reliable 30 ppy production rate. As these infrastructure requirements are defined or updated, they are provided to the Infrastructure Investments team.
- Complete all activities to obtain approval from NNSA and the LLNL DA to begin WR production of the Pit by March 2023.
- Produce FPU by September 2023.
- Produce 10 WR pits in 2024.
- Produce 20 WR pits in 2025.
- Produce a minimum of 30 WR pits in 2026.

For the purpose of this Plan, the pit to be produced for the 30 ppy mission ("the Pit") is a modified version of a pit currently in the active stockpile. The pit that the Pit's design is based on is referred to as the "Legacy Pit." The Pit is intended for use in an emerging nuclear weapon system to be acquired through an NNSA weapon acquisition program. This Plan addresses the actions LANL must take to achieve the pit production goals and does not discuss the activities at other NNSA sites.

Product Realization Process (PRP) Overview

The PRP for WR product realization is defined by NNSA in Defense Programs Business Process System (DPBPS) *R001, Product Realization* and is contractually required. Figure 34 is from DPBPS R001 and shows the phases required for WR product realization with the critical activities, deliverables, and milestones for each phase. The integrated phase gate requirements outlined in R001 allow for tailoring by NNSA.

As stated in DPBPS R001, NNSA's phase-gated PRP is intended to achieve the following objectives:

- Use concurrent engineering to optimize the product for the lifecycle (design, performance, quality, cost, schedule, safety, surety, testing, qualification, production, surveillance, and dismantlement);
- Increase cross-functional interaction among customers, DAs, and PAs throughout the PRP;
- Incorporate systems engineering rigor and consistency in application;
- Assess technology and manufacturing system maturity;
- Ensure accountability at all levels of the PRP; and
- Implement risk-informed decision-making at key transition points in the PRP.

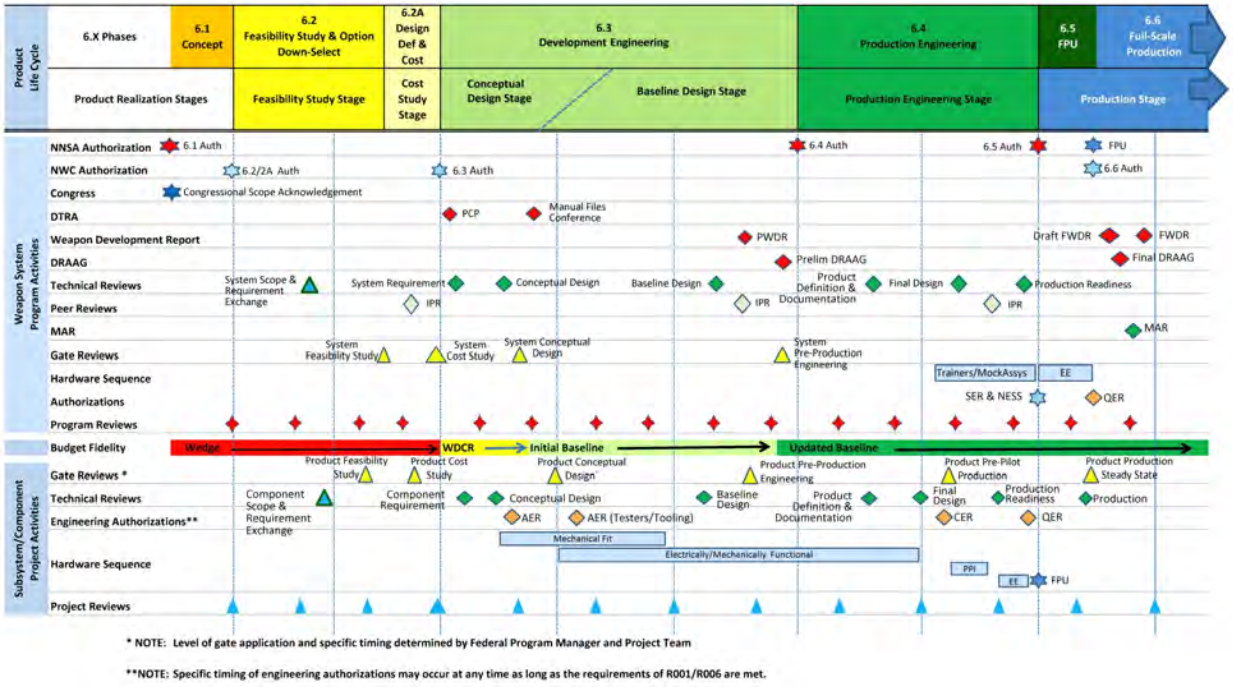


Figure 34. Summary of the product realization process elements from DPBPS R001.

For pit production, NNSA and the Product Realization Team (PRT) define the following progression of pit development build activities within the Baseline Design and Production Engineering Stages:

- Development (DEV) phase;
- Process Prove-In (PPI) phase; and
- Qualification (QUAL) phase.

The primary purpose of the DEV phase is to modify (or install if necessary) required production equipment, testers, and tooling. These are used to develop the production processes and control parameters to meet design definition specifications established by the LLNL DA for the Pit. At the start of the DEV phase, the product made is based on the LLNL DA's conceptual design as specified in the Advanced Engineering Release. As the DEV phase proceeds, the Pit design is improved to become the LLNL DA's baseline design.

After the DEV phase is complete, a Final Design Review (FDR) is conducted and the LLNL DA issues the Complete Engineering Release. The Complete Engineering Release is the specification for the pits built during the PPI phase.

The PPI phase is used to verify that facilities, production processes, tooling, gauges, test equipment, inspection and acceptance methods, and materials have attained production readiness. The PPI phase typically occurs in advance of production qualification activities so that process adjustments and improvements are implemented prior to the QUAL phase. Product made at the end of the PPI phase should be of Mark Quality. To demonstrate completion of the PPI phase, the PRT conducts the production readiness review to validate that the LANL PA has attained a Manufacturing Readiness Level of 7 as defined in DPBPS C017, *Conduct Manufacturing Readiness Level (MRL) Assessment*.

Following completion of the PPI phase, the LANL PA enters the QUAL phase. During the QUAL phase, the PRT performs EEs to ensure processes are stable and mature enough to produce consistent components, and the

LLNL DA completes its evaluation of pit production processes. The QUAL phase ends with NNSA diamond stamping the FPU for WR use.

Throughout the PRP, the LLNL DA executes (with support from the LANL and KCNSC PAs) the Pit Certification Plan. The certification process assures the LLNL DA that the Pit meets the engineering and physics performance requirements for the Military Characteristics across all environments in the Stockpile-to-Target Sequence.

Pit Product Realization Status

As LANL completed the W88 pit production campaign, NNSA established the Plutonium Sustainment Program Office to maintain the nation's pit manufacturing and pit certification competencies. The objective was to ensure a responsive and agile pit production capability would be available for the planned Life Extension Programs. NNSA chartered the formation of an Integrated Product Team (IPT) in 2010 to modify the design of the Legacy Pit and concurrently begin Pit manufacturing development. LLNL was identified as the DA for the Pit and Emerging System. KCNSC was identified as the PA for the Pit's non-nuclear subcomponents, and LANL was identified as the PA for the nuclear subcomponents and Pit assembly.

The Pit IPT updated the product definition, specifications, and drawings to reflect the manufacturing practices at LANL and KCNSC, which are different than those used at the Rocky Flats Plant (RFP) for production of the Legacy Pit. In anticipation of meeting the Emerging System's assumed safety and surety requirements, the LLNL DA developed design concepts for the Pit that are different from those for the Legacy Pit. In 2011, the Pit IPT developed an initial strategy to perform the process qualification and pit certification activities required to produce FPU. In 2012, LANL made DEV pits by using equipment and processes from the W88 production campaign, legacy nonnuclear subcomponents from RFP, and new tooling specific to the Pit design. Prior to the TA-55 PF-4 operational pause in June 2013, LANL made four DEV pits to be used to evaluate design concepts for the Pit.

In September of 2016, NNSA chartered a Pit PRT to mature the general pit production processes by producing Legacy Pits while concurrently developing the required manufacturing processes and nonnuclear subcomponents required for the Pit. Given the limited resources and that requirements for the Emerging System that are not fully defined, NNSA directed the Pit PRT to use a graded approach within the DPBPS PRP framework. In implementing the graded approach, the PRT assumed the program was in the Baseline Design stage (based on the progress made earlier by the Pit IPT). In addition, the Pit PRT assumed that all reviews (e.g., Conceptual Design Review) and phase gates (e.g., Product Conceptual Design Gate Review) had been adequately performed to support the decision of Baseline Design stage. The Pit PRT established (and is updating) a baseline product realization schedule (discussed in Section 2.2) to deliver the Pit FPU in 2023. To meet the required Pit FPU date, the Pit PRT eliminated scope in its graded approach to the DPBPS product realization process.

F.2.2 Technical Approach and Solutions

Discussed in Section 2.2.

F.2.3 Schedule for Conducting Scope of Work

Discussed in Section 2.2.

F.3 Safety Basis

F.3.1 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.

F.3.2 Technical Approach and Solutions

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

- **TA-55 PF-4**: A project execution plan has been developed to upgrade the safety basis to DOE-STD-3009-2014.
- **RLUOB**: The safety design strategy defining the approach for RLUOB to become an HC-3 nuclear facility has been prepared and approved by NNSA. This approach requires development, review, and approval of a new safety basis that is compliant with DOE-STD-3009-2014. A revision to the safety design strategy has been submitted to NNSA for approval to use the new DOE-STD-1228-2019 applicable to HC-3 nuclear facilities. With concurrence to use this standard, the RLUOB DSA is being built following DOE-STD-1228-2019.
- **TWF**: A revision to the safety basis has been developed to replace the seismic switch and upgrade the fire suppression system. Once these controls have been upgraded and implemented, annual updates will be made to the safety basis, with a schedule for an upgrade to meet DOE-STD-3009-2014.
- **Radioassay Nondestructive Testing (RANT)**: The facility completed readiness/restart and is authorized for nuclear operations, which have been in cold standby since 2014. Annual updates are made to the safety basis, with a schedule for an upgrade to meet DOE-STD-3009-2014.
- **Radioactive Liquid Waste Treatment Facility (RLWTF)**: The DSA and maintenance updates to this facility will continue until the replacement facility (TLW) is operational.
- **TRU Liquid Waste (TLW)**: A new DSA is required per DOE-STD-3009-2014 or DOE-STD-1228-2019 to start up operations of the new facility. The safety design strategy will need to be revised to use DOE-STD-1228-2019.

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 flow sheet and MAR limits.

Other elements of safety basis for the 30 ppy mission are discussed briefly below.

TA-55 Criticality Safety DSA Addendum: A DSA addendum has been developed and submitted to NA-LA to provide an alternate method for criticality safety analysis of Design Basis Accidents (DBAs) such as seismic events and fires. DOE Order 420.1C requires DBAs 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.

Meteorology: Development and implementation of a new upgraded weather station data collection system at LANL to supply data required for safety basis dispersion analyses.

Dispersion Methodology: A new dispersion model methodology has been developed and must be implemented for all Hazard Category 2 nuclear facilities. A new methodology to reduce dispersion factors through plume meander is being developed. Additional work may be required to address canyon effects, but additional data from new weather stations in the canyons will be necessary to support this work.

F.3.3 Schedule for Conducting Scope of Work

Facility	(b) (5)	Activity, Deliverable, or Milestone
TA-55 PF-4		Complete DSA Upgrade to 3009-2014
RLUOB		NA-LA approve DSA for HC-3 Operations
TWF		Start DSA Upgrade to 3009-2014
		Complete DSA Upgrade to 3009-2014
		NA-LA approve DSA Upgrade to 3009-2014
RANT		Start DSA Upgrade to 3009-2014
		Complete DSA Upgrade to 3009-2014
		NA-LA approve DSA Upgrade to 3009-2014
Criticality Safety DSA Addendum		NA-LA approve DSA Addendum
Plume Meander Methodology		Complete Plume Meander Methodology
All		Update DSA for each facility

F.4 Product Quality

F.4.1 Summary of Work Scope

The Product Quality team implements an assurance framework to ensure compliance with NNSA requirements. LANL document PA-PLAN-01062, *Weapon Quality Assurance Program-Production Agency* (WQAP-PA) provides a foundation for implementing the following:

- NNSA NAP-24A, *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.

The Product Quality team ensures compliance through the following:

LLNL DA Engineering Evaluations: The requirements outlined in NAP-24A 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 Pit PRT to ensure that each pit production process meets LLNL DA design intent to produce a product that meets requirements and specifications.

Software Quality Assurance: The LANL Software Quality Assurance Program provides a software engineering and assurance framework to ensure compliance with NAP-24A Attachment 4, *Nuclear Enterprise Assurance*, and DOE O 414.1, *Quality Assurance*. 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.

(b) (5)

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.

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. The LANL Standard and Calibration Laboratory (S&CL) determines if equipment procured meets manufacturers' stated accuracy through calibration testing or analysis. This testing may be 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. This process directly supports the requirements listed in NAP-24A Attachment 4 to detect and mitigate subversion, along with satisfying the requirement to validate certificates.

Receipt Inspection and Procurement: The supplier evaluation and export control teams created a line of inquiry and added it to the NAP-24A Supplier Assessment Checklist. (b) (5) Inquiries are made as to whether visitors are escorted, how the building is secured during off-hours, and how the LANL inventory and products are secured.

