



# Los Alamos Study Group

*Nuclear Disarmament • Environmental Protection • Social Justice • Economic Sustainability*

## Toward a viable plutonium pit production plan: part 1

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*Comments, questions, and corrections are welcome.*

### Summary

- **Despite the experience and integrity of present National Nuclear Security Administration (NNSA) management, NNSA's unquestioning, contractor-like "mission orientation," combined with what it perceives to be "unconstrained" funding, leads the agency to cling to the pit production plan it inherited from the previous administration, a plan we believe is failing.**
- **Practical engineering realities and other realities on the ground, as well as past choices, strongly constrain NNSA's pit program. All "good government" policies will incorporate these constraints. We believe the considerations offered here lead to the best pit production policy choices realistically available, independent of political view.**
- **Congress may not yet understand the scale and rapidly-expanding cost and schedule of NNSA's pit production program. Under the current strategy, the effort to restart pit production is likely to cost at least as much as the entire Manhattan Project. More than half of this cost has been and will be at LANL, which has consistently failed to fulfill pit expectations and commitments for the past quarter-century.**
- **The full scope of the LANL pit production effort is undefined. Assuming reliable production is even possible at LANL, *enduring* production would require additional nuclear facilities, and also other facilities. Some of these may not be feasible at the site.**
- **In addition to uncertainties inherent in the early phases of design, NNSA cannot produce a fully-resourced Integrated Master Schedule (IMS) or Life Cycle Cost (LCC) for pit production without knowing the scope of LANL's pit program.**
- **The dramatic delays and cost increases predicted in the FY24 Congressional Budget Request (CBR) threaten success at both main production sites. The split-production, "double moon-shot" approach was always a very risky long shot. However, for NNSA's nuclear physics labs especially as well as nuclear weapons contractors more generally, and for interested politicians, payoffs are certain and substantial.**
- **In 2017 NNSA rejected: a) split production, with its very high costs, impacts, and its inattention to economies of scale; and b) trying to use LANL's old PF-4 building as an enduring pit facility, which it will never be. In 2019, the Institute for Defense Analyses (IDA) warned that 24/7 work at PF-4 would be "very high risk." No federal study supports the present approach at LANL, which threatens to sink the entire program.**
- **Production milestones resolve into four levels: technology demonstration and training; "base" production; "reliable" production, and "enduring" production. How much time and money could be saved by focusing LANL solely on demonstration and training, while NNSA focuses on building an enduring, adequate, reliable pit facility?**
- **LANL is still about a decade away from having a pit production capability, let alone a safe and reliable one. Emergency construction of a temporary pit facility at LANL sets up**

expensive, delay-inducing competition for scarce engineers, gloveboxes, and other resources. NNSA is needlessly “competing with itself.”

- It is not clear why repurposing a portion of LANL’s aging, inadequate facilities, with poor safety margins and little surge capacity or flexibility, would add resilience to pit production. Further legacy safety and reliability problems remain to be discovered. We question whether “reliable” or even “base” production can be established at LANL.
- It is not clear why the nation should support two pit factories when the Savannah River Plutonium Processing Facility (SRPPF) alone, which requires less funding to produce more pits, with greater flexibility, would suffice. We doubt the nation will do so.
- For reasons beyond its immediate control, NNSA cannot say how many pits it can produce by any given date. This uncertainty will persist indefinitely. Statutory pit requirements should be eliminated in favor of annual executive branch direction with annual congressional review, authorization, and funding.
- Pit production in the 2030s is not necessary for full deployment of any current or planned nuclear weapon system, or for the retention of about 80% of current “hedge” warheads and bombs (i.e. all but the W78 warhead as it is retired).
- If pit production is to be possible by the late 2030s, planning and construction of an adequate, reliable, enduring production facility must continue now. The *operation* of that facility can be adjusted then. *Whether to have such a facility* must be decided now.
- Initially, Sentinel ballistic missiles are to be deployed with W87-0 warheads, which besides using insensitive high explosive (IHE) are also well-studied, accurate, and numerically sufficient for the entire Sentinel fleet, absent using multiple independent reentry vehicles (MIRVing). Why precisely is the W87-1 warhead needed now?
- A sufficient number of new pits were supposedly going to be available to produce W87-1 warheads in the early and mid-2030s. Now, new pits are unlikely to be available in sufficient numbers to support the current W87-1 production schedule, which therefore appears to be unrealistic, as well as early-to-need.
- It appears that the baseline SRPPF design, with a single production shift, can achieve a production rate of at least 80 War Reserve (WR) pits per year (ppy). Beyond this, the potential production capacity of SRPPF is not publicly known. Besides producing W87-1 pits in the 2030s, is there a rationale for LANL production?
- If the cost of producing pits is included, the cost of the W87-1 Life Extension Program (LEP) is several times higher than NNSA currently projects. The capability being established by the current program of record at LANL is not enduring, so why should its cost not be included, given that the W87-1 LEP is its only pre-SRPPF “customer”?
- Halting preparations for industrial pit production at LANL would save roughly \$11-\$21 billion (B), about as much as SRPPF construction will cost. Such a policy would almost certainly decrease the time necessary to create an enduring 80 ppy capacity, while also lowering SRPPF costs and risks.
- NNSA and Congress should therefore halt the Los Alamos Plutonium Pit Production Project (LAP4) and related infrastructure expansion, while creating a detailed “off-ramp” from LANL’s pit production ambitions. Hiring for a second shift should stop.
- Nearly all of NNSA’s work, including assessments of pit production policy, is done by contractors, placing government in a weak position. To strengthen the hand of “Madisonian” government (including NNSA itself), to illuminate policy choices, and to fulfill its oversight responsibilities, Congress should require NNSA to clarify these and related issues in detail, with as much public transparency as possible.

