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U.S. DEPARTMENT OF
ENERGY

NNSASM
National Nuclear Security Administration

Assessment of the Pit Production at Los Alamos National Laboratory Plan

Report to Congress
May 2021

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National Nuclear Security Administration
United States Department of Energy
Washington, DC 20585

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Message from the Acting Administrator

Pursuant to Section 3120(c)(1) of Public Law 115-232, the Department of Energy's National Nuclear Security Administration (DOE/NNSA) provided a report to Congress entitled *Pit Production at Los Alamos National Laboratory* (dated May 2020). The Report provided a summary of NNSA's initial plan to produce at least 30 pits per year at the Los Alamos National Laboratory in Los Alamos, New Mexico during 2026. As required by Section 3120(c)(2), NNSA is providing an independent assessment of the plan, as conducted by NNSA's Office of Cost Estimating and Program Evaluation.

Pursuant to statutory requirements, this report is being provided to:

- **The Honorable Patrick Leahy**
Chairman, Senate Committee on Appropriations
- **The Honorable Richard Shelby**
Vice Chairman, Senate Committee on Appropriations
- **The Honorable Dianne Feinstein**
Chairman, Subcommittee on Energy and Water Development
Senate Committee on Appropriations
- **The Honorable John Kennedy**
Ranking Member, Subcommittee on Energy and Water Development
Senate Committee on Appropriations
- **The Honorable Rosa L. DeLauro**
Chairwoman, House Committee on Appropriations
- **The Honorable Kay Granger**
Ranking Member, House Committee on Appropriations
- **The Honorable Marcy Kaptur**
Chairwoman, Subcommittee on Energy and Water Development, and Related Agencies
House Committee on Appropriations
- **The Honorable Mike Simpson**
Ranking Member, Subcommittee on Energy and Water Development, and Related Agencies
House Committee on Appropriations
- **The Honorable Jack Reed**
Chairman, Senate Committee on Armed Services
- **The Honorable James Inhofe**
Ranking Member, Senate Committee on Armed Services
- **The Honorable Angus King**
Chairman, Subcommittee on Strategic Forces
Senate Committee on Armed Services

- **The Honorable Deb Fischer**
Ranking Member, Subcommittee on Strategic Forces
Senate Committee on Armed Services
- **The Honorable Adam Smith**
Chairman, House Committee on Armed Services
- **The Honorable Mike Rogers**
Ranking Member, House Committee on Armed Services
- **The Honorable Jim Cooper**
Chairman, Subcommittee on Strategic Forces
House Committee on Armed Services
- **The Honorable Michael Turner**
Ranking member, Subcommittee on Strategic Forces
House Committee on Armed Services

If you have any questions or need additional information, please contact Dr. Howard Dickenson, Acting Associate Administrator for External Affairs, at (202) 586 7332, or Ms. Katie Donley, Deputy Director for External Coordination, Office of the Chief Financial Officer, at (202) 586 0176.

Sincerely,



Charles P. Verdon
Acting Under Secretary for Nuclear Security
and Administrator, NNSA

Executive Summary

The United States has not manufactured a plutonium pit since 2012 and has not had the ability to manufacture more than 10 pits per year (ppy), since the closure of the Department of Energy's (DOE) Rocky Flats Plant in 1992. Currently, the only U.S. facility capable of producing war reserve pits is the Technical Area-55 (TA-55) Plutonium Facility-4 (PF-4) at the Los Alamos National Laboratory (LANL), in Los Alamos, New Mexico. PF-4 is a Hazard Category (HC)-2/Security Category (CAT)-I facility that will exceed its planned lifetime of 50 years, during 2024.

To meet the Nation's pit production requirements, DOE's National Nuclear Security Administration's (NNSA) recommended alternative for pit production included continued investment in DOE/NNSA's Los Alamos National Laboratory (LANL) to produce an enduring 30 war reserve ppy during 2026. Pursuant to Section 3120 (c)(1) of the *John S. McCain National Defense Authorization Act for Fiscal Year 2019* (Public Law 115-232) (FY 2019 NDAA), NNSA provided a report to Congress (dated May 2020) that included a summary of an initial, preliminary plan of the oversight, staffing, equipment, schedule, funding, and infrastructure necessary to establish the capability at LANL to produce a minimum of 30 ppy during 2026. The plan is a work in progress that will be continuously updated with execution data and improved with future year forecasting.

Pursuant to Section 3120 (c)(2) of the FY 2019 NDAA, NNSA's Office of Cost Estimating and Program Evaluation (CEPE) conducted an independent assessment of the plan, which is included in this report. CEPE recognizes that the initial plan is a work in progress and substantial foundational work in scheduling, program management, and risk mitigation has been done.

CEPE's assessment concludes that there are significant risks in staffing, program management, production activities, supporting infrastructure, waste management, and other program requirements. The initial plan also provided no analysis describing the impact on all plutonium operations of increased Advanced Recovery and Integrated Extraction System (ARIES) activity in support of the Surplus Plutonium Disposition Program, at LANL.