F.4.2 Technical Approach and Solutions

Qualification/Evaluation: This element includes the development and validation of the data collection system used during PPI as required for qualification of the product. It also includes reviewing, grading, and qualifying software associated with the production systems, reviewing more than 100 specific process instructions to ensure comply WQAP-PA requirements, and reviewing electronic data collection for product verification. The LLNL DA specified EEs and subsequent documentation must be completed prior to FPU. If changes to process and product requirements are identified during the EEs they must 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. SNL found that a central control system improved equipment calibration and reduced the number of errors and time spent correcting them. LANL is transitioning to a similar system.

Electronic Data Collection: 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) with 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.

(b) (5)

F.4.3 Schedule for Conducting Scope of Work

Objective	Date	Activity, Deliverable, or Milestone
Procurement Strategy	(b) (5)	Establish a procurement strategy that identifies • what must be procured, • how to procure it • LANL PA analysis and inspection requirements, and • storage requirements.
MMP	Ongoing	Develop, deploy and improve the MMP system during PPI and QUAL. Obtain NA-LA approval for use prior to FPU.
EE Process/ Qualification	Ongoing	Complete the EE Process for all DA-specified processes.
(b) (5)		

F.5 Certification – LANL DA Peer Review

F.5.1 Summary of Work Scope

NNSA directed LLNL to coordinate an Interlaboratory Peer Review (IPR) of its Pit Certification Plan. The Certification team is responsible for LANL performing this independent assessment.

LANL was tasked by LLNL in May 2019 to review LLNL's Pit Certification Plan and comment on the sufficiency of the plan to allow certification of the Pit for use in a weapon system that will not be fully defined until after the Pit FPU. LANL started the IPR activity in July 2019 and will provide a briefing of the IPR team's findings to NNSA (b) (5)
(b) (5)
(b) (5)

F.5.2 Technical Approach and Solutions

Originally, the IPR plan was to be developed based on LANL's experience and lessons learned from the certification activities for the last-produced pit. LLNL performed an engineering and physics peer review of the LANL-designed W88 pit; that review resulted in the development of long-term collaborations to assess independently the certification of the system. A similar long-term collaboration is anticipated as the full weapon definition is completed.

At this time, LANL is tasked with reviewing LLNL's Pit Certification Plan and commenting only on the sufficiency of the Pit Certification Plan as written, while making note of insufficiencies in the traceability of requirements and the lack of specificity that results.

LANL has assembled a team SMEs from organizations across LANL to conduct the IPR. Team members have experience from the certification of the W88 pit, with other IPRs, or in specific technical areas. Their expertise covers a range of weapons-related technical areas, including pit production, plutonium science, weapon systems engineering, gas transfer systems design and testing, materials testing, weapon hostile-environment analysis, physics performance analysis, and pit surveillance.

F.5.3 Schedule for Conducting Scope of Work

Objective	Date	Activity, Deliverable, or Milestone
Complete the IPR of LLNL's Pit Certification Plan	(b) (5)	Complete the technical review of the Pit Certification Plan and provide a briefing of the findings to NNSA
		Deliver the LANL IPR team's final report to LLNL
		Deliver the LANL IPR team's final report and the LLNL Resolution Report to NNSA
		Provide a LANL and LLNL joint briefing to NNSA

F.6 Criticality Safety

F.6.1 Summary of Work Scope

The Criticality Safety team 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 provides qualified analysts to assist operations in developing criticality safety evaluation documents (CSEDs), performing procedure reviews, providing event response, and participating in annual process reviews. The criticality safety program is assessed triennially.

F.6.2 Technical Approach and Solutions

Staffing: (b) (5) fied. Taking into account attrition and the time required to qualify new analysts, LANL must continue to attract, hire, and retain analysts through programs such as the university pipeline system created in partnership with the University of California and Texas A&M University. Through the pipeline system, students are hired for summer internships at LANL; after successful completion of a summer internship, 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. This pipeline system should provide the necessary analysts to fully support the pit production mission.

Criticality Safety Evaluation Document (CSED) Backlog: LANL is responsible for 444 fissionable material operations. (b) (5)
LANL evaluated the CSEDs requiring re-work to identify those that do not comply with DOE O 420.1C and those for which there are federally approved compensatory measures. LANL is further analyzing the CSEDs in the backlog, binning them into groups with similar issues to be addressed when the documents are re-worked. The non-complaint CSEDs are the highest priority to be addressed in the backlog. The backlog was evaluated in 2019 and a plan issued to eliminate the backlog by September 2022.

CSEDs for Pit Production and Other Missions: CSEDs must be developed to support pit production and other missions, including D&D of existing equipment to make way for new equipment installations. 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 first step is to determine the quantities of SNM needed for each element of the pit production flow sheet, which is needed to identify and schedule the CSEDs to be revised or developed. 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 maintained at LANL.

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*.

Safety Evaluations: For the development of CSEDs, it will be necessary to reduce the time to produce new or revised criticality safety evaluations by using corporate reach back resources. Consistent prioritization of criticality safety evaluations through the TA-55 Nuclear Criticality Safety Board is required. To further simplify analysis, fissionable material operations in drop boxes require reevaluation.

Documents: Actions to improve documentation include

- Coordinate with operations responsible supervisors to develop and document operational requirements, by using subcontractor assistance;

- Standardize engineered and administrative controls;
- Prepare the technical justification for a DSA addendum that broadly analyzes the criticality safety implications of certain abnormal conditions;
- Coordinate with the Safety Basis team to consider elevation of engineered controls and a possible DSA addendum; and
- Develop criticality safety procedures, postings, and evaluations to support generic maintenance activities for de-posted (active) workstations.

Specific Training for Criticality Safety: Actions to address specific training needs include

- 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;
- Extend the retention program for qualified criticality safety analysts;
- Streamline training by redesigning training modules for additional roles, such as an accelerated qualification program for highly experienced engineers.

General Issues: Actions include

- Collocate nuclear criticality safety staff near TA-55;
- Integrate early with IPT design reviews of new or modified equipment;
- Establish and maintain specific classified and unclassified computer servers for nuclear criticality safety; and
- Improve the nuclear criticality safety database.

F.6.3 Schedule for Conducting Scope of Work

Objective	Date	Activity, Deliverable, or Milestone
Current Mission Support	Ongoing	Continue triennial assessments
Complete New CSEDs While Eliminating the Backlog	(b) (5)	Eliminate the CSED backlog per schedule issued in September 2019

F.7 Physical Security

F.7.1 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.

F.7.2 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 on a 24/7 basis 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) , and the increase in security systems equipment will require additional staff to perform preventative and corrective maintenance, performance testing, and 24/7 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 Office of Personnel Management and National Background Investigations Bureau (NBIB) investigators at LANL. LANL is investigating allowing protective force officers with interim-Q or standard Q-clearances but without HRP certification to work posts outside of the TA-55 material access area (MAA) and/or protected area (PA). 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 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 in-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.

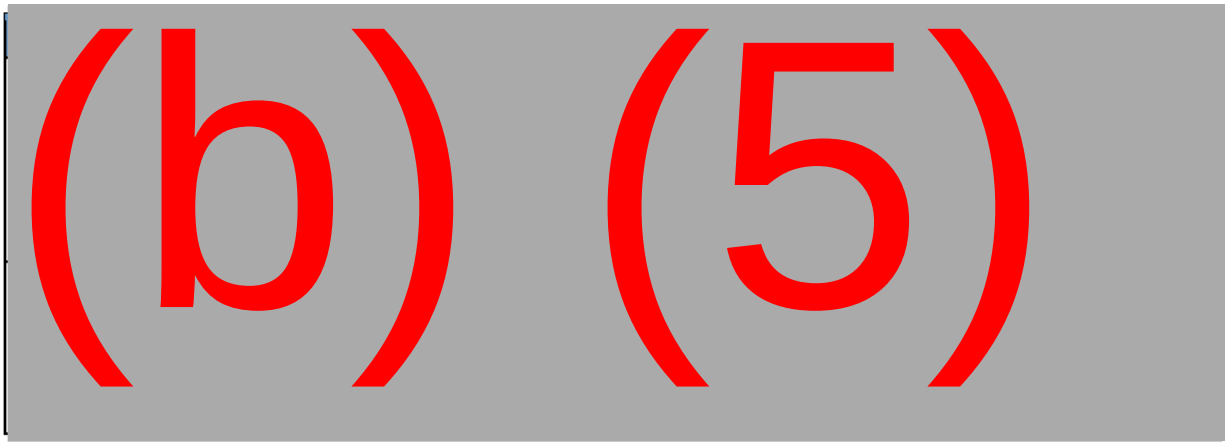
Vulnerability Assessments for the Design Basis Threat: LANL is performing a VA based on the current TA-55 configuration to meet the current DBT as well as other requirements in the implementation plan, such as security risk and roll-up analyses. (b) (5) Because of the current variables in the TA-55 configuration (for example, numbers of entry control portals, infrastructure being built in and around the PA 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), (b) (7)(E), (b) (7)(F) 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 (e.g., the (b) (7)(E), (b) (7)(F) entry portals at TA-55) 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.

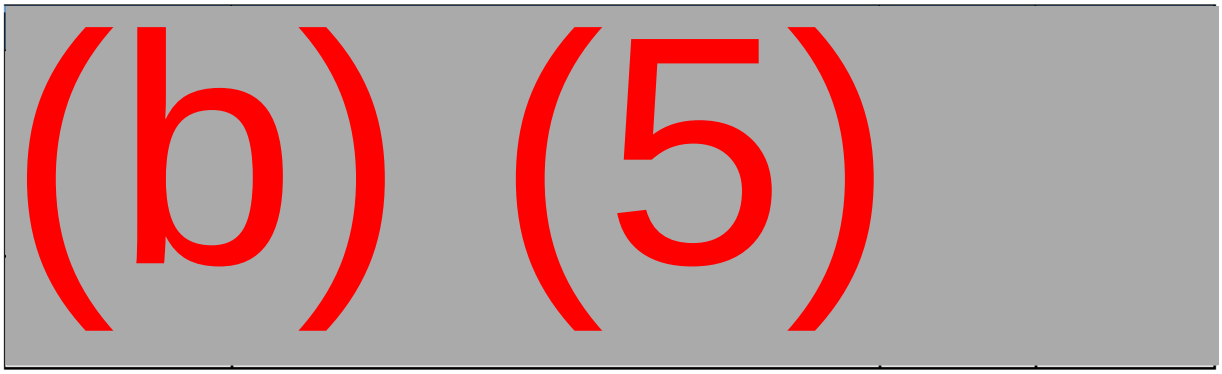
Expanded Hours of TA-55 PF-4 Operation with Increased Access Portals: LANL intends to continuously expand the hours of availability for routine programmatic, construction, and maintenance activities. In July 2019, LANL began utilizing the current protective force staff on overtime as a gap measure to staff a limited number of protective force posts (b) (5) 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) .

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.

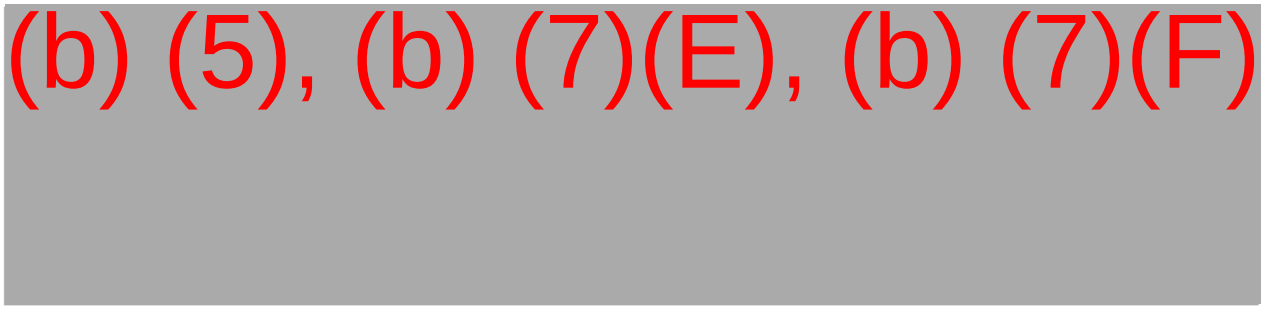
TA-55 East Entry Control Facilities: The TA-55 east Entry Control Facility (ECF) is the main pedestrian entrance into the TA-55 Protected Area. It currently includes six pedestrian entry control portals and a single vehicle entry control lane (east vehicle access) that functions as a backup vehicle entry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



TA-55 West Entry Control Facilities: The TA-55 west ECF is currently the secondary pedestrian and primary vehicle entrance into the TA-55 Protected Area. The facility currently includes one pedestrian entry control portal and a single vehicle entry control portal. 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.



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.



Other Infrastructure Investments requiring Physical Security evaluation and support:

(b) (5)

Current projections are that the facility and capability are required (b) (5) The LANL VA team is in the process of hiring subcontract VA staffing to model (b) (5) 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)

RLUOB Category 3 Facility: LANL will transition RLUOB to a CAT III facility (b) (5) . 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 location 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 of this new nonstandard storage facility. The SRA for this facility is expected to be completed (b) (5) 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.

F.7.3 Schedule for Conducting Scope of Work

Objective	Date	Activity, Deliverable, or Milestone
S&S support for extended-shift operations at TA-55 PF-4	(b) (5)	Protective force officers at TA-55 work overtime as funding permits to support extended-shift operations at TA-55 PF-4.
		Hire additional canine teams to support extended-shift operations at TA-55 PF-4.
	Ongoing	If funding permits, LANL and protective force subcontractor hire additional non-uniformed S&S staff.
	Ongoing	If funding permits, hire approximately 15 additional protective force officers each quarter until full staffing levels are reached.
Clearance and HRP processing	Ongoing	Establish and maintain resident teams of Office of Personnel Management investigators.

