



# Los Alamos Study Group

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

## What will NNSA's pit production program cost?

Greg Mello, August 24, 2021

### Summary

We find that NNSA's pit production start-up costs for its two-site plan will lie in range of \$32-39 billion (B) through FY2033, with more than half of these expenses occurring at LANL under all assumptions. Omitting sunk costs, we estimate that FY22-33 pit production costs will lie in the range of \$27-\$34 B.

We estimate costs for LANL pits made over the years 2023-2033 to be in the range of \$57-84 M per pit. SRS production capacity is expected to be much greater than LANL; our estimates assume 30-41 pits per year (ppy) at LANL vs. 50-103 ppy at SRS. We also estimate that SRS will have lower operating costs due to single-shift production, vs. two-shift production at LANL. For these reasons alone, not considering others, SRS per-pit costs will be much less than LANL's.

The obvious way to cut back these tremendous program expenses without jeopardizing the goals of the pit production program overall is to eliminate early-time, quantity production at the inferior site. We do not develop all the reasons for this policy in this brief note, which deals only with costs.

Assumptions and details are presented in this [spreadsheet](#) and discussed further below.

The National Nuclear Security Administration (NNSA) has not published any complete cost estimates for its Plutonium Modernization Program spanning the future years necessary to stand up plutonium warhead core ("pit") production at the Los Alamos National Laboratory (LANL) and the Savannah River Site (SRS).

For this reason, Congress is largely in the dark about the start-up costs of pit manufacturing, how these costs are apportioned between sites, the operating costs which can subsequently be expected, and what these imply for the cost of pits produced at both sites.

For example:

- NNSA's fiscal year (FY) 2022 Congressional Budget Request (CBR) did not include a Future-Years Nuclear Security Plan (FYNSP);
- key line-item projects have had incomplete Project Data Sheets (PDSs) for years;
- key supporting line-items are listed separately from Plutonium Modernization despite that being their only purpose;
- little or no detail is available for program expenditures;
- there is almost no visibility for small construction projects;
- there is no attempt to estimate end-of-life for old facilities needed by the program; and
- planned future line-items are omitted.

Because of these omissions, members of Congress may have the impression that the capital costs of pit production, or perhaps even the *overall* costs of pit production, are encompassed by just two line-item projects: the Savannah River Plutonium Processing Facility (SRPPF); and the Los Alamos Plutonium Pit Production Project (LAP4). This is far from the case.

While much is not known, much *is* known, and more can be reasonably estimated based on current spending patterns and NNSA's project cost estimates. I've tried to do that in this [spreadsheet](#). If you would like a working Excel version of these estimates, ask.

The two main pit production sites differ in how pit production is funded, in part because LANL has been investing in pit production facilities, programs, and supporting infrastructure for a long time, while SRS has not. In addition, key LANL facilities will need augmentation or replacement early in the pit production program. NNSA mentions two such facilities:

- Sigma Replacement Project (>\$750 million [M], 2026-2038, see FY21 [Stockpile Stewardship and Management Plan](#) (SSMP), p. 4-4);
- Radiography/Assembly Complex Replacement (RACR); (\$100 - \$750 M, 2032-2041, Ibid.)

The highly-uncertain costs of these projects – likely necessary if LANL pit production is to continue – are omitted in the present tally.

Also omitted are any costs for augmentation or replacement of LANL's main plutonium facility (PF-4), except as a possible post-2033 cost. Yet investment in PF-4 replacement – a ballpark \$10 B project – might easily appear earlier.

I also omit all small (non-line-item) construction projects to the extent they are funded outside the Plutonium Modernization program, which is unclear. These might include facilities such as parking garages, office buildings, training facilities, and cafeterias.

I also omit all pro-rata costs for site-wide, area-wide, and corridor-wide projects which support pit production at either main site which NNSA does not include in the Plutonium Modernization program.

I also omit all sunk costs incurred prior to FY19 at LANL – there are none at SRS – no matter how obviously targeted at pit production capability and capacity they are, with the exception of these three continuing projects:

- The LANL Chemistry and Metallurgy Research Replacement (CMRR) project (04-D-125);
- The LANL Transuranic (TRU) Liquid Waste Facility (07-D-220-04); and
- The LANL TA-55 Reinvestment Project Phase III (TRP-III, 15-D-302).