## Introduction

It is important to state at the outset that in our opinion, the nation is fortunate to have individuals of deep experience and integrity running the NNSA. It is important to take advantage of this situation while we can, in our respective governmental and non-governmental oversight roles.

Much of the principled discussion needed will need to be done in a classified setting. We urge congressional members and staff, and executive branch individuals outside NNSA with oversight responsibilities such as the Office of Management and Budget (OMB), to engage in those discussions. Some discussion can be done in an unclassified setting and we hope you will find this note a useful contribution.

There are plenty of red flags in the pit program and we should pay attention to them. NNSA needs congressional and OMB's help in rethinking the pit mission, which involves statutory deadlines which everyone knows and admits are impossible. These milestones were passed under circumstances which have now changed and with assumptions that are no longer true.

Too often, an excessive "can-do" optimism, which also happens to align with contractor, pork-barrel, and ideological perspectives, keeps even the best leaders from reexamining policies which are failing. There is a tendency to double down. Right now, NNSA's pit production endeavor – by far the largest program in the agency's history – is running off the rails in our opinion, because of this entirely normal bureaucratic phenomenon.

Despite good-faith efforts to communicate with Congress in its latest [Congressional Budget Request](#) (CBR), NNSA's pit production program is becoming increasingly opaque, even to itself.

Strategic conclusions NNSA reached after wide-ranging, careful [analysis](#) were [reversed](#) in 2018 as a result of political pressure from Congress (e.g. [here](#) and [here](#)). Since then, no strategic analyses or comprehensive engineering analysis has been done, as far as we can tell, and no comprehensive program planning is available even to NNSA itself, as the Government Accountability Office (GAO) found in its January 2023 review ("[NNSA Does Not Have a Comprehensive Schedule or Cost Estimate for Pit Production Capability](#)," GAO-23-104661).

Since 2018, NNSA has been trying to implement what could be called an "anti-Solomonic" decision made in that year, which "cut the baby in half" without any analysis supporting the decision to do so. NNSA [decided](#) to build not just one but two new pit factories, overturning its own conclusions running back decades – a "double moon shot."

Apparently, the agency did this to satisfy the New Mexico senators<sup>1</sup>, the Air Force – which sought early access to a new warhead capable of being deployed in multiple independent reentry vehicles (MIRVs) for its new silo-based missile system, now called "Sentinel" – and the two NNSA weapons physics labs. One lab – Lawrence Livermore National Laboratory (LLNL) would design the warhead (thus providing a continuous workload for its weapons teams), and Los Alamos National Laboratory (LANL) would quickly produce the pits for it more quickly than could the larger pit facility NNSA knew it needed, to be built at the Savannah River Site (SRS).

As NNSA had never done its own feasibility or engineering analysis of the Los Alamos National Laboratory (LANL) portion of the new pit plan, which required reliable as opposed to sporadic or nominal production, it depended upon proposals prepared by the new LANL contractor, Triad. NNSA's cursory review of

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<sup>1</sup> Ironically NNSA, LANL, and the New Mexico senators, from 1946 until (in the case of the senators) 2017, [opposed](#) industrial pit production at LANL when the subject came up, as have [local governments](#) (except Los Alamos County). For 1946 see: "[The Post-War Laboratory](#)," Norris Bradbury et. al, August 1946, Roger Meade ed., LA-UR-16-28879.