Objective	Date	Activity, Deliverable, or Milestone
Vulnerability Assessment	(b) (5)	Perform the VA for the DBT. The results will be used to update the site security plan based on the current TA-55 configuration will be complete (b) (5) Changes to TA-55 infrastructure requiring additional VA modeling and modifications to the VA and site security plan include the following: • VA for TA-55 general infrastructure investments • VA for the TA-55 HENC Pad • Security risk analysis for the RLUOB CAT III Facility • Multiple risk analyses for construction projects
MC&A		Process monitoring implementation • Hire first four process monitors [2 hired]. • After the first four process monitors have established operations, the program and future staffing needs will be evaluated and a more detailed plan will be created for full implementation in all material balance areas. Submit updated Process Monitoring Implementation Plan to NA-LA and NA-70
	TBD	Identify prerequisites for changing MC&A inventories to a six-month cycle. Process monitoring must be established then verified through at least two inventory cycles. Once this has happened, and LANL has demonstrated sufficient levels of process excellence to NNSA, LANL will request approval to reduce the MC&A inventory periodicity.

F.8 Cybersecurity and Information Technology

F.8.1 Summary of Work Scope

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

- Certification and accreditation of wireless technology in LANL limited areas, including TA-55 PF-4
- 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 VTC equipment from the approved LANL list; and
  - Evaluate audio and voice masking mitigation equipment.
- Prepare and issue an Enterprise Classified Computing Roadmap to address
  - Cybersecurity protections and capability for mobile classified computing;
  - Opportunities to use wireless technologies in facilities required for pit production;
  - Opportunities to implement classified cloud services;
  - Opportunities to introduce collaboration tools on the classified network; and
  - Improve and connect internal LANL classified networks and NNSA-wide networks, especially to transfer large files between sites.

F.8.2 Technical Approach and Solutions

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.
- Expand wireless capabilities across the institution, including contractor resources.
- Modernize information technology in the areas of desktop, server, networking and cybersecurity at TA-55.

F.8.3 Schedule for Conducting Scope of Work

Objective	Date	Activity, Deliverable, or Milestone
Classified Computing Network	(b) (5)	Develop IT gap analysis to define IT vision. IT organizations will meet with stakeholders within pit manufacturing and associated programs to ensure a fundamental understanding of the IT required to support 30 ppy and reduce existing gaps in current services that could interfere with mission success.
		Expand classified computing service for future growth by purchasing and installing additional hardware. The current classified computing infrastructure is based on Virtual Desktop Infrastructure (VDI), which provides diskless computing architecture. This environment will require expansion to meet the growing user base as well as hardware lifecycle refreshes, license renewals, and periodic maintenance.
		Install and configure Microsoft Exchange, including setup of collaboration tools and email security markings. The LANL CIO received approval from NA-LA to start deploying Microsoft Exchange in 2019. (b) (5)
Wireless Technology		Define scope of work and required security approvals.
		Purchase technology and award contract.
Secure VTC configuration and approvals to operate		(b) (5)

F.9 LANL Staffing

The LANL Staffing team identified the staffing required for the pit production mission and developed a strategy for recruiting, hiring, training, and retaining this workforce. Key elements of that strategy are described below. Section 2.4 discusses and Figure 22 shows the annual growth in staffing required. Some of the goals and deliverables of the staffing plan are shown in Figure 23. Key elements of the strategy are described below.

F.9.1 Recruiting and Hiring

LANL must recruit new staff to meet the required levels forecasted in the staffing plan. LANL is developing a recruiting program to attract highly qualified and skilled personnel to meet both near- and long-term staffing needs. The recruiting plan will be updated as the staffing requirements and high-demand competency areas are further refined.

Recruiting approaches include creating a pipeline of early-career hires for high-demand areas; identifying and hiring mid-career professionals with specific skill sets needed for pit production; and recruiting highly skilled late-career hires. LANL and Texas A&M University, through the Texas A&M Engineering Extension Service (TEEX), are developing a better understanding of resources and solution options for attracting and retaining craft resources. TEEX conducted a labor market analysis to support immediate and long-term workforce solutions at LANL. This analysis focused on the craft trades and RCTs at LANL, as well as the external regional labor market.

TEEX representatives examined the following:

- Current and changing workforce trends
- Employment trends and growth analysis
- Wage analysis
- Critical labor categories and positions
- Specialized skills and certification requirements
- Regulatory and legal requirements
- Geographic profiles and demographics
- Workforce availability
- Workforce demand
- Workforce pay rates

Based on current and projected mission requirements, geographical location, labor sourcing and utilization, and regulatory requirements, LANL faces significant challenges in the recruitment and retention of RCTs and certain craft labor positions (b) (5) LANL will continue to work with TEEX to understand and implement the proposed strategies to resolve the workforce challenges presented in the TEEX report.

LANL is conducting recruiting and hiring activities on a schedule that accounts for the 1–3 years required for workers to obtain a security clearance and HRP certification and complete job-related training. This is to ensure the LANL workforce is authorized, trained, and qualified in time to support the pit production mission. Components of the recruiting strategy are discussed below.

College/University Partnerships and Pipeline Programs: LANL is collaborating with Texas A&M University, the University of California, and regional community colleges and universities to establish programs supporting a pipeline of students and other workers with critical skills for the pit production mission. An example is with Northern New Mexico College to establish and maintain a radiological control technician (RCT) academy. As a start, Northern New Mexico College offered a radiation protection associate's degree program in 2019 with an initial class of 40 students, who will be offered LANL internships while they pursue the two-year program.

Craft: LANL is exploring options with the craft unions, the New Mexico Building and Construction Trades Council, and local schools to increase the craft workforce and alleviate fluctuations in craft levels from regional competition. The fluctuating regional demand for craft presents a challenge for attracting and retaining craft

largely because of competition from the Albuquerque metro area. LANL is developing incentives to attract and retain craft by offering per diem, incentivizing HRP, and establishing vocational programs.

Recruiting Tools: LANL has developed and implemented a number of recruiting tools to expedite hiring including

- Combining the job postings for specific disciplines needed by multiple organizations (e.g., research technicians).
- Authorizing managers to make on-the-spot employment offers during the interview process.
- Providing dual career hiring assistance to support the employment of a candidate's spouse or partner.
- Waiving advertising requirements to expedite the hiring of skilled talent who meet established criteria (currently requires the LANL Director's approval).
- Providing hire-on incentives.

Hiring Center: LANL is establishing a hiring center as a centralized location for interviews, recruiting events/fairs, onboarding, and training activities.

F.9.2 Workforce Education and Skills Development

DOE/NNSA requires nuclear facility workers to be trained and qualified to ensure safe and secure operations. Training and qualification address facility operations, including MC&A, safety basis, radiological control, and criticality safety, as well as program-specific operations. LANL maintains a qualified workforce with the breadth and depth in critical skillsets required for pit production through the following:

Training Initiatives – LANL is developing training initiatives to enhance cross-training and provide worker (b) (5)

Knowledge Management – LANL is capturing historical knowledge and specialized technical expertise and organizing it into an integrated searchable system. Information sources include interviews with subject matter experts, as well as documents, radiographs and other test results, and film and video records from archives at RFP, LANL, and LLNL. Knowledge is gathered and the information is preserved for use in educational programs and on-the-job training.

College/University Partnerships – LANL is partnering with the University of New Mexico and other regional New Mexico colleges and universities to develop new academic certificate and associate's degree programs for the LANL technician and technologist workforce.

- Academic certificate – A one-year program (approximately 30 credit hours) of technical concepts necessary for fissile material handling in a nuclear facility. Credit from the certificate program can be applied to an associate's degree.
- Associate of Applied Science – A two-year degree program (approximately 60 credit hours). Credit from the associate's degree program can be applied to a bachelor's degree.

LANL has expanded joint faculty appointments to allow LANL staff to teach accredited college-level courses in weapons, nuclear facility, and plutonium related subjects.

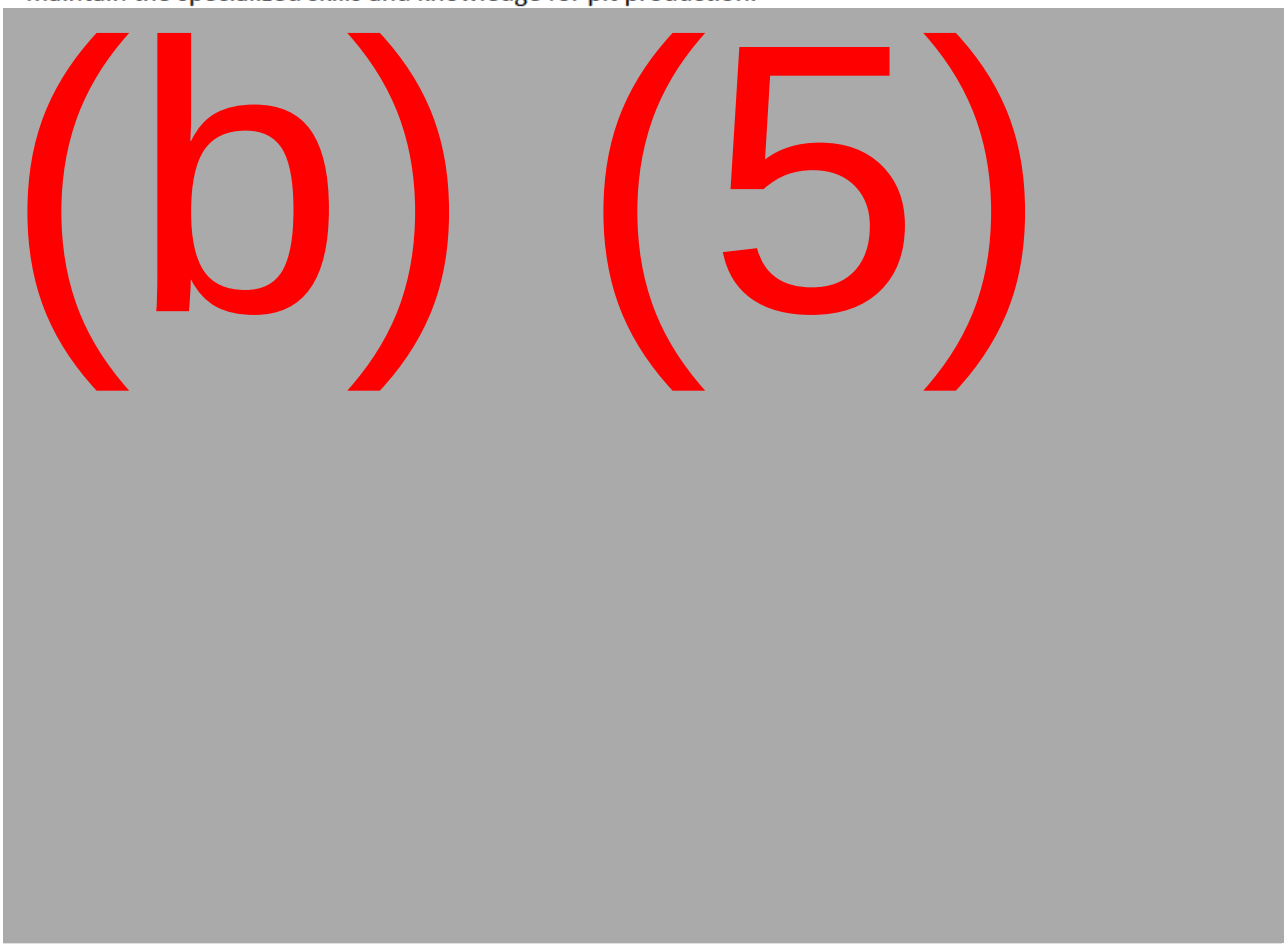
Nuclear Enterprise Science and Technology (NEST) education program – The G.T. Seaborg Institute was established to preserve expertise in actinide science. The LANL branch of the Seaborg Institute focuses on research and education in plutonium. LANL is building the success of the Seaborg Institute and its expertise in

plutonium science to establish the Nuclear Enterprise Science and Technology (NEST) education program to support the pit production mission.

The NEST education program will teach technicians, operators, scientists, and engineers about plutonium and the technical basis of nuclear facility operations. NEST courses will be developed and taught by LANL subject matter experts in plutonium science, engineering, and manufacturing. Courses will address operational and technical issues relevant to pit production, including the following:

- Pit production equipment and processes;
- Safe handling, packaging, storage, and disposal of radioactive materials; and
- Topics associated with TA-55 PF-4 and other nuclear facilities at LANL including
  - Facility and general operations,
  - Structural design and support systems, and
  - Safety basis requirements.

TA-48 Plutonium Training, Support, and Development Center – LANL's training infrastructure must be expanded to provide training for the pit production mission. LANL will design and build the facility to include classrooms, lecture halls, and non-radiological laboratories with gloveboxes, process equipment, and instrumentation as similar as possible to those used for pit production in TA-55 PF-4. The training and development areas will have unclassified and classified space to train nuclear workers and to develop and maintain the specialized skills and knowledge for pit production.