CEPE assesses that more work will need to be done to improve the current plan and mitigate risks. Foremost, CEPE recommends that NNSA should complete and implement a fully integrated NNSA Integrated Master Schedule in FY 2021. Other recommendations include:

- (1) Develop an overarching program management plan to establish a process for tracking performance, tracking baseline changes, managing risks, and reporting for the entire plutonium pit production mission;
- (2) Re-examine the Pit Product Realization Team Integrated Master Schedule to address the excessive float issue identified by CEPE;
- (3) Complete an AoA, currently scheduled to begin in FY 2021, according to Government Accountability Office best practices that examines options (i.e., sites beyond LANL) to

increase plutonium oxide production to the required level, and records the effect of the options on all plutonium missions at LANL; and

- (4) Maintain diligent oversight into operations safety based on government and industry best practices.

As the plan matures, these current gaps should be addressed as the Plutonium Program Office continues to manage and mitigate risks to meet the requirement to produce 30 ppy at LANL during 2026, while maintaining all other plutonium operations.



Assessment of the Pit Production at Los Alamos National Laboratory Plan

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I. Legislative Language

This report is provided in response to legislative language set forth in Section 3120 (c) of the *John S. McCain National Defense Authorization Act for Fiscal Year 2019* (Public Law 115-232) (FY 2019 NDAA), wherein it is stated:

...the Administrator shall submit to the congressional defense committees a report containing – (A) a detailed plan to produce 30 pits per year at Los Alamos National Laboratory by 2026, including – (i) equipment and other construction already planned at the Chemistry and Metallurgy Research Replacement Facility; (ii) additional equipment or labor necessary to produce such pits; and (iii) effects on and from other ongoing programs at Los Alamos National Laboratory; and (B) a detailed plan for designing and carrying out production of plutonium pit 31-80 at Los Alamos National Laboratory, in case the MOX facility is not operational and producing pits by 2030.

...Not later than 120 days after the submission of the report required by paragraph (1), the Director for Cost Estimating and Program Evaluation of the National Nuclear Security Administration shall submit to the congressional defense committees an assessment of that report, including an assessment of the effect of increased ARIES activity in support of the dilute and dispose program on the plutonium pit production mission.

II. Introduction

The United States has not manufactured a plutonium pit since 2012 and has not had the ability to manufacture more than 10 pits per year (ppy), since the closure of the Department of Energy's (DOE) Rocky Flats Plant in 1992. Currently, the only U.S. facility capable of producing war reserve pits is the Technical Area-55 (TA-55) Plutonium Facility-4 (PF-4) at the Los Alamos National Laboratory (LANL), in Los Alamos, New Mexico. PF-4 is a Hazard Category (HC)-2/Security Category (CAT)-I facility that will exceed its planned lifetime of 50 years, during 2024. In 1978 PF-4 had ample design and physical floor space to perform required missions in a safe environment. Increasingly stringent nuclear safety requirements and regulations limit LANL's ability to further increase plutonium operations in the existing PF-4 space.

Plans to revitalize the Nation's pit production capability have been halted and delayed for decades. In May 2018, pursuant to Section 3141 of the *National Defense Authorization Act for Fiscal Year 2018* (Public Law 115-91), DOE's National Nuclear Security Administration (NNSA) provided Congress with the recommended alternative to meet national security requirements to have the capability to produce no fewer than 80 ppy during 2030. The recommended alternative consists of continuing to invest in LANL to produce at least 30 ppy during 2026; and repurposing the Mixed Oxide Fuel Fabrication Facility (MFFF) at the Savannah River Site (SRS) near Aiken, South Carolina to produce at least 50 ppy during 2030.

As requested in Section 3120(c)(1) of the FY 2019 NDAA, NNSA delivered to Congress the plan to produce 30 ppy at LANL in the report, *Pit Production at Los Alamos National Laboratory*, in

May 2020 (hereafter referred to as the *Pit Production at LANL Report*). The plan provided a summary of the preliminary oversight, staffing, equipment, schedule, funding, and infrastructure necessary to produce 30 ppy during 2026 at LANL.

Section 3120(c)(2) of the FY 2019 NDAA directed NNSA's Office of Cost Estimating and Program Evaluation (CEPE) to perform an independent assessment of the initial pit production plan to achieve a 30 ppy capability. CEPE reviewed supporting analyses and underlying data, when available, in addition to interviewing program personnel and collecting additional planning details that were not in the *Pit Production at LANL Report*, such as the recent LANL plan, *Integrated Strategy for Plutonium Missions at Los Alamos National Laboratory* (dated June 2020) (hereafter referred to as the *LANL Integrated Strategy*). The *LANL Integrated Strategy* provides useful information on how LANL proposes to achieve the 30 ppy mission and will be used by NNSA's Plutonium Program Office in maturing NNSA plans. The goal of CEPE's assessment was to identify program level risks in achieving the 30 ppy capability and provide recommendations to NNSA to inform an updated plan. Recommendations are included throughout this report and highlighted in the conclusion.

