



Los Alamos Study Group

Nuclear Disarmament • Environmental Protection • Social Justice • Economic Sustainability

Pit Production Recommendations and Considerations

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To: **Hon. Lisa Gordon-Hagerty**, Under Secretary for Nuclear Security, Department of Energy (DOE) and Administrator, National Nuclear Security Administration (NNSA)

Hon. Dan Brouillette, Deputy Secretary, DOE

Other interested parties

From: Greg Mello and Trish Williams-Mello, Los Alamos Study Group (LASG)

Given the statutory deadline you face in making a recommendation for pit production recapitalization, we cannot tarry further in getting these recommendations to you even though a) we do not have a redacted copy of NNSA's November 2017 pit production Analysis of Alternatives (AoA) or subsequent analyses, which may touch upon some of the issues raised here, and b) we have not had time to address all the facets involved, or to treat them with the thoroughness they deserve.

These issues are complex, and we have written extensively on them. We treat them here in summary fashion only, and invite your comments and questions. We are available to discuss these and other issues at your convenience. "Echo-chamber" decision-making is an insidious danger for all of us.

As you will know, we promote thoughtful disarmament. Nonetheless we believe we can offer useful and relatively objective advice on the subject of pit production. We endeavor to do so here.¹

We will update this memo as promptly as we can as more information becomes available, and as we address other issues not mentioned here, and deepen our analysis of these.

We anticipate discussion of some of these issues in a workshop we will organize in Washington, DC in partnership with the Princeton University Program on Science and Global Security in the second half of May.

1. Section 3141 of the FY2018 National Defense Authorization Act² requires from you a recommended alternative for the recapitalization of plutonium (Pu) science and production capabilities which (quoting):

¹ Obviously, moving pits from the active stockpile (deployed and reserve) into and through the dismantlement queue not only decreases the number of pits which must be maintained but also increases the number of potential spare pits. In that regard, a 1998 Defense Programs Advisory Group (DPAG) analysis of pit production assumed pit production requirements would be based on an "active-only stockpile." Linda Branstetter, Sandia National Laboratory, "Plutonium-Pit Production in the 21st Century: Salient Features of the DPAG Study," March 21, 2000 (unclassified summary). http://www.lasg.org/MPF2/documents/Branstetter_DPAG_pits_21Mar2000.pdf. We hope that is or could be the case today.

² This became Public Law 115-91 on 12 Dec 2017. <https://www.congress.gov/bill/115th-congress/house-bill/2810>.

- a. is acceptable to the Secretary of Defense and the Nuclear Weapons Council and meets the requirements of the Secretary for plutonium pit production capacity and capability;
 - b. is likely to meet the pit production timelines and milestones required by section 4219 of the Atomic Energy Defense Act ([50 U.S.C. 2538a](#));
 - c. is likely to meet pit production timelines and requirements responsive to military requirements;
 - d. is cost effective and has reasonable near-term and lifecycle costs that are minimized, to the extent practicable, as compared to other alternatives;
 - e. contains minimized and manageable risks as compared to other alternatives; and
 - f. can be acceptably reconciled with any differences in the conclusions made by the Office of Cost Assessment and Program Evaluation of the Department of Defense in the business case analysis of plutonium pit production capability issued in 2013;
2. It is our understanding that the mandate at 1a. requires NNSA to provide, with high confidence, a sustained pit production capacity of at least 80 pits per year (ppy) by 2030, but not more.³ We presume NNSA interprets this as a single-shift capacity,⁴ so the actual (two-shift) steady-state capacity of the core production facility would be 160 ppy.⁵ If “only” a “50-80” ppy single-shift capacity is required instead of “80” or “80+”, the arguments presented here do not change. (In the text that follows, all references to pit production capacity refer to single-shift capacity unless otherwise noted.)
3. There is no indication in the public domain that these statutory and military requirements are anything but technically arbitrary. As far as we can tell they are not driven by plutonium aging, pit aging in general, or stockpile requirements. We believe they are fiscally irresponsible and will have excessive life cycle costs – billions of dollars in extra costs as we shall see. We believe these requirements arise from a combination of ideology, contractor influence, and pork-barrel politics, not science or good management.⁶ There is no managerial or technical need to manufacture entirely new

³ NNSA, Pit Production Analysis of Alternatives [AoA], 9pg summary, Nov 2017, http://www.lasg.org/MPF2/documents/PlutoniumPitProductionAoA_Nov2017_9pg.pdf.