LANL's plan found it to be, with evident charity, a "work in progress," with "significant risk" in nearly every aspect.<sup>2</sup>

As of this year, the result is that the LANL nominal 30 pit per year (ppy) capability that in 2017 was said to cost \$3 billion (B) we now project, using NNSA's estimates, to cost \$21-\$24 B in its "reliable" version, *seven times as much*, and take 7-9 years longer, as will be explained below.<sup>3</sup>

The time and cost advantage that many people once thought LANL could provide is gone. What has replaced it is competition with SRS for design engineers, gloveboxes, and management attention, with more difficulties on the way.<sup>4</sup>

NNSA, and so far Congress as well, are ignoring these warning signs, insofar as they point to the need for a fundamental change of plan.

What apparently happened in 2018 is that NNSA's senior management allowed a few people in Congress and elsewhere to override its own experts, and NNSA has never revisited that decision.

The upshot is that its entire program appears to be failing at this point, exactly as the Institute for Defense Analyses (IDA) [warned](#) it could four years ago.

To use a military analogy, NNSA no longer has a strategy. It has tactics, some of which are failing at LANL in particular. Despite the best efforts of NNSA's skilled managers, the center has not really held. NNSA – and the Department of Energy (DOE), which is ultimately responsible for many of NNSA's decisions – have not been able to reassert the leadership previous management relinquished, given the political pressures that still bear on the agency and the momentum embodied in current contracts.

The Integrated Master Plan (IMS) and Life Cycle Cost (LCC) analyses recommended by GAO cannot be produced because NNSA still does not know the scope and feasibility of its own program, let alone what it will cost.

The analytical and oversight burden this state of affairs places on Congress is far too great. Congress cannot provide adequate oversight when NNSA itself has no comprehensive foresight or fully-conscious strategy. Critically important information and the wisdom of past analyses are being forgotten as blind momentum carries the ever-expanding pit program toward fiscal heights and schedule delays few thought possible five years ago.

We believe NNSA's strategy at LANL in particular is doomed to fail. The barriers to LANL becoming an *enduring* pit facility are nothing short of Himalayan, and NNSA has no apparent plan or budget to address them – none at all. It is more than possible that LANL's looming [fifth pit production failure](#) will consume enough of NNSA's limited human and other resources for long enough to drag the entire program into a

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<sup>2</sup> [NNSA Assessment of Pit Production at LANL](#), Office of Cost Estimating & Program Evaluation (CEPE), May 2021.

<sup>3</sup> [Pit Production Analysis of Alternatives briefing slides](#), Nov 2017, slide 2; [Pit Production Startup Costs By Site and Year](#), Los Alamos Study Group, May 11, 2023. The 2023 LANL startup costs cited here are total LANL costs in that [spreadsheet](#) under the two scenarios shown, both less pre-2019 spending of \$1.85 B.

<sup>4</sup> LANL has a long history of over-promising and under-delivering. In 1996, LANL was assigned an "interim" pit production mission, partly on the basis of faulty assumptions made in the [Analysis of Stockpile Management Alternatives](#) (DOE, July 1996). There, DOE said that acquiring a production capacity of 50 ppy, with a single shift working 5 days per week at LANL, would require a \$310 million (M) capital investment (\$601 M in 2023 dollars), followed by \$30 M/year operating costs (\$58 M today). Full production could begin in 2002 ([p. 8-7](#)), i.e. in six years. An additional \$44 M (\$85 M today) in capital investment would provide a capacity of 100 ppy, again working with a single shift for 5 days per week ([p. 8-19](#)). The maximum LANL capacity was thought to be 100 ppy ([p. 8-2](#)).

black hole from which it cannot recover under current and future fiscal conditions. To repeat, complete failure is very possible, [said](#) the IDA.

Over the past several years we have produced several comprehensive reviews of pit policy. Some parts of those earlier reviews are obsolete; others not.<sup>5</sup> It is quite difficult for us to produce information which is both fairly comprehensive and up-to-date. The present paper doesn't begin to be the comprehensive one needed, but we hope it will be useful. Please ask if you have particular questions and we will try to respond.

### **1. Congress may not understand the scale and rapidly-expanding cost and schedule of NNSA's pit production program.**

Restarting the production of plutonium warhead cores ("pits") is the largest warhead-related program in the post-Cold War history of the U.S. It is much larger than any of the National Nuclear Security Administration's (NNSA's) current Life Extension Programs (LEPs), which are expected to cost in the \$8 billion (B) to \$20 B range in then-year dollars (see FY2023 [Stockpile Stewardship and Management Plan](#), [FY23 SSMP], p. 5-29).