F.9.3 Retention

LANL must not only recruit, hire, and train the staff for pit production but retain the workforce as well. LANL currently experiences approximately (b) (4) . This attrition rate coupled with the 1–3 years it takes to hire, clear and train replacement staff results in a potential (b) (4) . It is imperative that LANL take steps to improve staff retention. LANL recognizes the needs and motivators are different for the various categories of workers (e.g., craft, scientists, RCTs, etc.). Components of the retention strategy include the following:

Monetary compensation: LANL annually evaluates the structure of the compensation program for all positions relevant to the pit production mission to consider optimal base and non-base salary options. Additional monetary programs under evaluation include (1) streamlined ancillary pay programs to reward and retain workers with unique skills and qualifications who work in unique facilities; (2) shift-differential pay programs in support of extended shifts and operations; and (3) retention-pay program (base and non-base) options in support of retaining key contributors. For example, LANL recently completed a compensation evaluation for RCTs, a position with a high-rate of attrition. In 2018 and 2019, LANL completed key alignments of the education and experience requirements for RCT job levels and salary bands, which resulted in approximately 80 salary adjustments and promotions.

Employee benefits: LANL annually evaluates and refines employee benefit options to remain competitive with other NNSA sites and the external market. LANL is implementing communications programs to increase employee awareness of available benefits, including enhanced education of benefit options, and is considering issuing a total compensation statement. Additional benefit offerings that are being explored include additional paid time off and comp time options, student loan assistance, and transportation subsidies.

Employee development opportunities: Workforce retention is a strong driver for the strategies identified in the workforce education and skills development section. LANL is integrating employee training programs via the Weapons Learning Capability program to streamline employee development from pre-hire to mid-career. In addition to onsite training options, the tuition assistance program offers individual employee development via formal education programs.

Community engagement: LANL recognizes the unique community benefits available in Northern New Mexico and the challenges of being in a remote location. Ongoing engagement with the Northern New Mexico community is important for the development of community infrastructures to support an increased workforce with shifting cultural needs. LANL leadership will update and involve the community by becoming members of, participating in, and/or regularly attending meetings of county commissions, chambers of commerce, the Regional Coalition of LANL Communities and similar regional business organizations, and city and county councils.

Facilities and infrastructure: A attractive work environment that meets the expectations of today's and the next generation's workforce must be established. Current infrastructure planning is addressing office, parking, and laboratory space; wellness facility options; food service options; and classified and unclassified training/education facilities.

F.10 Facilities Operations and Maintenance

F.10.1 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

- 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-03 CMR (until operations are transferred to RLUOB), and
- TA-03 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 F discuss some of these functions in more detail.

F.10.2 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) 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)

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.

F.10.3 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.

Objective	(b) (5)
TA-55 PF-4 Waste Management	
TA-55 PF-4 Operations	
TA-55 PF-4 Operations	
TA-55 PF-4 Seismic Upgrades	

Objective	(b) (5)
TA-55 PF-4 HVAC Upgrades	
TA-55 PF-4 Fire Protection Upgrades	
TA-55 PF-4 Balance of Plant	
RLUOB Waste Management	
RLUOB Maintenance	
RLUOB Facility Upgrades	

Objective	(b) (5)
RLUOB Recapitalization Projects	
RLWTF Waste Management	
RLWTF Facility Upgrades	
RANT Operations	
RANT Facility Upgrades	

F.11 Infrastructure Investments

F.11.1 Summary of Work Scope

The infrastructure investment scope is addressed in Section 2.3.

F.11.2 Execution Approach and Solutions

This section does not address the project acquisition strategies and associated details for execution (see Section 2.3). Rather, it provides high-level overview of LANL's approach will take to manage this scope and secure resources.

Management

LANL is combining the execution of most of the infrastructure investments identified in this Plan to be managed by the Associate Laboratory Director for Capital Projects. This allows for

- Level-loading craft resources and minimizing unproductive time;
- Aligning resources to recover projects with a schedule variance;
- Integrating schedules of all infrastructure investment projects to optimize overall execution;
- Standardizing project management and reporting practices (project and mission lifecycle focus).

Craft

LANL and Texas A&M University are conducting studies of the availability of craft in New Mexico and the best approaches to attract and retain the required craft to complete the infrastructure investment projects as planned. The following are some of the initial finding and proposed recruiting and retaining approaches

- Increase salaries;
- Provide an incentive to obtain HRP certification;
- Provide busing from Albuquerque and other locations;
- Modify the shift hours and days of the work week; and
- Develop a craft skills development program with local high schools (see Appendix F.9).

Shift construction and maintenance to the off-shifts

- (b) (5)
-

F.11.3 Schedule for Conducting Scope of Work

The infrastructure project execution schedules are addressed in Section 2.3.

F.12 Shipping, Receiving, Staging, and Storage

F.12.1 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.

F.12.2 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)

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.

F.12.3 Schedule for Conducting Scope of Work

Date	Activity, Deliverable, or Milestone
(b) (5)	Develop a shipping schedule for nuclear material and components for LANL through 2030.
	Establish the required storage container types and supply chain requirements for SNM storage container quantities that are appropriate for all nuclear material movements.
	Evaluate neutron-based NDA measurement equipment on the TA-55 operating floor.
	Implement the replacement of the Model FL container with the DPP-1, based on availability of the DPP-1.
	Establish an improved method for sample transfer from TA-55 PF-4 to RLUOB and CMR.
	Implement neutron-based NDA measurement equipment on the TA-55 PF-4 operating floor based on NDA evaluation completed (b) (5)
	Complete specific vault de-inventory goals to directly support the 30 ppy feed and product storage requirements.
	Complete a TA-55 PF-4 SNM storage reconfiguration that will significantly increase storage capacity (b) (7)(E), (b) (7)(F)

F.13 Waste Management

F.13.1 Summary of Work Scope

Managing the liquid and solid waste generated by the pit production mission at LANL is essential for the program to operate without interruption. Waste management includes the characterization, processing, staging, and shipping of waste streams from multiple LANL facilities to offsite entities, such as WIPP, for final waste disposition. Waste management must reliably address all waste streams from generation through final off-site disposition and meet all regulatory requirements.

The radiological liquid waste (RLW) facilities support both low-level and TRU liquid processing. The existing facilities are undergoing modifications to handle projected capacities and modernize processing capabilities. The construction of the new low-level liquid waste (LLW) facility, with a larger liquid storage capability for low-level liquid waste, and the new TRU liquid waste (TLW) facility supports the projected processing throughput required for production of 30 ppy.

The solid waste capability at the TRU Waste Facility (TWF) is planned for expansion to include drum characterization capabilities. After staging at TWF, the drums of waste are transferred to the RANT facility for packaging and shipment to WIPP.

The Enduring Mission Waste Management Plan provides the institutional strategy and path for waste streams other than TRU waste.

Preliminary analysis indicates that infrastructure investments would improve the reliability and efficiency of waste management. LANL is working with the NNSA Office of Safety, Infrastructure and Operations (NA-522) to refine the requirements for the following waste management infrastructure investments:

- TA-54 Warehouse – 30,000 square foot warehouse to store new waste drums and commodities;
- TA-54 Low-Level Waste Pad – RCRA-approved storage location for low-level waste; and
- Non-Public Road – road for transferring solid waste between TA-55, the LLW Facility, TWF, and RANT.

F.13.2 Technical Approach and Solutions

Increased operations to support the 30 ppy mission will increase the volume of waste generated. Additional staff are needed to manage the increased waste streams and to operate and maintain existing and new waste management facilities. A staffing plan to support the scope and schedule for management of the waste facilities and waste streams in support of pit production is being updated and implemented.

Actions necessary to support the expanded pit production mission are discussed below.

- Maintain efficient and reliable operation of the radioactive liquid waste facilities and collection systems. Concurrent with ongoing liquid waste operations, LANL will
  - Implement the expected requirements of the New Mexico Ground Water Discharge Permit;
  - Transition operations to the new LLW facility and future TLW facility; and
  - Stabilize and maintain waste management operations at RLWTF until the transitions to the new LLW and TLW are complete.
- Ship the LANL inventory of TRU waste to WIPP prior to the planned temporary closure of WIPP in 2021 for ventilation upgrades.

- (b) (5)
- Dedicate resources for the central characterization program and the LANL mobile loading unit teams to certify and ship NNSA TRU waste.
- Obtain priority from the Carlsbad Field Office for planned TRU waste shipments from LANL to WIPP.
- (b) (5)

Transformation of the waste facilities and systems to support the expected waste disposition needs requires NNSA and LANL to

- Establish and use at the TWF pipe overpack container storage, real-time radiography, NDA, and measurements of flammable gas content.
- Establish and maintain agreements with the DOE Office of Environmental Management and the NNSA to provide waste characterization, certification, and shipping resources to support waste management for the 30 ppy mission.
- (b) (5)
- Designate an NNSA-dedicated certification team to expedite TRU waste stream certification, acceptable knowledge assessments, chemical compatibility evaluations, and oxidizer and combustible content reviews.
- Improve TRU waste packaging and transfers to increase the movement of TRU drums from TA-55 PF-4 and stablish TRU waste packaging in RLUOB.
- Collocate waste packaging and visual examination activities in TA-55 PF-4 for metal supply byproducts.

Understanding the projected waste streams and volumes is essential to establishing key resources and capabilities such as those listed below.

- Establish an approved method to remediate current and future non-certifiable TRU waste, such as gloveboxes, empty confinement vessel dispositions, pencil tanks, and non-compliant drums.
- Update and maintain the TRU waste generation model to provide up-to-date waste projections. This modeling includes both newly generated program waste, construction waste, and waste from the TA-55 PF-4 vault de-inventory. The model is based on historical waste production and projected program and construction schedules.
- Integrate with the MR&R program to manage residues (from metal purification) for disposition, including physical movement, post-processing, NDA, and MC&A for the transfer of residues to waste.

F.13.3 Schedule for Conducting Scope of Work

Date	Activity, Deliverable, or Milestone
(b) (5)	
Ongoing	Establish and stabilize operations at the new LLW facility and future TLW facility
	Establish TRU waste drum characterization capabilities at TWF
	Transition storage of LLW waste from inside the TA-55 protected area to a storage location outside the TA-55 protected area

F.14 Business Support Services

F.14.1 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

- 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; and
- 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

F.14.2 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)
- Upgrade facilities, infrastructure, and technology to accommodate additional users and business hours. LANL 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 is assured and to enhance availability of process data.

- Increase the project controls staff to ensure support 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.

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.

F.14.3 Schedule for Conducting Scope of Work

Objective	(b) (5)	Activity, Deliverable, or Milestone
Business Processes and Supporting IT Systems		Identify and define the business processes and support IT systems that enable the 30 ppy mission Prioritize and bin the business processes and supporting IT systems into a set of focus areas
Gap Analysis for IT Systems		Identify the gaps in the IT system requirements for improved business systems with the capabilities of the existing IT systems
IT System Improvement Plan		Develop and issue an IT improvement plan that • addresses the gaps for each IT system • defines roles and responsibilities for organizations and functions • provides a resource loaded Primavera P6 schedule • identifies the funding sources
Off-shift operations at TA-55		(b) (5)
Records Management System on Classified Network		Stand up classified implementation of an EDRMS-like software, including wireless access capability

F.15 Environment, Safety, and Health (ES&H)

F.15.1 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

- 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; and
- 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) . 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 thru 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 appropriated ES&H support and oversight. Associated work can be highly variable and complex, particularly when it involves reconfiguring equipment or when hazardous materials 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 Plan, 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.

F.15.2 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.

F.15.3 Schedule for Conducting Scope of Work

Objective	(b) (5)	Activity, Deliverable, or Milestone
Increase ES&H staffing		Execute the ES&H staffing plan as funding permits.
Establish occupational health clinic at TA-48		Provide requirements for the planned occupational health clinic that will be included in the TA-48 office building.
Establish respiratory protection training and fit testing at TA-48		Provide requirements for the planned respiratory protection training and fit testing space that will be included in the TA-48 office building.
Submit permits for planned infrastructure investments		Prepare and submit permits associated with new infrastructure investments.
Complete compliance work associated with proposed new facilities at TA-48 and elsewhere		Excavate cultural resources within the footprints of proposed facilities.

F.16 Technology Maturation and R&D Support

F.16.1 Summary of Work Scope

The Technology Maturation and R&D Support team evaluates LANL's existing and planned pit production and support capabilities, LLNL's Pit specifications and certification requirements, and input from other focus area teams to identify opportunities to draw on LANL's scientific and engineering expertise and resources to make improvements. (b) (7)(E), (b) (7)(F) 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.

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 similar but independent 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.

F.16.2 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)

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

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.

F.16.3 Schedule for Conducting Scope of Work

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

F.17 Institutional Quality

F.17.1 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, inspections, 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 dramatically increase.

F.17.2 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. Upgrades and improvements are also being made to institutional issues management and oversight processes and to tools for addressing nonconformance issues.

F.17.3 Schedule for Conducting Scope of Work

Objective	(b) (5)	Activity, Deliverable, or Milestone
Improve procurement process		Streamline Exhibit H (compensatory action)
		Evaluate current tracking software and modify or replace to meet needs for the increased work scope
Improve supplier evaluation process		Establish an enhanced buyer information source to guide the selection of suppliers for mission-critical items and services
		Rewrite supplier evaluation related procedures and overhaul forms and templates to simplify and improve consistency of data entry
		Achieve full participation in the Master Approved Supplier List to expand the number of approved suppliers to support mission-critical needs for items and services
Warehousing		Provide warehousing requirements to the relevant infrastructure investment projects

F.18 Emergency Management

F.18.1 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) 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.

F.18.2 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.

F.18.3 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.

F.19 Other Regulatory Challenges

F.19.1 Summary of Work Scope

The Other Regulatory Challenges team evaluates the compliance requirements needed to conduct increased pit production 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. The team identifies regulatory and permitting requirements for LANL to increase pit production 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.

F.19.2 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.to reduce redundancy from the use of different tools, increase communication between users and SMEs, and increase compliance with institutional and regulatory requirements. The IRT is the mechanism to provide compliance feedback to project managers. Proper and timely use of the tool reduces unanticipated impacts to project cost, scope, and schedule.