III. Staffing

A significant amount of hiring will need to occur across the nuclear enterprise to achieve the 30 ppy production capability at LANL during 2026 while maintaining and, in some cases increasing¹, all plutonium operations. According to the *Pit Production at LANL Report*, LANL will require a 77 percent increase (+1,789 employees) in enduring staff, craft, subcontractors, and support personnel from FY 2020 to FY 2026 to produce 30 ppy, while maintaining all plutonium operations at current levels (see Table 1).² The *Pit Production at LANL Report* provides a brief summary of the LANL hiring requirements, but does not provide a detailed implementation plan or provide the initiatives that LANL will implement to reduce hiring risks. LANL exceeded the direct-funded staffing goal in FY 2020 (see Table 1: 1,666 vs. 1,618 full time equivalents [FTEs]). NNSA retains programmatic risk in this area and should evaluate the effect to major plutonium milestones, if hiring goals are not met.

¹ Programs such as the Surplus Plutonium Disposition program could require staffing growth which is not included in Table 1.

² Includes enduring direct-funded (staff, craft, and security sub-contractors) and indirect-funded supporting personnel (LANL human resources, etc.), but does not include the interim workforce required for one-time infrastructure investments.

	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2026 minus FY 2020
Actual FTEs (Direct Only)	1,666							
Pit Production at LANL Report (May 2020)	2,316	2,746	3,099	3,373	3,887	4,105	4,105	+1,789
Direct	1,618	1,900	2,134	2,305	2,668	2,805	2,805	
In-direct	698	846	965	1,068	1,219	1,300	1,300	

Table 1. NNSA Report estimates of LANL enduring staff required to produce 30 ppy, while performing all plutonium missions in PF-4 at the current levels.

There are many risks in hiring at LANL. The plutonium workforce will continue to consist of workers with advanced technology degrees, years of relevant experience, and a willingness to work in high hazard material environments. The New Mexico Department of Workforce Solutions/Economic Research & Analysis Bureau, provided NNSA with a report on the state of the labor market in Los Alamos, New Mexico in which they characterize the plutonium workforce as requiring a minimum of an Associate’s Degree in a technology field with an average of 3-8 years of related experience. The report notes that the LANL locality has experienced lower unemployment than the national average (2007 – 2016) and that the “population in the LANL locality is generally older than ... the national average.” The Bureau of Labor Statistics’ labor market information shows that a ready-available workforce in the broad labor categories that cover plutonium production skills is extremely scarce (see Table 2).

Occupation Category	Example Disciplines	National Occupational Unemployment		
		Calendar Year 2019 (%)	Oct 2019 (%)	Oct 2020 (%)
Architecture and engineering	<ul style="list-style-type: none"> •Engineer: nuclear, chemical, mechanical •Technician: science, electronics, industrial engineering 	1.7	2.2	3.1
Life, physical, and social science	<ul style="list-style-type: none"> •Engineer: chemist, material science, physics •Technician: chemical, nuclear, occupational health/safety 	1.7	1.4	4.0

Table 2: Bureau of Labor Statistics unemployed persons by broad occupation categories related to pit production and plutonium operations.

Unemployment rates in more specific job categories related directly to pit manufacturing processes, e.g., chemical and machinery manufacturing, are at 5.1 percent and 3.5 percent, respectively, which further shows that there is an already low availability of labor relevant to pit

manufacturing. Once hired, new workers will require time to fully train and qualify as pit production workers.³ Hiring delays could affect LANL’s ability to train and certify new hires in time to match plutonium milestones.

As an example of planning maturation, the *LANL Integrated Strategy* does address many of the risks mentioned above, details many planned mitigation measures, and provides updated staffing objectives by job category to cover all plutonium missions at LANL. As a Federally Funded Research Development Center with the Lab operating at a Government Owned Contractor Operated facility, LANL is primarily responsible to decide the staffing ramp by functional category to meet mission requirements. The *LANL Integrated Strategy* also describes the plan to recruit, train, and retain staff. To manage staffing risk, LANL is exploring monetary and non-monetary compensation and benefits offerings to reduce attrition below the current 8 percent annual rate. The *LANL Integrated Strategy* will go far to increase the likelihood of success in hiring. The NNSA Program Office should review the *LANL Integrated Strategy* and integrate many of its planning activities into the updated NNSA pit production plan.

NNSA has experienced a tremendous growth in program scope since 2015 in response to the modernization requirements of the nuclear security enterprise. This growth has not been accompanied by a commensurate growth in federal staffing. While NNSA has an aggressive plan to increase federal staffing to meet mission needs, NNSA’s staffing remains beneath organizational requirements. NNSA has conducted detailed analyses to inform NNSA’s federal hiring requirements through FY 2026. In FY 2020 additional employees were allocated to critical offices, although not all authorizations are specific to the plutonium mission. As of September 30th, 2020 (see Table 3), some allocations remain unfilled.

Office	FY 2019 Authorization	FY 2020 Authorization	FY 2020 Close-out Actual
Defense Programs	216	230	210
Safety, Infrastructure, and Operations	102	112	108
Defense Nuclear Security	78	88	81
Los Alamos Field Office	84	91	87
Savannah River Field Office	42	45	39

Table 3. Federal employee authorizations and FY 2020 actuals in key offices that oversee plutonium missions, among other missions.