Using figures in NNSA's congressional budget requests (CBRs), we estimate that the expected startup cost to construct a reliable 80 War Reserve (WR) pit per year (ppy) capacity under the two-site plan is likely to be at least \$42 B, in then-year dollars. (See "[Pit Production Startup Costs By Site and Year](#)," May 11, 2023, discussed further in section 4.)

More than half of this cost would be at Los Alamos National Laboratory (LANL), for what would be the smaller, less flexible, less resilient, and less enduring of the two planned pit capabilities.

Of this total, \$10.3 B, including \$1.9 billion in pre-2019 costs in three construction line items at LANL that NNSA includes in its Plutonium Modernization program, has already been appropriated.

The remaining minimum startup cost (\$32 B) is roughly equal to the \$31.3 B (in 2023 dollars) spent by the entire Manhattan Project through Dec. 31, 1945 (or in 1945 dollars, \$1.9 B; see [Atomic Audit](#), p. 60).

The Governmental Accountability Office's (GAO's) January 2023 review of NNSA's pit production plans ("[NNSA Does Not Have a Comprehensive Schedule or Cost Estimate for Pit Production Capability](#)," GAO-23-104661) identified at least \$18-\$24 million (M) in pit production start-up costs (p. 52), using NNSA's 2022 cost estimates.

Since GAO's report, NNSA submitted its [FY2024 CBR](#). In its new request, NNSA predicts additional delays (2-4 additional years at LANL and 1-3 additional years at SRS) and cost growth of 20%-40% in its two main pit production construction line items, the Los Alamos Plutonium Pit Production Project (LAP4) and the Savannah River Plutonium Processing Facility (SRPPF) (pp. 210-211 and pp. 237-238).

Unusually, NNSA adds these delays and cost increases in text but not to the Project Data Sheet (PDS) tables, suggesting they were a recent addition to the PDSs in response to GAO and congressional requests for greater transparency. On large projects like these, even NNSA's high-end estimates usually turn out to be optimistic, so these warnings from NNSA must be taken seriously. In our view these new estimates should be taken as NNSA's temporary baseline estimates, pending its more formal estimates at Critical Decision (CD-) 2.

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<sup>5</sup> Despite being somewhat dated discerning readers will be able to take what is valuable from, for example, "[NNSA pit production strategy: no clear goals, plans, or likelihood of success; Production at LANL has high risks and costs, few or no program benefits](#)," Oct 1, 2020; or [Letter to some congressional staff re: ongoing failure of pit plans at LANL](#), Jul 8, 2021. Much more can be found [here](#).

This new information dramatically increases expected pit production startup costs, well beyond what GAO tallied last year for its January 2023 [report](#). NNSA's current estimates could easily lead to [total costs of \\$47-\\$54 B](#) incurred up to and including the first year of 80 ppy operations.

The huge scale and complexity of the program, not all of which is visible even now, led the Institute for Defense Analyses (IDA) to conclude in 2019 that "eventual success of the strategy to reconstitute plutonium pit production is far from certain" ("[Independent Assessment of the Plutonium Strategy of the NNSA](#)," IDA, for DoD, Mar 2019, p. v). In the four years since that warning, projected capital expenses have increased roughly fourfold at both main sites, personnel requirements have roughly doubled at both sites, and expected start-up dates until full production is achieved have receded by what NNSA now warns could be 6-9 years at both sites. These large cost and schedule overruns do not augur for success.

## **2. NNSA does not yet have a fully-defined pit production plan.**

We believe that despite (or because of) the vast scale and complexity of the program, NNSA currently has no well-defined or viable plan to produce pits. At the moment, NNSA has a "revise-as-you-go" plan which is being implemented without being fully scoped, costed, or scheduled.

GAO emphasized the need for an Integrated Master Schedule (IMS) for pit production since a classified review of plans for the W87-1 warhead in February 2020 (later released in unclassified form in September of that year: "[NNSA Should Further Develop Cost, Schedule, and Risk Information for the W87-1 Warhead Program](#)," GAO-20-703, pp. 31-34, with an IMS defined and described on p. 17). Shortly after, NNSA's Office of Cost Estimating & Program Evaluation (CEPE) made the immediate completion and implementation of an IMS the "foremost" recommendation in its May 2021 report to Congress, "[Assessment of Pit Production at LANL](#)" (p. iii).

The crying need for a pit production IMS and associated life cycle cost (LCC) estimate was also the title theme of GAO's [January 2023 review](#). What comprises an LCC is described on p. 18 of that report.

Congress has also requested cost and schedule information for pit production, and by 2021 specifically an IMS and LCC, since the two-site pit program's formal inception in 2019 ([p. 3](#)).