F.19.3 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. 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 G. Equipment and Infrastructure List (EIL)

G.1 Plutonium Sustainment

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

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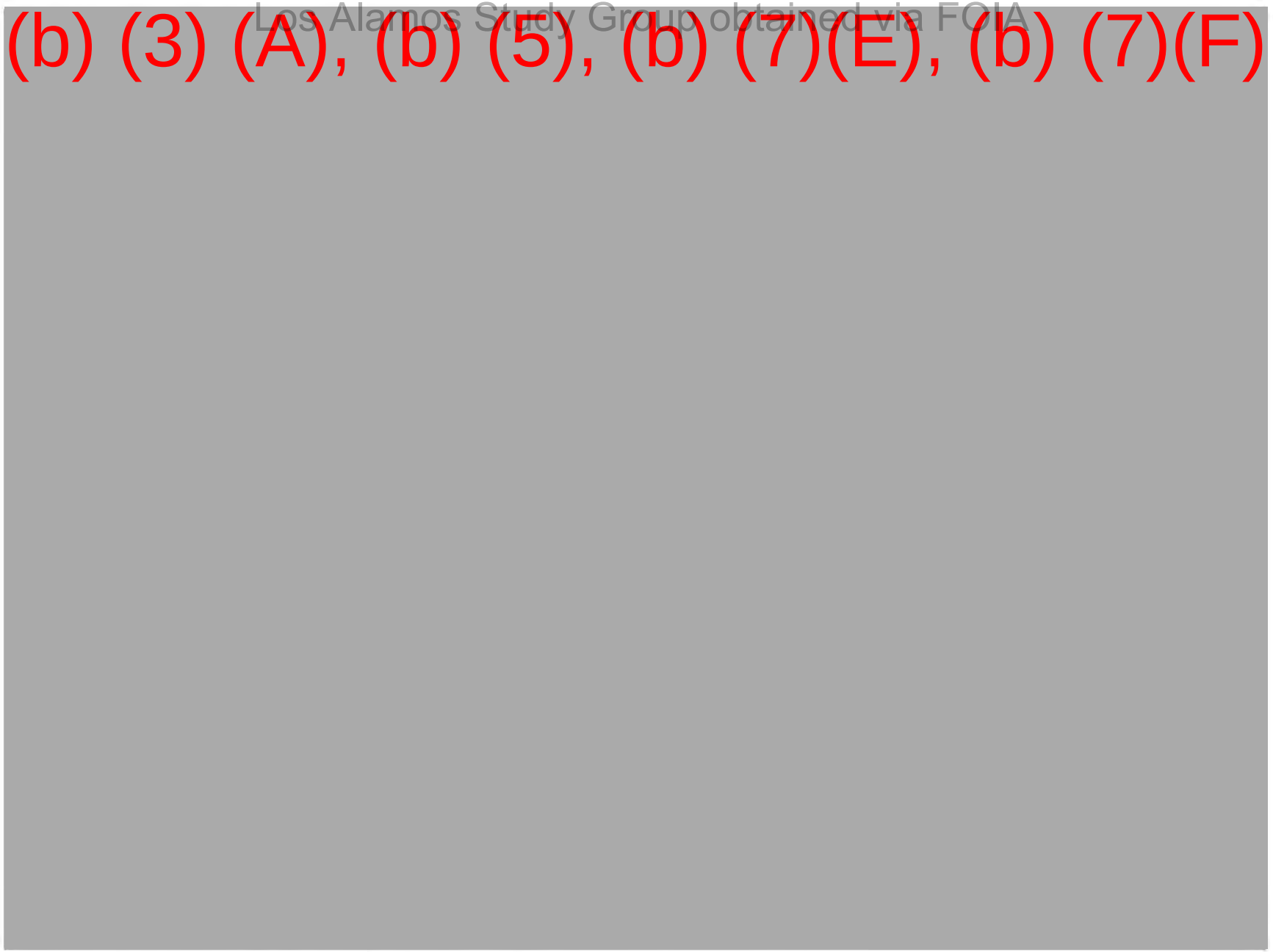

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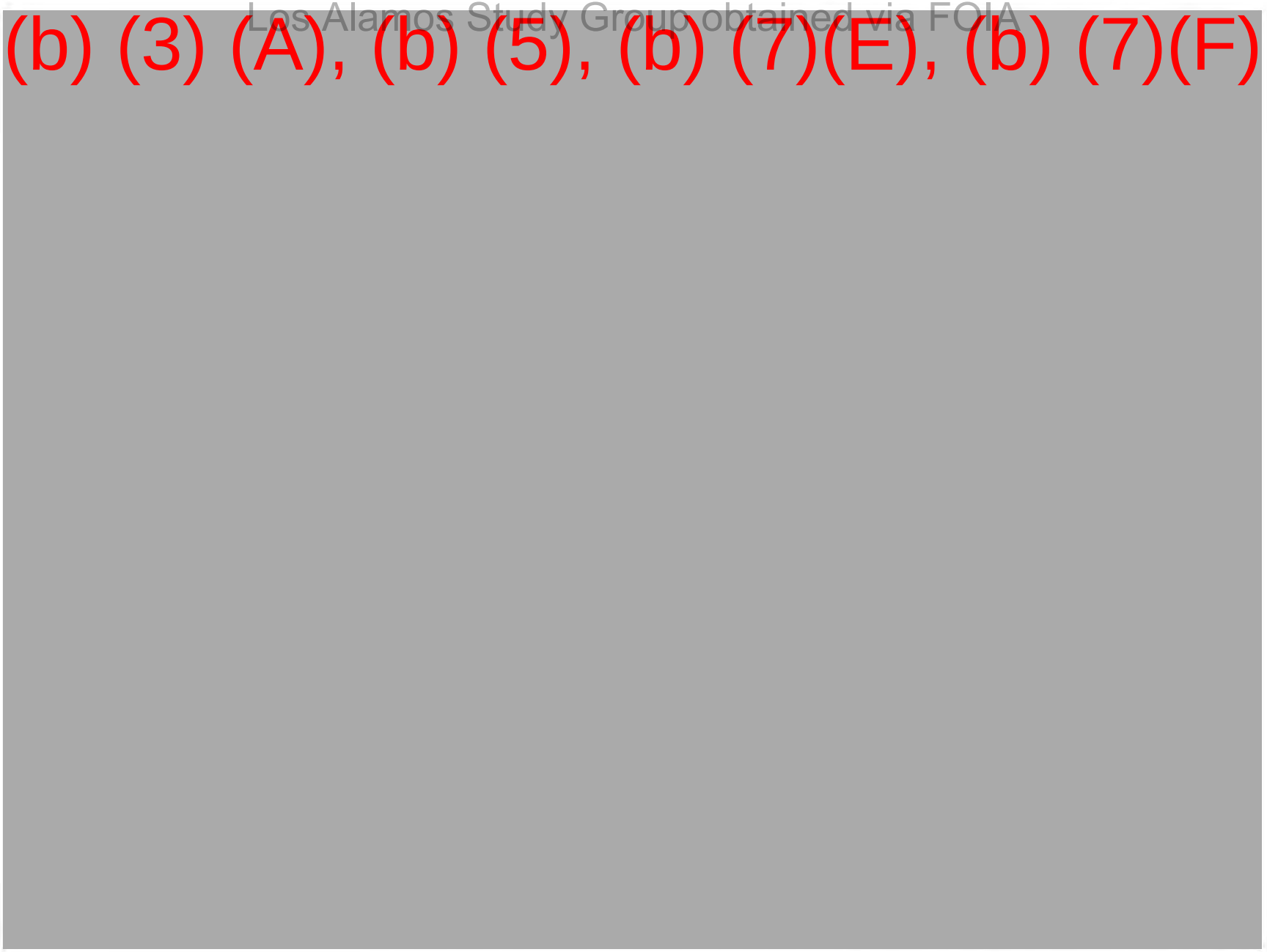

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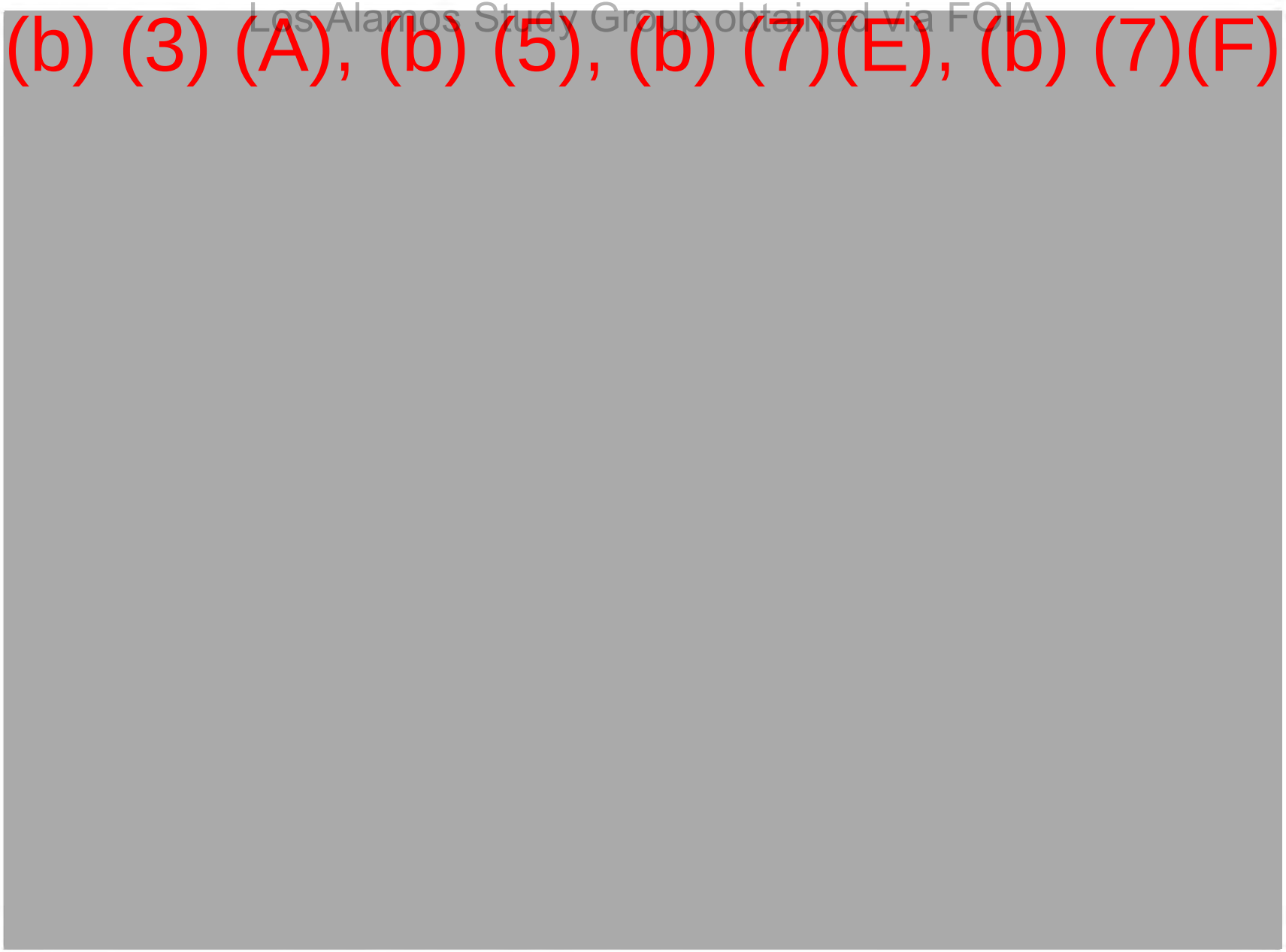