³ It can take 12 to 18 months to receive the necessary security clearance, 6 months to obtain certification in the DOE Human Reliability Program and up to 3 years of on-the-job training for new pit production staff members

IV. Program Management

The *Pit Production at LANL Report* describes several entities that have been set up to oversee and manage aspects of the pit production mission, including:

- The Pit Product Realization Team (PRT) led by the Lawrence Livermore National Laboratory (LLNL), in Livermore, California, with participation from LANL and the Kansas City National Security Campus (KCNSC), in Kansas City Missouri. The Pit PRT identifies, tracks, trends, and reports on the progress for achieving the FY 2023 First Production Unit (FPU) pit, relative to the baseline schedule. In February 2020, NNSA expanded the scope of the Pit PRT mission to include product realization oversight of the 10 pits per year (ppy) during 2024 and 30 ppy during 2026 requirements for LANL.
- The Matrixed Execution Team (MET) chaired by Defense Programs (DP) with members from supporting offices and management and operating (M&O) contractors, to manage the overall program. MET meetings occur on a monthly basis and involve the review of a 90-day look ahead schedule to resolve resource conflicts and other technical and schedule issues.
- The Senior Management Team (SMT), also led by DP and composed of senior executives from NNSA's Office of Acquisition and Project Management (APM) and many supporting organizations, to monitor the design and acquisition process and resolve issues for major construction projects that support pit production.

NNSA's Plutonium Program Office plans to finalize a NNSA Integrated Master Schedule (NIMS)⁴ during FY 2021. The *LANL Integrated Strategy* will inform the NIMS and the NIMS will incorporate schedule logic to enable critical path analysis.⁵ The maturation of the NIMS is critical as a fully integrated schedule underpins the establishment of a valid performance measurement baseline. Scheduling authorized work packages enables effective planning, assessing, and forecasting, which are crucial to the success of any program.

Because the NIMS is not yet completed, CEPE cannot verify that the NIMS contains the detail-planned work packages, planning packages, schedule logic, or hand-offs between other programs that are required in an IMS. The Plutonium Program Office has developed a milestone-level unclassified schedule, a classified high-level schedule of pit production equipment activities, and a summary of planned infrastructure (subject to DOE's capital asset acquisition processes); the latter two items are included in the NNSA report. While these documents are useful for initial planning and program coordination purposes, the documents

⁴ The NIMS is a requirement outlined in the DP Program Execution Guide under the Enhanced Management B process. The NIMS is not a milestone schedule; it is a system engineering product which can be used for statistical analysis of schedule risks.

⁵ Schedule Logic is the capability of a schedule to be designed in the way that ensures logical connection between schedule elements such as tasks and milestones. The critical path analysis identifies the longest sequence of tasks from project start to finish that must be completed to ensure the project is finished by a certain time.

are not conducive to a detailed critical path analysis and schedule risk assessment. As the planning for the 30 ppy capability matures and these documents are updated, they and especially the NIMS should provide the backbone of a mature scheduling and program management capability.

The *Pit Production at LANL Report* did not mention the development of a single, integrated Program Management Plan (PMP) for pit production that is a requirement from the DP Program Execution Guide for Enhanced Management B programs. A PMP formalizes the process on how the program is to be managed, executed, and controlled. Additional details of a PMP include performance monitoring, baseline change control, risk management, scheduling, and reporting. A properly developed PMP enables situational awareness of program status to assess cost, schedule, and technical performance to support informed decisions and corrective actions as necessary. Project Execution Plans, which are a form of PMPs under the DOE Order 413.3B acquisition process, currently exist for numerous TA-55 construction projects that achieved the Critical Decision-2 (CD-2, Approve Performance Baseline) acquisition milestone. However, there is no systemic plan for baseline risk management across all projects into a single baseline change process. To improve program management of the entire pit production mission, CEPE recommends that the Plutonium Program Office develop an overarching PMP to integrate project and programmatic activities to reach the 30 ppy requirement.

V. Pit Product Realization Team

The *Pit Production at LANL Report* highlights the roles and responsibilities of the Pit PRT, which includes developing a baseline schedule that adheres to product realization processes to produce the first war reserve pit during 2023 at LANL. CEPE received the baselined PRT IMS (PIMS) for review, with a period of performance from FY 2019 to FY 2024. Most of the activities outlined in the PIMS involve testing, data analysis, and report submissions. The Pit PRT baseline schedule is independent of planned PF-4 equipment installation or infrastructure upgrades and does not contain pit production activities after the production technical review and production steady-state gate review in FY 2024.

CEPE conducted a systems engineering level assessment of the baseline PIMS. The average float is 315 days in the overall baseline schedule. In CEPE's estimation, the float is excessive and unrealistic given the amount of scope that is required to be complete prior to the start of production.⁶ CEPE was able to identify the critical path in the baseline PIMS and determine the network of activities that would cause the FPU milestone date to slip. However, the critical path does not impact the final FPU milestone until task activities realize at least 50 percent schedule growth due to significant schedule margins.

⁶ Float is the amount of time a task can be delayed without impacting subsequent tasks or the project's overall completion.