The lack of an IMS and LCC was the main subject of questioning by Senator Warren ([video](#)) in a Senate Armed Services Strategic Forces (SASC/SF) hearing on April 18, 2023. NNSA Administrator Hruby's response to Senator Warren emphasized the uncertainties of cost and schedules at this relatively early point in project development.

These however just encompass the "known unknowns." Beneath or beyond these uncertainties, the very [scope](#) of the project at one of the two main sites – LANL -- is not yet defined or known, as will be discussed shortly. The scope of the LANL effort is also certain to [change](#) over time in currently unforeseeable ways, as capacity, reliability, and safety "gaps" in legacy facilities are officially discovered. Without knowing the scope of the pit endeavor at LANL, and how that scope will change, NNSA cannot construct an IMS or LCC.

The way infrastructure for pit production is being planned, budgeted, and built differ extremely between the two main sites.

At the Savannah River Site (SRS), all but one key pit production infrastructure requirement is encompassed in the SRPPF project itself ([GAO 2023](#), p. 70). That one element is an administration building, a standard piece of commercial construction. The other ten are included in the SRPPF budget. They will be built new, to modern safety standards.

At LANL, by contrast, the LAP4 project accounts for only four out of eleven key infrastructure requirements, which can give the impression that capital costs for pit production at LANL are much less than they are. Five more necessary infrastructure functions are spread across nine listed construction

projects and subprojects, most of which involve remodeling and/or re-equipping active nuclear facilities, including legacy facilities dating from the 1950s (e.g. the Sigma Facility, not shown in GAO's chart) and 1970s (LANL's main plutonium facility PF-4). Two infrastructure improvements identified by GAO as needed to safeguard nuclear materials for pit production were not included in NNSA's planning or budgeting for LANL as of January 2023.<sup>6</sup>

Key pit production roles are played by other LANL facilities not named in GAO's report, some of which must be replaced or augmented to establish either a) reliable or b) enduring pit production at LANL.

An example is the Sigma facility in Technical Area (TA-) 3, a Hazard Category (HazCat) 3 nuclear facility, which also fabricates beryllium components. Sigma almost certainly does not meet NNSA seismic standards.<sup>7</sup> NNSA's newly released SSMP schedules replacement of this facility by *four* new facilities during the 2027-2038 period at a cost described only as ">\$750 million." This *required* project does not appear in NNSA's FY24 CBR.

Another example is the "eventual need for PF-4 upgrades or replacement" ("[2021 Campus Master Plan](#)," LA-UR-22-21424, p. 10-4), "eventual" being defined by LANL as post-2041. As NNSA notes, PF-4 "will exceed its planned lifetime of 50 years during 2024" ("[Assessment of Pit Production at LANL](#), CEPE, May 2021, p. iii). NNSA and its consultants and the Defense Nuclear Facilities Safety Board (DNFSB) have previously estimated PF-4's end of useful life to occur in the 2040 timeframe.<sup>8</sup>

In June of 2017, NNSA formally rejected the use of PF-4 for an enduring pit production because of its inadequate size for the whole mission, its lack of safety margin and safety basis vulnerabilities, its age, condition, and conflicts with existing missions ([Pit Production Analysis of Alternatives \(AoA\)](#), Oct 2017, pp. 47-48). PF-4, NNSA said, should have a *temporary* 30 ppy pit production mission, after which "PF-4 can return to the research and development mission for which it was built" ([p. 2](#)).

While it is not clear (to anyone) exactly when expenses related to (further) PF-4 "upgrades" or PF-4 "replacement" might need to begin, they will need to begin within the planned life of LANL pit production and must be included in life cycle cost analysis. Both approaches (replacement and augmentation) are expensive, with "replacement" tipping the scales at \$10 B or more<sup>9</sup> plus any supporting infrastructure

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<sup>6</sup> The proposed TA-46 Protective Force Facility, project 24-D-511, addresses at least some of these needs. See NNSA's [FY24 CBR](#), pp. 550-555.

<sup>7</sup> The Sigma Facility was one of 169 "high-priority" structures which failed LANL's over-lenient 1994 seismic screening process. See "[Seismic Hazards at Los Alamos National Laboratory with Emphasis on the Plutonium Facilities at TA-55](#)," pp. 4-5. Seismic accelerations and associated hazards at LANL were revised in 2007 and 2009 to be multiples of what was thought in 1994. At PF-4, seismic demand increased by a factor of 6x vertically and 3x horizontally ("[Los Alamos National Laboratory Plutonium Facility \(PF-4\) Seismic Safety](#)," NNSA, 2014).