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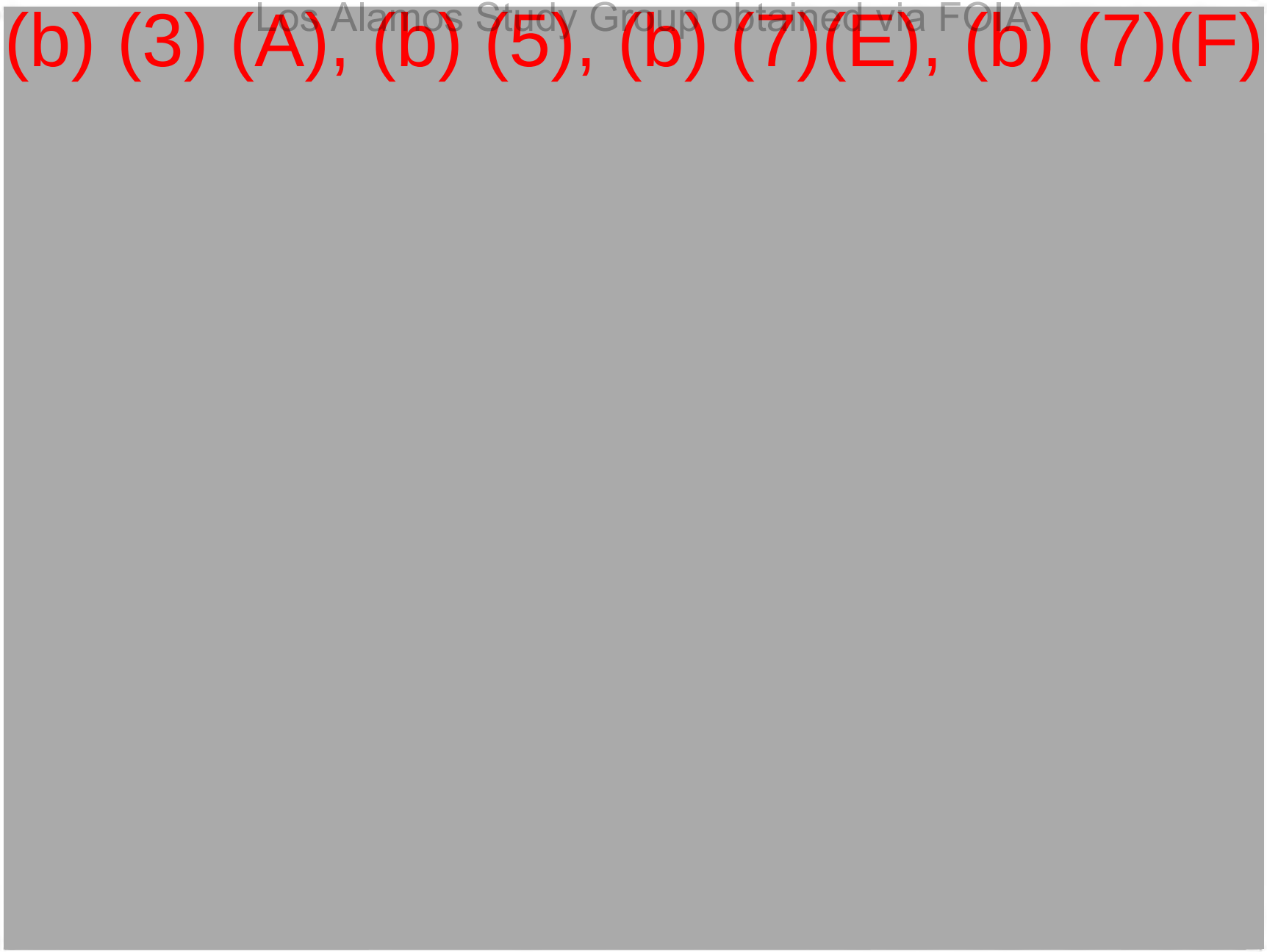

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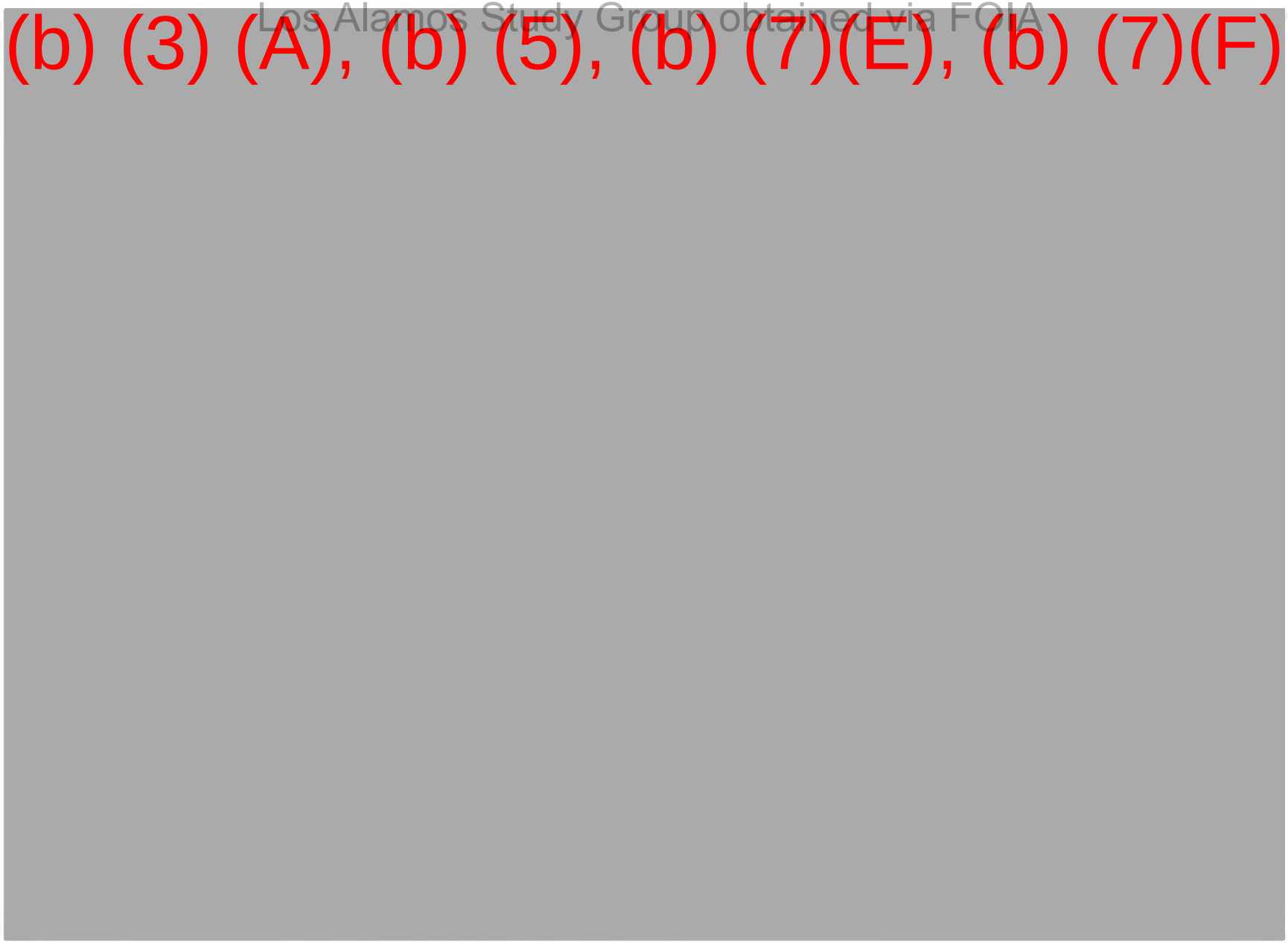

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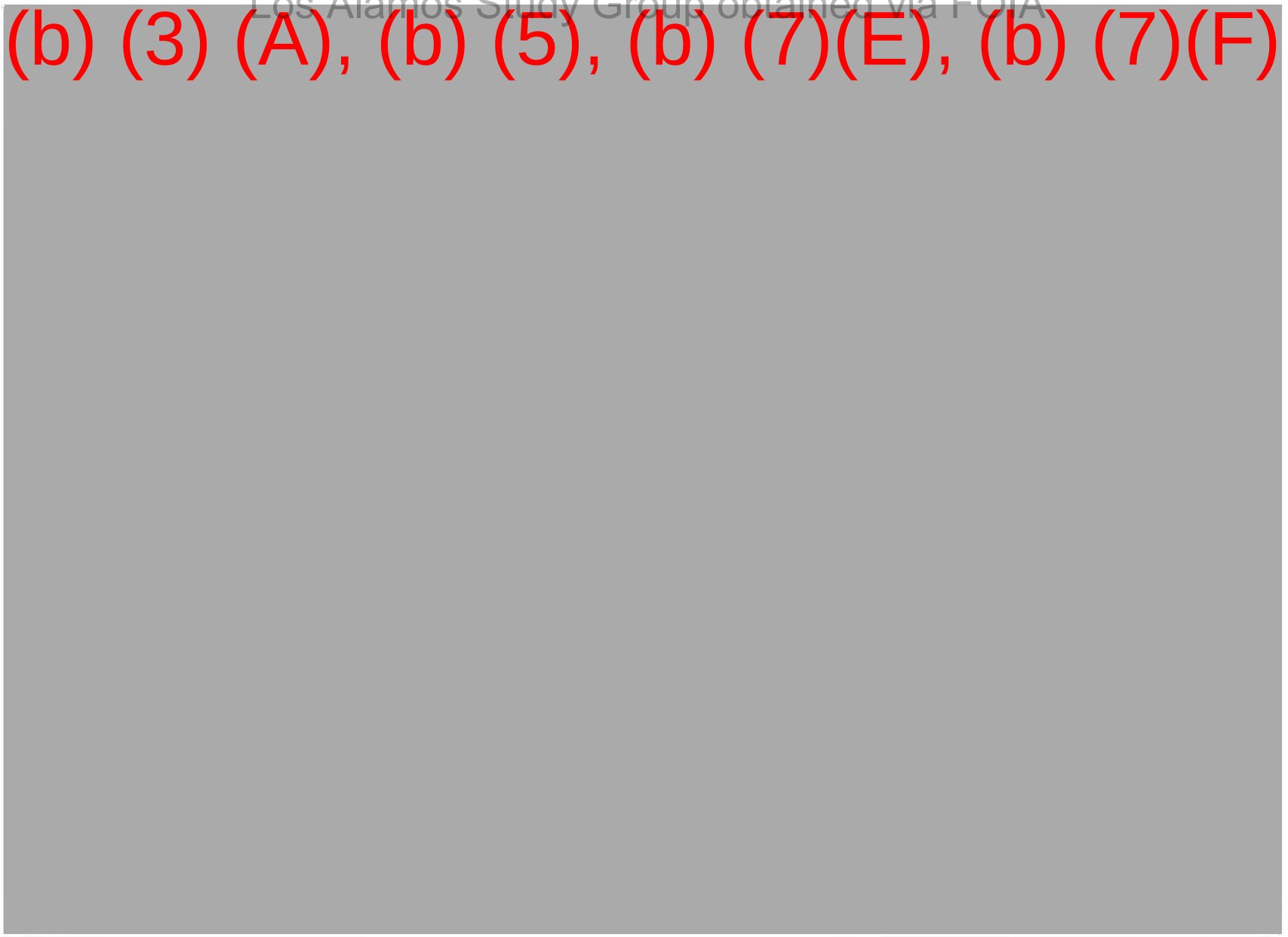

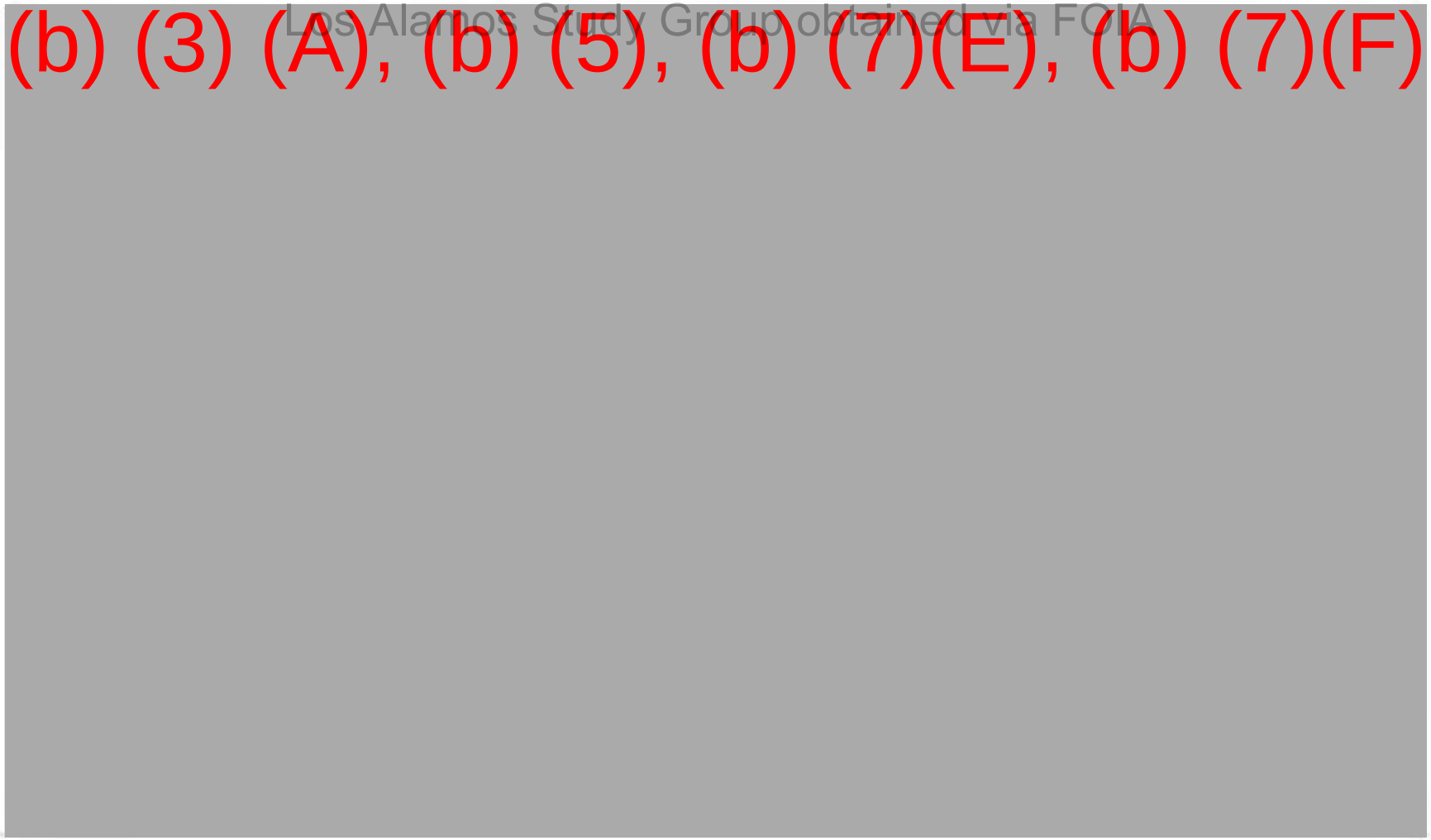

G.2 Line-Item Projects (TRP III, TLW, CMRR)