According to the Government Accountability Office (GAO) Schedule Assessment Guide (GAO-16-89G), the schedule should identify reasonable total float so that the schedule’s flexibility can be determined. Unreasonably high total float on an activity or path indicates that schedule logic might be missing or invalid. The CEPE assessment did not include an updated status of activities to show current progress against the original baseline. Notwithstanding, there may be excessive float in the baseline PIMS that exceeds GAO guidelines and will manifest itself even with updated execution data. CEPE recommends that the Pit PRT re-examine the schedule and address the excessive float issue.

VI. Production

To assess the probability of achieving 30 ppy capability based on the current process equipment sets planned in the May 2020 LANL Plutonium Pit Production Project (LAP4) Scope Definition and Requirements Document (SDRD), CEPE developed an independent discrete event model to forecast production output. The CEPE model adopts the processing time assumptions provided by LANL, LLNL, and Rocky Flats subject matter experts in classified documentation from 2017. The model results illustrated in Figure 1 indicate that LANL can achieve a 30 ppy capability at a 90 percent confidence level based on the planned equipment and current pit processing assumptions. The model also illustrates that LANL will have to increase pit production equipment and/or introduce a second operating shift to achieve a capability of more than 50 ppy. The model outcome is only achieved if other factors are met, e.g., staffing, equipment installation, infrastructure completion, and uninterrupted funding.

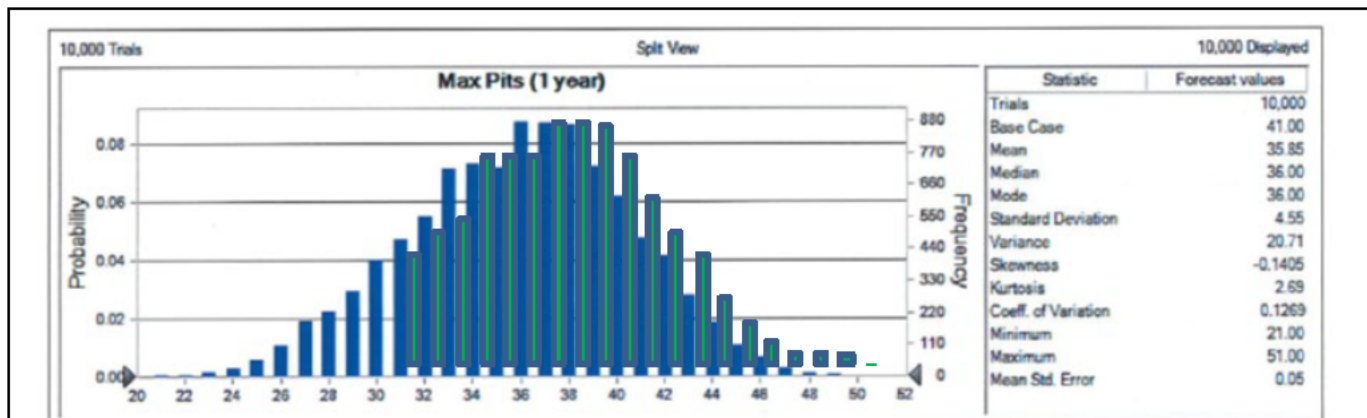


Figure 1: Independent simulation model shows LANL can achieve 30 ppy at a 90 percent confidence (sum of green bars) based on planned equipment and current processing assumptions. The current LANL plan does not support a 50 ppy capability.

The plutonium process for manufacturing pits involves working in a high hazard environment and the *Pit Production at LANL Report* does not describe how LANL will address safety while nearly doubling the plutonium workforce. The success of the 30 ppy capability program relies on LANL’s ability to control worker safety risk, and the *LANL Integrated Strategy* does address

safety in many areas.⁷ For instance, the LANL Strategy highlights the importance of continued facility recapitalization and elimination of deferred maintenance on major safety and process systems that enable safe and secure operations at TA-55. Emphasis on safety while working in a high hazard environment is vital to the success of the pit production mission. CEPE recommends that NNSA review and integrate many items regarding safety from the *LANL Integrated Strategy* into the pit production PMP.

VII. Supporting Infrastructure

Current line item projects such as the Radiological Laboratory Utility Office Building (RLUOB) Equipment Installation Phase 2 (REI2), PF-4 Equipment Installation Phase 1 (PEI1), PEI2, reclassifying RLUOB to a Hazard Category 3 facility (RC3), Transuranic Liquid Waste Facility (TLW), LAP4, and TA-55 Reinvestment Project Phase 3 (TRP III) are vital to the success of the plutonium pit production mission and careful monitoring of progress is necessary to ensure the projects are completed on time and on schedule.

As of the fourth quarter of FY 2020, the status of current line item projects indicate that existing construction is on track to support the plutonium pit production mission schedule. REI2 and PEI1 are over 90 percent complete with no major risks as the projects undergo transition to operations activities. The RC3 project team initiated project planning and design efforts in support of CD-2/3 and start of construction is currently planned for the second quarter of FY 2023. For the TLW project, the required Independent Cost Estimate (ICE) began in February 2021 and the planned start of construction date is August 2021. Lastly, TRP III ICE reconciliation activities are currently ongoing, and the start of construction is currently planned for FY 2021.