<sup>8</sup> "...PF-4 currently hosts the sole U.S. pit production capability [sic], as well as other missions, and will reach its assumed 50-year design life before 2030. Although DOE/NNSA continues to invest in facility sustainment projects to extend the life of the facility and reduce public and operations safety risks, any long-term commitment to achieve 80 ppy at LANL would either require future investments in PF-4, and/or in a new facility to address the eventual need to replace PF-4." "[Pit Production at \[LANL\]. Report to Congress](#)," NNSA, May 2020, p. 24. *Nota bene*: The "eventual need to replace PF-4" occurs at all production rates. In 2013, DNFSB told Congress PF-4 had about 30 more years of useful life, i.e. until 2043," Letter to Congress, DNFSB, p. E-1. The [AoA](#), [EA](#), and NNSA's [CEPE](#) review also emphasized the age of PF-4.

<sup>9</sup> HazCat 2 space in a then-proposed new facility in TA-55 was estimated in 2011 to cost a little over \$200,000/sq. ft. in 2023 dollars; see [CMRR cost history](#), Aug 8, 2012, p. 2. The Office of Management and Budget (OMB) estimated the actual cost of the nuclear facility in question then as greater than \$10 B (private communication, 2011). NNSA's 2017 higher-end [estimate](#) for a 80 ppy pit facility at LANL was \$9.3 B in 2023 dollars. Siting and construction of a new HC 2 nuclear facility at LANL would be problematic for reasons of seismicity, topography, security, and worker access.

needed, assuming a suitable site is available, and the basic feasibility of the project can be established, which is not at all assured given the present site's lack of space and geotechnical problems.<sup>10</sup> "Upgrades" may not solve all aging problems.

Besides those mentioned so far, there are five other construction line items, totaling an estimated \$250M in cost, specifically proposed to support pit production at LANL in NNSA's FY2024 budget [request](#).<sup>11</sup> Other line items address site-wide improvements needed, in part, to support pit production, including upgrades in on- and off-site transportation, site utilities and electrical supply, security facilities, (non-line-item) office buildings, major off-site leased facilities, parking structures, on- and off-site warehousing, and more.

The point here is the infrastructure scope of LANL pit production is at present undefined, with the result that an IMS and LCC cannot yet be constructed. The LANL pit production program implies an open-ended, undefined commitment to infrastructure construction that is more extensive than Congress understands.<sup>12</sup>

Another way to express this problem is to note that at LANL there are as-yet-not-fully-defined differences between the infrastructure needed for 1) demonstration ("pilot") pit production and training, 2) "basic" or "start-up" production at less than 30 WR ppy<sup>13</sup>, 3) "reliable" WR production at 30 or more ppy in 9 out of 10 production years (NNSA, pit [AoA](#), p. 1), and, especially, 4) "reliable and *enduring*" WR pit production.

The SRS pit production effort is by contrast far better defined. It is being designed from the outset for reliable *and enduring* production and is almost entirely encompassed within a single project conducted within the management structure for large Department of Energy (DOE) capital asset projects (DOE Order 413.3B).

### **3. The two-site "split production" strategy is not supported by any NNSA report.**

The scope of the overall LANL project is undefined in part because there are no clear standards or expectations for facility availability, safety, or longevity. There is also no complete inventory of facility and infrastructure dependencies and potential mission conflicts at LANL in the public domain.

We don't know these things because while there has been an [analysis of alternatives](#) (AoA) and [engineering assessment](#) (EA) supporting *the SRPPF portion* of NNSA's pit program, there has not been an overall AoA or EA supporting the present two-site "split production" strategy, which was [chosen](#) in 2018. The

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<sup>10</sup> These are the same problems which plagued NNSA's unsuccessful Chemistry and Metallurgy Research Replacement Nuclear Facility (CMRR-NF), leading to its cancellation. Issues include lack of adequate lateral earth buttressing for any large building on the south side of TA-55 given the high seismicity of the site, the presence of a thick layer of unconsolidated volcanic ash beneath the surficial tuff at TA-55 and elsewhere on the Pajarito Plateau, the lack of usable mesa-top space near TA-55 to support construction activity, and the impact on existing missions.

<sup>11</sup> These are: 23-D-518, Plutonium Modernization Operations & Waste Management Office Building; 24-D-511, Plutonium Production Building; 25-D-XXX, Plutonium Mission Safety & Quality Building; 26-D-XXX, Plutonium Program Accounting Building; and 27-D-XXX, Plutonium Engineering Support Building. Each is expected to cost about \$50 million.