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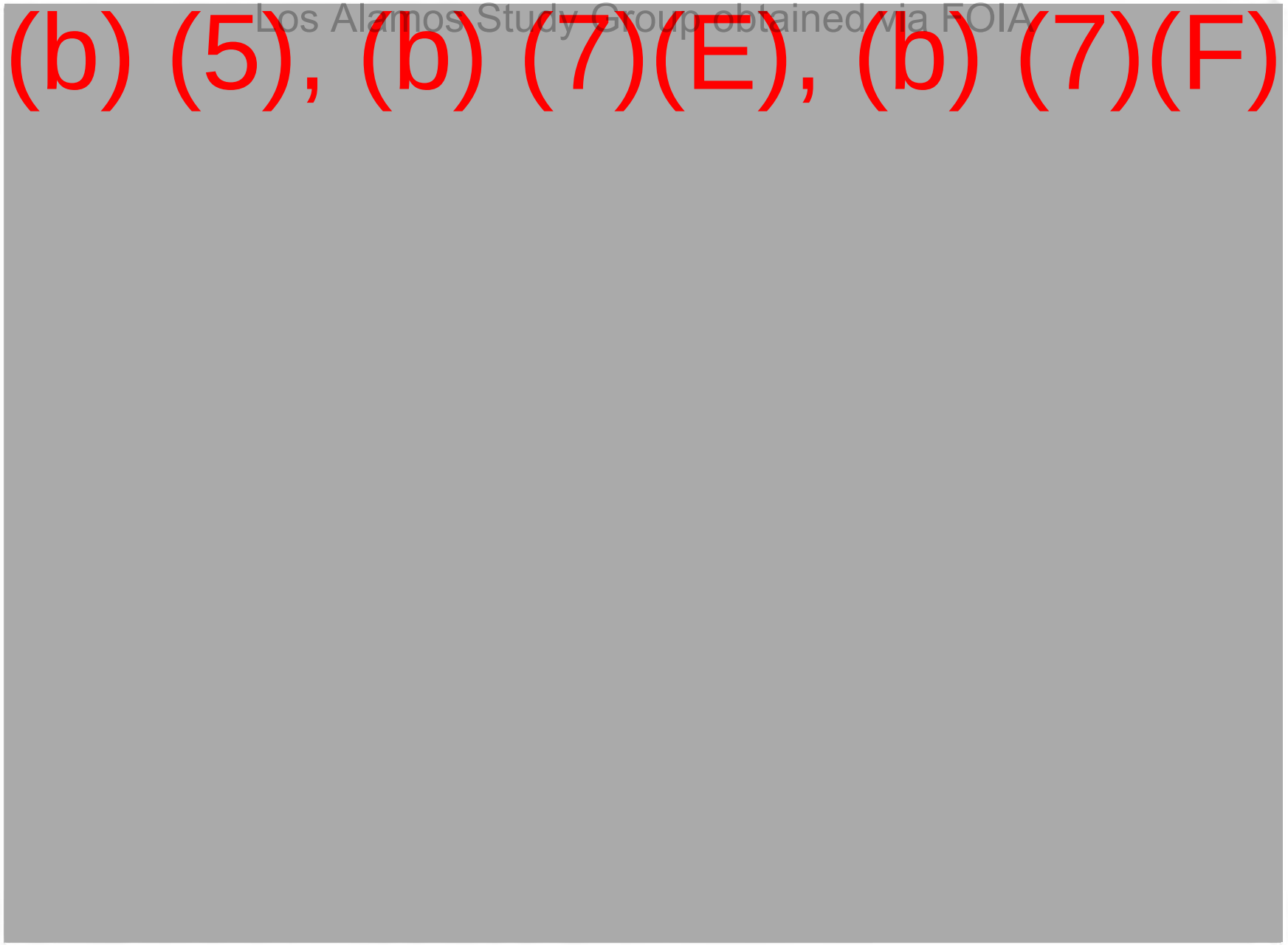
(b) (5), (b) (7)(E), (b) (7)(F)



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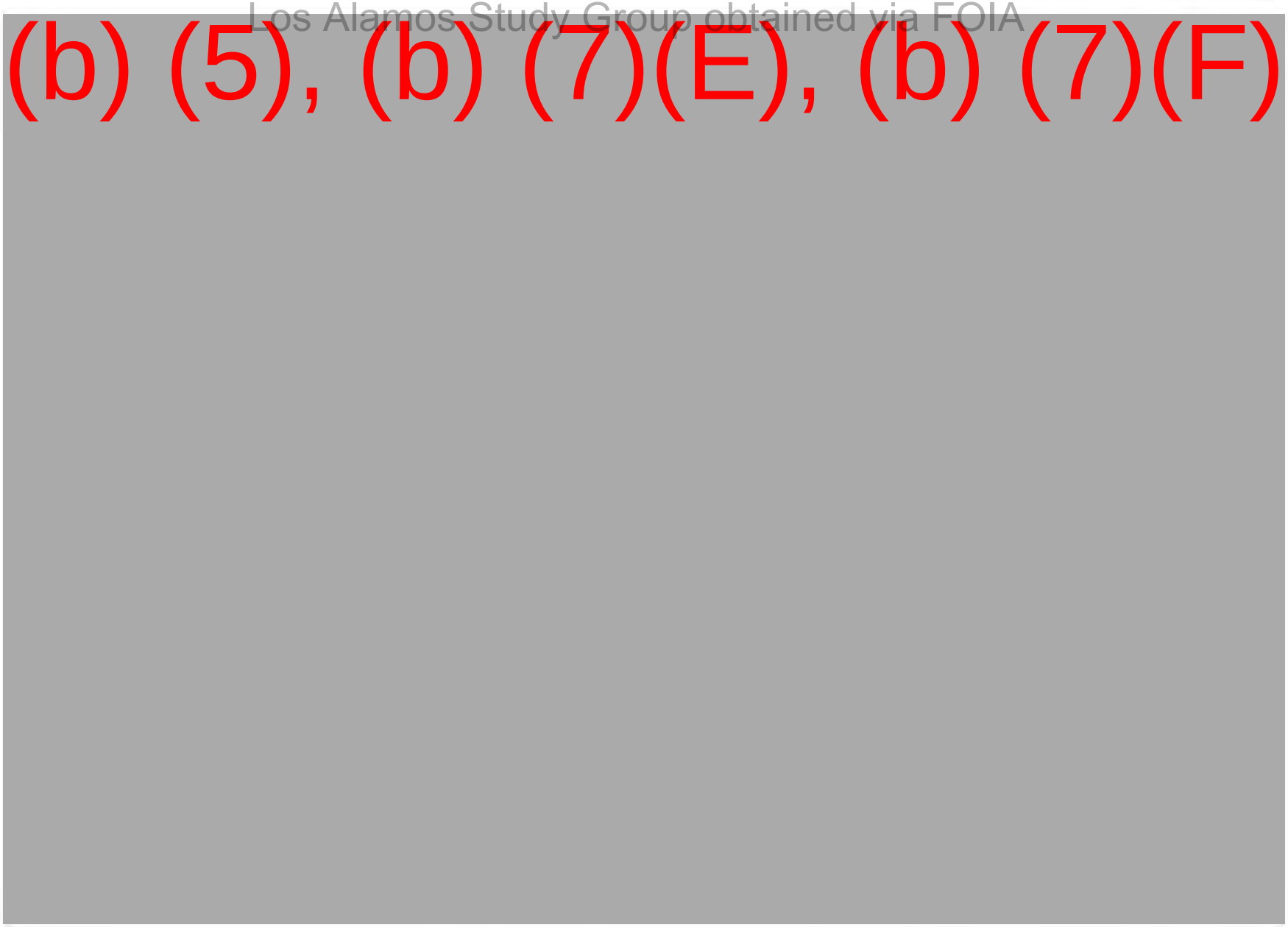

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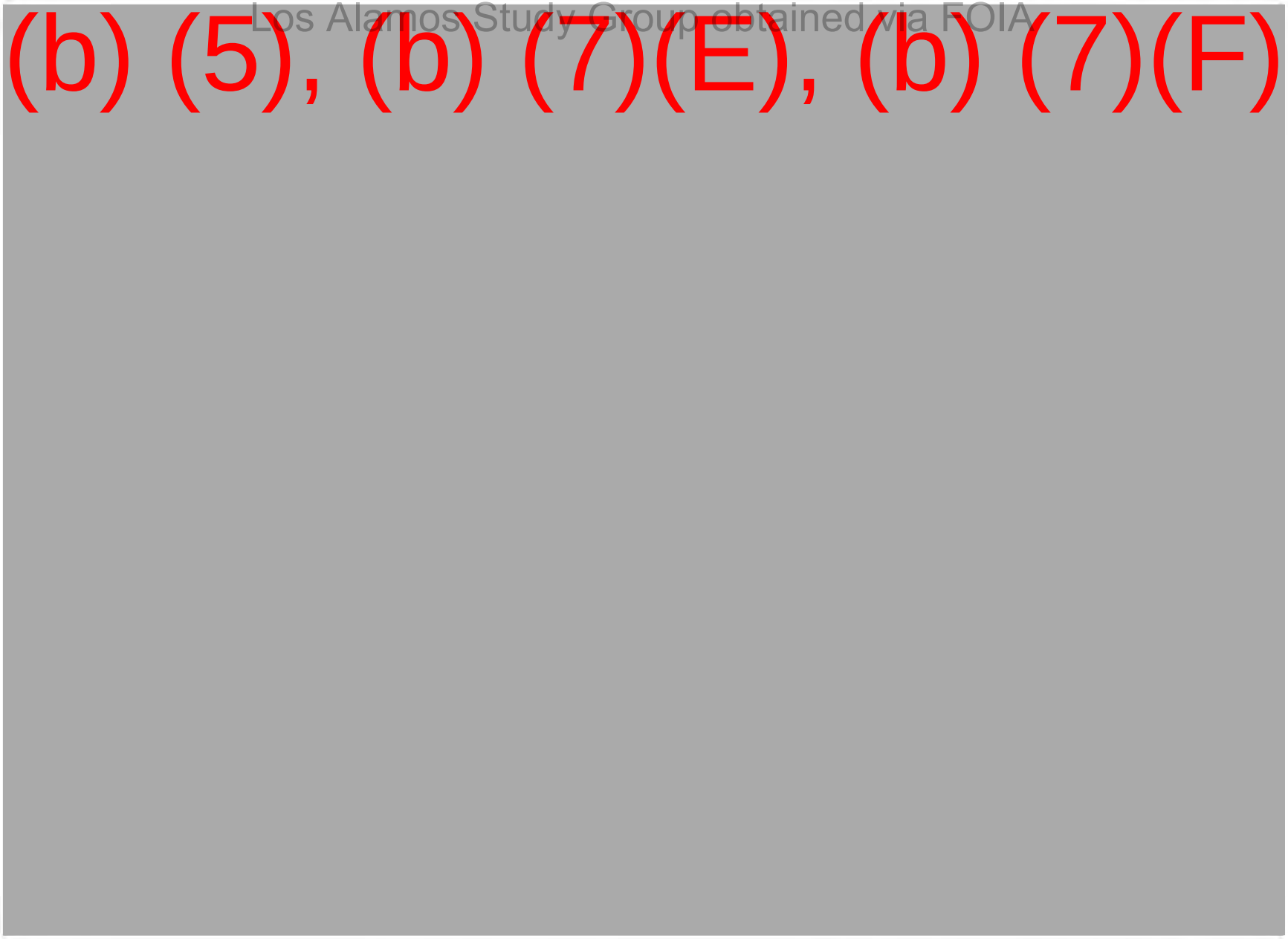

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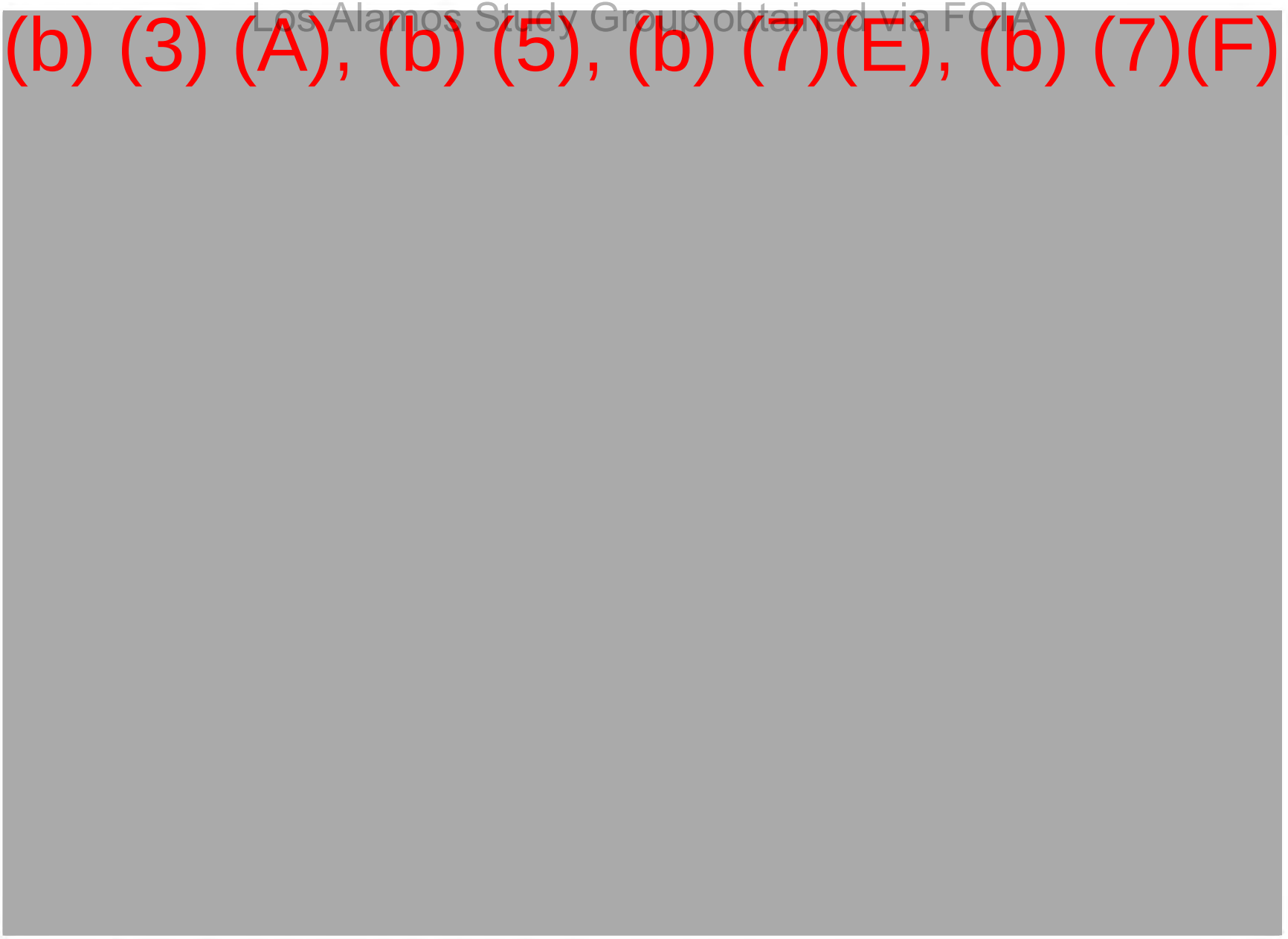