The mission of LAP4 is to provide required functions to enable the capability to produce 30 ppy during 2026, to include decontamination and decommissioning of existing gloveboxes and equipment, equipment installation in support of meeting pit production requirements, and supporting infrastructure. CEPE is currently conducting the ICE in support of CD-1, planned for completion in FY 2021. As with all projects in the conceptual design phase, there is risk in the cost, schedule and scope of the effort because less is known about program requirements or definition of the work involved.

VIII. Other Program Requirements

Safety, Infrastructure, and Operations. The initial plan in the *Pit Production at LANL Report* lists nine critical facilities that must be operated and maintained to produce pits. The plan does not provide a description of why these facilities are considered critical to the pit production mission or the current condition of these facilities (including equipment). As is typical for

⁷ Safety incidents occurred at LANL in 2013 which resulted in temporarily shutting down operations in PF-4; and a June 2020 safety incident impacted over a dozen plutonium operations employees.

facility management, NNSA's maintenance program is a level of effort funding program and does not track individual project costs, although all activities are managed with a Computerized Maintenance Management System. NNSA needs an effective maintenance plan to help prioritize resources, assuring that the highest risks to critical systems are addressed first, and minimizing any interruption to production.

Operations and Maintenance of facilities is primarily resourced with labor. Lack of staffing to repair equipment and maintain the facilities could result in delays in production. While the list of maintenance activities is prioritized in the plan, other priorities such as programmatic equipment failures could delay planned maintenance.

The *Pit Production at LANL Report* lists recapitalization projects and the associated total project cost (TPC) and required by date of 39 small recapitalization projects. These projects will revitalize infrastructure and reduce operational risk in TA-55. Of the 39 projects, 19 are not included in the Federal project milestones schedule. Three projects required by FY 2020 have slipped to FY 2021 and all three have increased in TPC. As NNSA examines and funds recapitalization projects annually based on prioritization and need, it is unlikely that the schedule slippage will have an adverse effect on meeting the pit production schedule.

Defense Nuclear Security. The *Pit Production at LANL Report* identifies a need for an increased security force and lists seven security construction projects. Ongoing and planned construction activities, combined with expanded hours of operation in TA-55, influence the need for additional security investments. Although the *LANL Integrated Strategy* does not provide a comprehensive list and description of additional physical security investments required, other LANL documentation does outline additional security resources needed to support the pit production effort.

Security projects are underway to reach the capability to produce 30 ppy starting during 2026. Specifically, NNSA is facilitating collaboration between LANL and the DOE National Training Center to accelerate and expand capacity for basic security police officer training and tactical response force courses needed to implement protective force hiring to meet the 30 ppy capability staffing plan. NNSA has also developed and implemented a pilot that allows security personnel to begin the Human Reliability Program (HRP) process locally as soon as the clearance investigation is underway. The pilot has proven to reduce the number of days to gain access to the HRP.

Security staffing will need to ramp up more quickly than other staffing functions (i.e., two to three years in advance) to ensure TA-55 PF-4 is accessible as programmatic, maintenance, and construction activities expand to 24/7 operations. Updated vulnerability assessments will inform physical security requirements.

Information Management. A secured classified wireless network may be necessary to accomplish production activities at PF-4 in support of the 30 ppy capability, such as waste characterization input, pit qualification activities, criticality safety program management, inventory and data acquisition, and facility monitoring. While the *Pit Production at LANL Report*

briefly mentions implementation of a wireless network at PF-4, the Report lacks the details of the additional IT and cyber activities required, including initial certification and accreditation by NNSA. A detailed cybersecurity and information technology plan will be necessary, once requirements are validated, to assure the data is protected and the workforce can share classified information.

IX. Effect of Increased ARIES Activity

In 2018, NNSA issued a conceptual plan for the Surplus Plutonium Disposition Program (SPD) Dilute and Dispose (D&D) Approach that requires LANL to expand production in PF-4 to produce a total of 26.2 metric tons (MT) of plutonium oxide by 2045. The conceptual plan calls for LANL to increase the physical space of the Advanced Recovery and Integration Extraction System (ARIES) in PF-4 by approximately 50 percent, hire more than 200 new staff, complete several projects to replace aging infrastructure, upgrade existing equipment, and add new equipment. LANL must complete these activities concurrently with the 30 ppy production mission in PF-4 as well as other plutonium operations, such as the production of plutonium-238 heat sources for use in space exploration.

The *Pit Production at LANL Report* provides a brief description of ARIES in the addendum, which does not address the effect of increased ARIES activity on the plutonium pit production mission at LANL. NNSA officials state that all plutonium operations at LANL can succeed on cost and schedule, given the planned mitigation measures. NNSA will update plans using the results of a FY 2021 Analysis of Alternatives (AoA) that will examine plutonium oxide production at LANL, as well as at other locations across the nuclear enterprise.

The current ARIES plutonium oxide production level at LANL is at or below 700 kg (0.7 MT) per year, which is less than half of the 1.5 MT per year required to implement the 2018 conceptual plan. CEPE assesses that the risks of meeting planned production levels for pits, ARIES, and other plutonium operations may be higher than currently estimated; this concern is supported by the October 2019 GAO Report on SPD.⁸ For example, PF-4 vault space is constrained physically, by Material-at-Risk (MAR) limits, and by waste storage space. LANL must remove a significant backlog of waste from TA-55 to enable all plutonium operations. LANL may also be required to increase pit production beyond 30 ppy, which would further constrain vault space and waste storage processing for ARIES, pit production, and other plutonium operations.