<sup>12</sup> Other older LANL facilities currently assumed to be available may not be, for reasons of inadequacy, age, or other factors. The Emergency Operations Center, to pick just one example, is situated in the Pajarito Fault Zone and cannot be *a priori* assumed to be functional in a design basis seismic event. The *discovery* of functional and/or safety inadequacies in legacy supporting facilities could be crippling without timely, compensating investment. As noted in reference to PF-4 replacement, this may not be possible.

<sup>13</sup> Public remarks by NNSA Administrator Jill Hruby in February of this year ([54:28 to 56:19](#)) and others indicate that LANL will not be able to make 30 WR ppy reliably until after completion of the "30 Reliable" subproject of LAP4, now scheduled for the fourth quarter (4Q) of FY2031, with an additional 2-4 years delay likely ([FY24 CBR](#), pp. 210-211).



benefits, costs, and risks of the current strategy have not been evaluated in any NNSA report, except in the 2017 AoA, which specifically *rejected* today's plans for "split production," which is grossly inefficient (pp. 45-46), and presents a high risk to existing programs (pp. 39-40). For its part, the EA found that use of PF-4 for production would have by far the highest risk of any alternative (see for example slide 8 in the [EA briefing slides](#)).

Many parties are possibly confused about the apparent similarity between the *nominal* "30 ppy" capability of the pre-2018 NNSA pit production program, which NNSA thought could be established at LANL by 2026 at a cost of \$3 B ([slide 2](#)), and the subsequent requirement to produce at least 30 WR pits in 9 out of 10 production years, i.e. the requirement to produce WR pits *reliably* ([pp. 1, 41](#)).

IDA also advised against a key part of today's plan, namely round-clock use of LANL's PF-4 facility: "Trying to increase production at PF-4 by installing additional equipment and operating a second shift is very high risk" ("[Independent Assessment of the Plutonium Strategy of the NNSA](#)," IDA for DoD, Mar 2019, p. vii).

Of particular note is the evolution from the assumption of single-shift production in the AoA (2017) and EA (2018), to the necessity of double-shift production at LANL, entailing round-the-clock operations to achieve as few as 20 ppy ("[Draft Supplement Analysis \[SA\] of the 2008 Site-Wide Environmental Impact Statement for the Continued Operation of Los Alamos National Laboratory for Plutonium Operations \[2008 SWEIS\]](#)," March 2020, p. 12; [Final SA of the 2008 SWEIS](#), p. 15).

As far as can be ascertained, reliable production at 20 ppy would require much if not exactly the same investment in plant and personnel as reliable production of 30 ppy.

This single dramatic change (to double-shift production) entails billions of dollars in additional line item projects and subprojects, and nearly doubles personnel and their associated costs from 2,207 full-time equivalents (FTEs) in the pit program in FY2019 to an estimated 4,105 FTEs needed to reliably produce 30 WR ppy ("[NNSA Pit Production at LANL, Report to Congress](#), May 2020, p. 5). These additions to plant and personnel have brought years of delay to startup, each year costing an additional billion or more in program costs, much of which is for personnel. Finding and keeping that personnel (as well as the housing needed<sup>14</sup> and ways for these additional staff to get to work<sup>15</sup>) are still a "work in progress."<sup>16</sup>

Whether 4,105 trained people will ever be available for pit production and support services at LANL is still an open question. As NNSA's CEPE noted in its less-than-glowing [review](#) of NNSA's LANL plan: "...there are significant risks in staffing" – as well as in "program management, production activities, supporting infrastructure, waste management, and other program requirements" (p. iii).

#### **4. More details on what pit production will cost, given current plans**

Using the estimates in NNSA's [FY2024 CBR](#), our minimum projection for the startup cost of the two pit production facilities program over the coming 13 to 16 years (i.e. until the estimated 2036-2039

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<sup>14</sup> References to this problem are extensive. One approach, with background, was discussed here: "[Nuclear-weapons-oriented "innovation triangle" developments, tax changes, pitched to NM legislature.](#)" Nov. 30, 2021

<sup>15</sup> See for example "[The troubled logistics of LANL pit production: how will LANL staff and contractors get to work?](#)" March 26, 2022.

<sup>16</sup> References to NNSA's and specifically LANL's hiring and retention challenges are almost too numerous to cite. See for example "[Evolving the Nuclear Security Enterprise](#)," Sep 2022, throughout); NNSA Administrator Hruby's [remarks](#) on February 14, 2023 -- much of the 2023 "Nuclear Deterrence Summit" conference at which she spoke was devoted to solving problems of hiring and retention; [FY23 SSMP](#), Appendix C; "[LANL Announces Plutonium Premium Pay Retention Pilot Program For Plutonium Mission Workers](#)," *Los Alamos Reporter*, May 16, 2023.

achievement of reliable 80 WR ppy) is \$42 B in then-year dollars, with \$10 B appropriated so far.<sup>17</sup> ("[Pit Production Startup Costs By Site and Year](#)," May 11, 2023).