Of interest, these three projects were [singled out](#) by Senator Heinrich as being part of the pit production program. We agree and include these projects in our cost estimates – but only these projects.

There is good visibility as to what has been appropriated for Plutonium Modernization at all sites through the end of FY2021, namely \$5.44 B. Of this, \$3.86 B was appropriated for LANL, again omitting all prior costs except the specific ones noted above.

For FY22, a complex-wide total for Plutonium Modernization, including these three LANL projects, of \$1.92 B has been requested – \$1.16 B (60%) at LANL, \$0.65 B (34%) at SRS, and \$0.11 B (6%) at five other sites, mostly Lawrence Livermore National Laboratory (LLNL). All indications are that the request for FY22 will be fully funded with little or no changes.

### **The estimates briefly explained**

In the absence of a FYNSP and complete PDSs, we have prepared low- and high-end estimates for FY22 and beyond based on NNSA's published estimates for total line-item project costs (TPCs) and what we

believe to be reasonable extrapolations of program costs. We believe our high-end costs are more likely accurate than our low-end costs.

NNSA has a legal mandate to begin producing at least 30 pits per year at LANL by 2026. Our high-end, complex-wide estimate for expenses through that year, *omitting all sunk costs prior to FY21*, is \$14.13 B, of which \$7.81 B (55%) is at LANL, \$5.61 B (40%) is at SRS, and \$0.71 B (5%) is at the other five sites.

Our low-end complex-wide estimate, again omitting all costs through Sept. 30 of this year, is \$11.88 B, of which 59% is at LANL, 36% at SRS, and 5% at other sites.

Despite NNSA's 2026 deadline, LANL's two largest capital projects supporting pit production (LAP4 and CMRR) will not be completed until late FY28 at the earliest. Using FY28 as a milestone, by that year Plutonium Modernization will have cost, in the high case, \$20.0 B omitting all costs through FY21, or \$25.7 B if sunk costs are included. In the low case, by FY28 Plutonium Modernization will have incurred costs of \$16.8 B without sunk costs, or \$22.2 B with sunk costs included.

NNSA has estimated it will be producing at least 80 ppy by some time in the range of 2032-2035. These estimates assume SRPPF includes all necessary capital expenditures for pit production at SRS, and that SRPPF expenses conclude in 2033 with at least 50 ppy production beginning in 2034.

We estimate that complex-wide pit production expenditures will reach \$39.4 B by the end of FY2033 in the high case (or \$33.9 B, omitting sunk costs), or \$32.4 B in the low case (or \$26.9 B, omitting sunk costs).

Estimated total (capital + program) LANL expenditures by that date exceed total SRS expenditures in all cases (low and high, with and without sunk costs included). This is because of the high staffing and hence operating expenses of running two production shifts at LANL, requiring from 3,600 to 4,000 full-time equivalent (FTE) staff.

We estimate that LANL's operating costs will rise from NNSA's FY22 estimate of \$635 M to \$1.00 B per year by 2027, and will continue indefinitely at that level thereafter. At LANL alone, we also include \$200 M per year in further capital costs and deferred maintenance, beginning in FY29. We estimate SRS operating costs will rise to \$500 M per year by FY28 and continue at that level.

Estimated per-pit costs at LANL through 2033 (our assumed completion year for SRPPF) run from \$52 M to \$75 M, for between 271 and 348 pits produced through 2033 (using post-start-up average production rates of 30 ppy and 41 ppy respectively). We do not believe per pit costs will decline much if at all over time due to the necessity to further recapitalize LANL's aging facilities.

We optimistically assume LANL production begins in a timely fashion, is continuous, and is unaffected by any significant outages. We assume the same at SRS.

SRS costs are likely to lie in the \$31 M to \$65 M per pit range for the first 6 years, falling to \$12-20 M per pit when averaged over the first 16 years of production.

We see SRS marginal pit costs in the same general range as the Congressional Budget Office (CBO) estimated, namely circa \$6 M/pit. It's really not possible to estimate a marginal pit cost at LANL due to uncertainties about the stability of production in LANL's older facilities and the need for recapitalization.

Through 2033, start-up costs at other sites will add about \$5-9 M per pit, thereafter falling toward what we estimate – possibly optimistically – as a marginal cost of \$1-3 M/pit over time.