LANL is currently working to maximize allocated space for all plutonium operations by installing removable inserts and by using other space-saving techniques. The Federal Government also recently settled with the State of South Carolina to allow DOE/NNSA to proceed with the planned dilute and dispose activities in South Carolina; meaning that LANL can ship (rather than store) plutonium oxide to South Carolina uninterrupted and without using additional storage. For Nondestructive Assay (NDA), the ARIES program is installing an NDA table in its main

⁸ Surplus Plutonium Distribution: NNSA's Long-Term Plutonium Oxide Production Plans Are Uncertain, GAO-20-166

operating room in PF-4, which will allow the program to minimize use of the basement NDA lab⁹. LANL installed a new crane at PF-4 that should increase shipping and receiving capacity for all operations. To address staffing issues, the ARIES staffing ramp currently hires up to 10 new FTE per year to meet FY 2023 requirements; the goal is to minimize surge hiring in FY 2023 concurrent with significant hiring demand in pit production.

The FY 2021 AoA will examine options to increase plutonium oxide production at LANL to the required level of 1.5 MT per year by the early FY 2030s, which is necessary to support overall SPD program goals. The FY 2021 AoA will also examine options for additional oxide production at other sites, besides LANL, to meet the 1.5 MT requirement. The AoA should describe the impacts on all plutonium operations in PF-4, for all the options examined. CEPE recommends that the Plutonium Program Office work closely with CEPE to complete the AoA according to GAO best practices.

X. Waste Management

Waste management includes the characterization, processing, staging, and shipping of waste streams from multiple LANL facilities to offsite entities, such as the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico, for final disposition. Due to physical space constraints and MAR quantity limits at TA-55, pit production at LANL is highly dependent on continuous removal of nuclear waste. The *Pit Production at LANL Report* briefly describes the waste management process, acknowledges the correlation between increasing pit production and waste generation, describes waste handling staffing and infrastructure requirements, and provides a brief list of relevant milestones. The *Pit Production at LANL Report* does not emphasize the most urgent risk, which is the lack of a comprehensive, integrated, and enduring plan to address increasing transuranic (TRU) waste generation as pit production activities rise at LANL.

Figure 2 (taken from the *LANL Integrated Strategy*) depicts the historical and projected balance of TRU waste drums stored at LANL. The balance is increased monthly with newly generated drums and reduced by the number of drums shipped offsite to WIPP. The forward projection assumes that TRU waste throughput at LANL will increase from 1,000 drums per year in FY 2020 to 2,000 drums per year by FY 2023. The chart illustrates that the current waste inventory in LANL already exceeds the target optimal storage of 850 drums on site with a risk of breaching MAR and volume limits through FY 2026. Exceeding MAR and volume limits will constrain overall plutonium production activities at LANL.