This \$42 B includes only those construction line items and programs that NNSA includes in its Plutonium Modernization budget line. Only LANL costs through 2033 are included, which is the earliest its hoped-for 30 WR ppy "reliable" production is likely to be achieved, according to NNSA's FY2024 [budget request](#) (p. 211) and public comments by NNSA Administrator Jill Hruby (see "[Schedule for Nuclear Warhead Core \("Pit"\) Production Slipping. Costs Increasing: NNSA's Strategy is Failing](#)," Mar 22, 2023).

This \$42 B includes the latest expected costs ([p. 238](#)) at the Savannah River Site (SRS) costs plus all the "Enterprise" costs at other sites through 2036 only, the current earliest date, for 50 WR ppy "reliable" production.

In making these projections, we used NNSA's estimates for spending over the coming five years from the [FY24 CBR](#), with operational costs extrapolated at LANL at \$50M/year after that and a conservative \$50 M/year in additional capital costs added, with no other major construction. LAP4 costs were increased 30%, NNSA's minimum (p. 211). At SRS we increased SRPPF costs by 20% per NNSA's minimum (p. 238) and gradually ramped up annual program costs to \$524 M/year by 2036.

Other reasonable assumptions will not produce greatly different results in the overall cost predicted.

If LANL's operational costs are included past its start-up date, up to SRS's later start-up date – i.e. until the program is expected to produce 80 WR ppy, total program costs will be found to lie in the \$47-\$54 B range, or \$37-\$44 B if sunk costs are excluded.

Cumulative startup costs through 80 ppy are about 30% greater at LANL than at SRS under every scenario, primarily due to LANL's higher operational costs, which in turn are driven by the need to operate LANL's facilities on a 24/7 basis. Under the current plan, NNSA expects higher annual appropriations for pit production at LANL than at SRS in every year henceforth, through at least FY2028, as has already been the case so far. We expect this disparity to continue indefinitely, even during SRPPF construction past 2028.

With both sites operating, LANL costs would be roughly twice as great as SRS's for a combined 80 WR ppy even without the further investments needed at LANL to create an enduring pit capability, because LANL will need about twice as many staff as SRS in their respective baseline plans.

On a per-pit basis, LANL pits will cost very roughly 3x what SRS pits cost under the most optimistic scenario. We believe more realistic production scenarios would increase this disparity, even without the further major capital investments at LANL that are necessary for enduring pit production.

##### **5. Halting preparations for industrial pit production at LANL would save \$11-\$21 billion, about as much as SRS construction and some start-up costs.**

Scenario modeling using the above [cost model](#) shows that a policy of demonstration, training, and *de minimus* production at LANL, involving cancellation of LAP4 this year and decreasing program costs by eliminating a second production shift would save anywhere between \$11 and \$21 B between now and the time production at SRS is fully underway in the 2036-2039 timeframe, roughly comparable to the total remaining construction and startup costs at SRS.

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<sup>17</sup> These sunk costs do not include \$3 B in pit production program funds spent at LANL in fiscal years 2005 through 2018 ([GAO 23-104661](#), p. 12). GAO's "3.6" B includes 2019 and 2020 program spending, which are subtracted out here to avoid double-counting.

Such a policy would almost certainly decrease the time necessary to create an enduring 80 ppy capacity, while also lowering SRPPF costs and risks.

**6. LAP4 and SRPPF are in competition for scarce personnel, gloveboxes, and other resources.**

According to NNSA's current CBR, both schedules and hence costs at both LAP4 and SRPPF have are increased due to competition between these and other projects for scarce specialized design engineers ([pp. 210, 211; 236-238](#)) and the hundreds of gloveboxes needed for each project.<sup>18</sup> There may be other resources which are scarce as well. We believe NNSA's oversight and management personnel and attention are also scarce, both as regards new construction and as regards operations.

At present, appropriations are adequate for pit production preparations at both main sites. NNSA recently wrote that overall, "[d]elivery of mission is becoming paramount while the fiscal environment is evolving from being cost-constrained to being cost-conscious." (NNSA, "[Evolving the Nuclear Security Enterprise](#)," Sep 2022, p. 3). We find this attitude highly problematic and do not believe this apparent situation will last.

*\*\*\* This concludes Part 1. Part 2 will follow as soon as possible. \*\*\**

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<sup>18</sup> As of 2019, over 300 new gloveboxes were needed at LANL. See [LANL subcontractors forum slides](#), Aug 8, 2019, p. 37.