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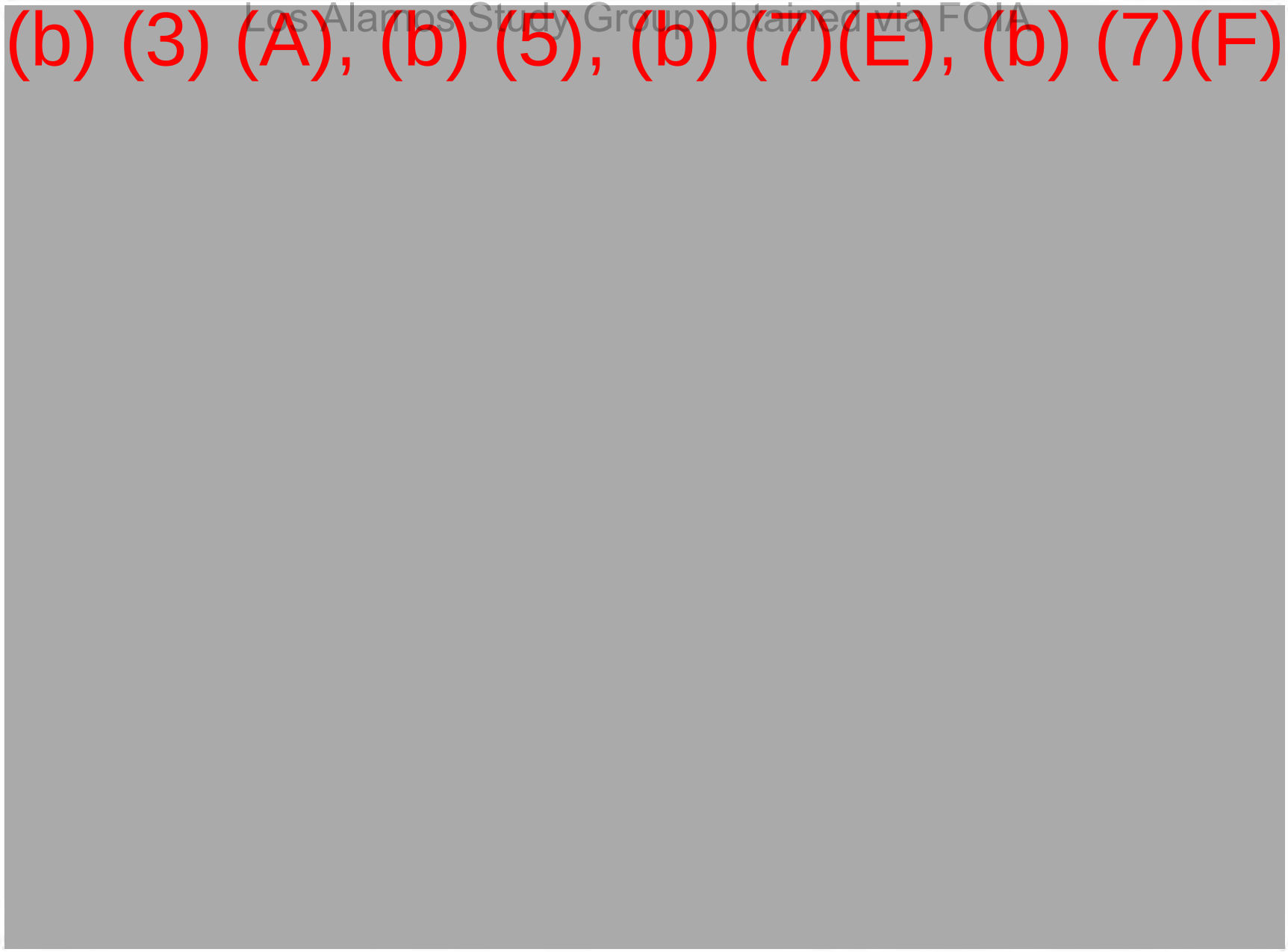

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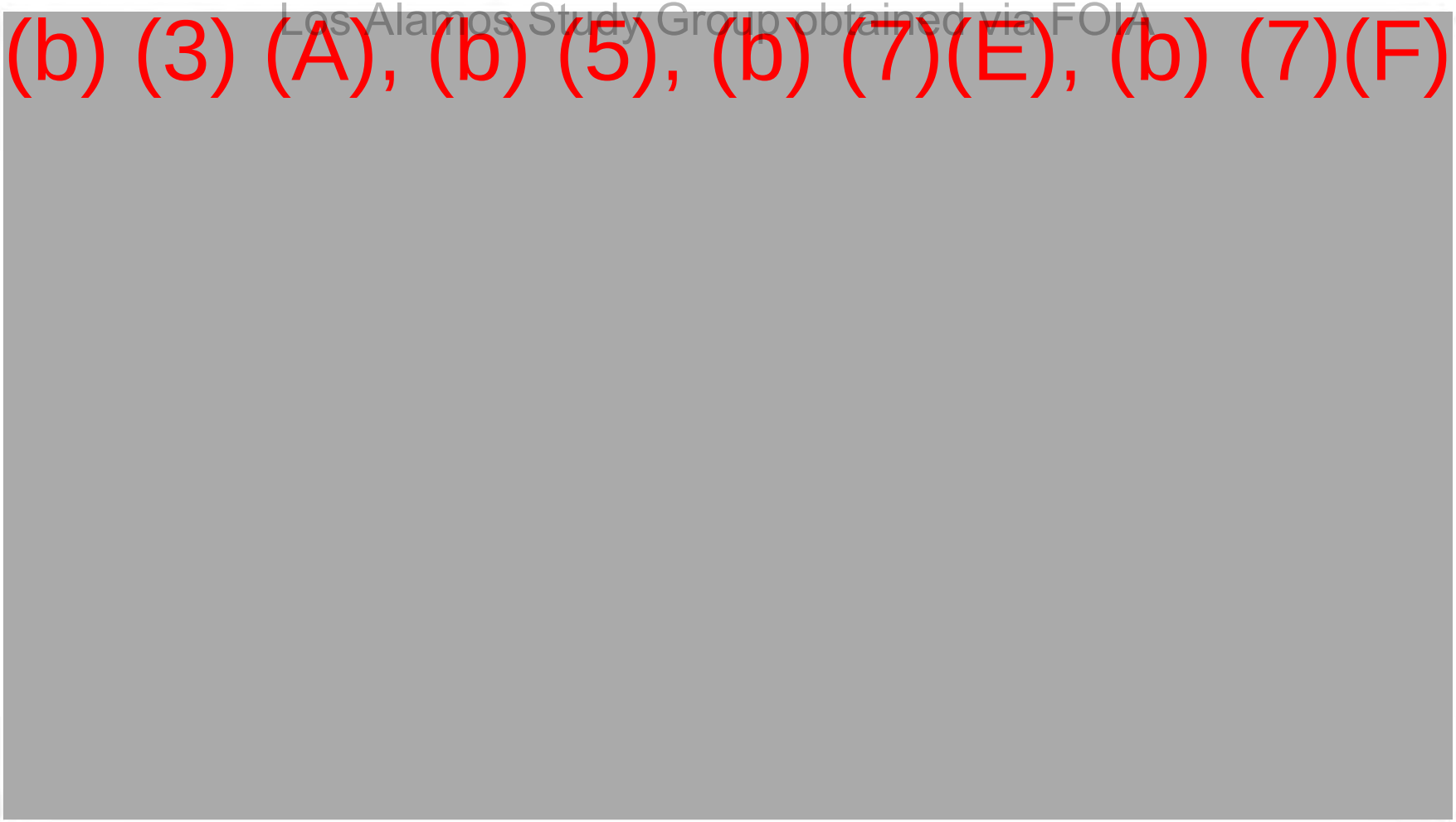


G.3 Material Recycle and Recovery (MR&R)

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

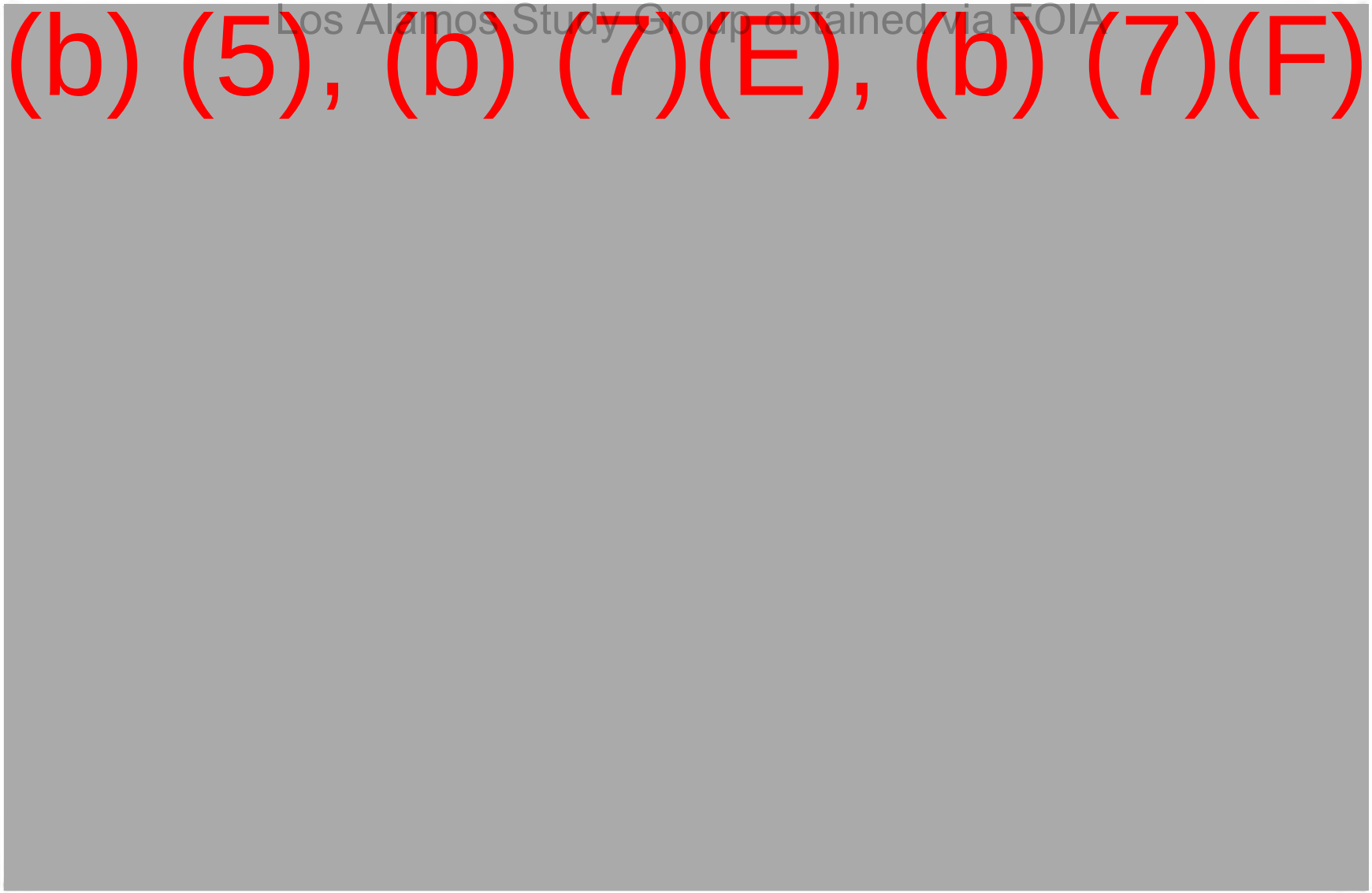
G.4 Capability Based Investments (CBI)

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

G.5 Recapitalization

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

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



G.6 Operations and Maintenance

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

G.7 LANL Overheads

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