⁹ The basement NDA lab in PF-4 is a shared resource for all plutonium operations

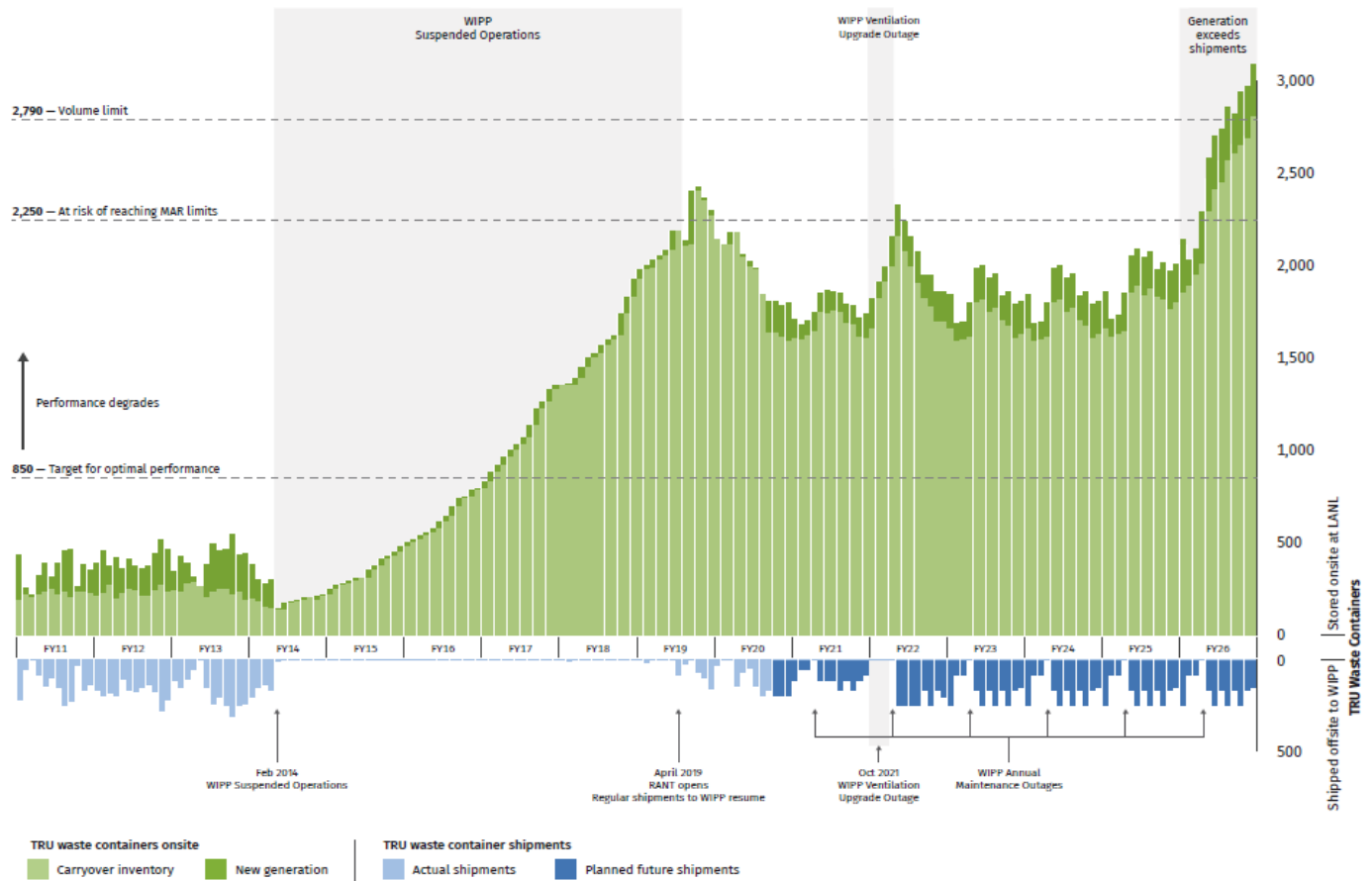


Figure 2: Transuranic (TRU) solid waste containers stored onsite and shipped offsite at LANL, based on forecasting included in the LANL Integrated Strategy.

The *Pit Production at LANL Report* combined with the *LANL Integrated Strategy* do provide some mitigation measures to address waste backlog and processing at LANL. For example, NNSA will fund projects to explore waste minimization techniques and technologies. In FY 2020, additional funding for the Material Recycle & Recovery (MRR) program increased throughput capacity at the Transuranic Waste Facility (TWF), to remove backlog inventory. LANL will free floor space in TA-55 PF-4, by using other plutonium facilities (such as the Radioassay and Nondestructive Testing Facility, TWF, Radioactive Liquid Waste Facility, and RLUOB) to train workers. LANL will construct a new TLW facility, with CD-2/3 occurring in FY 2021, which will increase waste processing throughput. LANL has also recently demonstrated some success in increasing waste shipments to WIPP. In FY 2020, LANL made 42 shipments to WIPP containing 1,275 containers of TRU waste, more than twice the FY 2019 amount. LANL’s FY 2021 plan continues to increase the TRU waste shipment rate with a forecast of 52 shipments containing approximately 1,450 containers. If successful, the inventory at the end of FY 2021 will be reduced to below 1,000 containers, lower than projected in Figure 2.

The soon-to-be-published FY 2021 LANL Waste Management Enduring Plan (WMEP) will need to address three critical areas mentioned in the *Pit Production at LANL Report*:

- Removal of current waste backlog at LANL;
- Increased processing and storage capacity at TA-55; and
- Increased throughput to WIPP, to include a plan for the WIPP shutdown in FY 2022.

Related activities include meeting schedules for decontamination and decommissioning of old equipment; challenges associated with achieving compliance with the WIPP acceptance criteria and certification; and uncertainty in major construction costs (e.g., TLW facility), due to the immaturity of project design. The WMEP must also address the declining pool of specially trained and qualified waste management coordinators and unplanned shutdowns at WIPP. The enduring waste management plan should also consider the effects of additional waste produced at PF-4 because of the increased ARIES activity in support of the SPD Program at LANL.

XI. Conclusion

The United States must reestablish the capability to manufacture primaries for nuclear weapons, in particular plutonium pits, to support future weapon modernization programs. The *Pit Production at LANL Report*, which provides a summary of the initial plan to produce a minimum of 30 ppy during 2026, demonstrates that significant work has been done in the current planning process. CEPE assesses that more work will need to be done to improve the current plan and mitigate risks. Foremost, CEPE recommends that NNSA should complete and implement the fully integrated NIMS in FY 2021. Other recommendations include:

- (1) Develop an overarching PMP to establish a process for tracking performance, tracking baseline changes, managing risks, and reporting for the entire plutonium pit production mission;
- (2) Re-examine the Pit PRT IMS to address the excessive float issue;
- (3) Complete an AoA according to GAO best practices that examines options (i.e., sites beyond LANL) to increase plutonium oxide production to the required level, and records the effect of the options on all plutonium missions at LANL; and
- (4) Maintain diligent oversight into operations safety based on government and industry best practices.

CEPE also recommends that the pit production office review and integrate, as appropriate, many of the activities and planning actions that are included in the LANL Integrated Strategy (dated June 2020) as planning and management activities mature.