⁴ “Assessment of Nuclear Weapon Pit Production Requirements, report from Sec. of Defense Chuck Hagel to House Armed Services Committee,” 16 Jan 2014. http://www.lasg.org/MPF2/Hagel_ltr_HASC_pits_16Jan2014.pdf.

⁵ Two-shift operation roughly doubles throughput; three-shift operation is infeasible (Branstetter, op. cit.) Analytical chemistry (AC) requirements scale linearly with production, *ceteris paribus*, but most tests are confirmatory, i.e. not on the critical path. AC (and other pit production topics) were covered extensively by Jon Medalia of the Congressional Research Service (CRS); see “Pit Production Options,” compiled by LASG from separate CRS publications and presentations at http://www.lasg.org/MPF2/CRS_PitProd_compilation_2Sep2015.pdf.

⁶ The factors listed in this memo apply. Executive Office of the President, “Structural Features Making NNSA an Unusual Federal Agency,” 2016, <http://www.lasg.org/Modernization/StructuralFeaturesMakingNNSAUnusualFedAgency.pdf>.

pits for decades hence.⁷ Plutonium aging is not a reason to produce new pits.⁸ No current or planned US nuclear weapon requires new pits.⁹ Thousands of spare pits of modern design are available.

4. In some quarters there are what appear to be irrational, ideological motivations for pit production, such as “the Russians (whose pits had and may still have a short life) have a large pit production capability,” “our investments (i.e. fiscal outflows) help deter adversaries and reassure allies,” and so on. By definition these are beyond rational argument and we do not treat them here.
5. Preservation of pit production capability, which must involve infrastructure, knowledge and skills (including “tacit” institutional knowledge), adequate workforce (hiring, training, retention, morale, and more) is a real issue. But even if plutonium pit production knowledge and skills were entirely lost, which is truly a remote possibility, there would be no effect on the reliability of the US stockpile for at least four decades – two human generations – provided pit rebuilding skills, supply chains, and facilities were retained. Further, if new-pit production skills could not be reconstituted as needed – from archives and related active fields – the US by implication would not be a technologically-capable country. In that case, making new pits would be the least of our worries. Overall and in any case there is no need to panic, as some in Congress (expressing Eisenhower’s “unwarranted influence”) are wont to do. Pit production should not be NNSA’s highest priority.
6. We believe that no matter what investments are made and how many years elapse, an enduring 80+ ppy pit production capacity will never become available at Los Alamos National Laboratory (LANL). Even less could an 80+ ppy capacity be attained “with high confidence” at LANL.
7. Given PF-4’s age (50 years in 2028) and its estimated end of life assuming further investment (2039¹⁰), to the extent pit production depends on PF-4 (and certain other aging LANL buildings and capabilities), LANL does not have enduring pit production capability. Adding any number of “modules” in TA-55 (which would be physically or functionally dependent on PF-4) will not improve this situation, or extend the safe functional life of PF-4. Further, attempting to build out an 80+ ppy capacity at LANL by the required dates (2027 for 90 days, and by 2030 enduringly) is likely to interfere with achieving the earlier 2024-2026 milestones (to the extent these are important).
8. If NNSA wishes to meet its statutory pit production requirements, NNSA must therefore promptly invest in larger pit production capacity at another site. NNSA has so far determined that the Savannah River Site (SRS) is likely to be that site, whether at a repurposed Mixed Oxide Fuel Fabrication Facility

⁷ DOE and DoD, “National Security and Nuclear Weapons in the 21st Century,” Sept. 2008, p. 21ff.

<https://www.defense.gov/Portals/1/Documents/pubs/nuclearweaponspolicy.pdf>. See discussion in Greg Mello, “Questions about projected U.S. plutonium pit production capability” and “Pit production in the United States: Background and issues,” 22 Feb 2018, International Panel on Fissile Materials, http://fissilematerials.org/blog/2018/02/questions_about_projected.html and <http://fissilematerials.org/blog/US%20pit%20production-background.pdf>.

⁸ “Pit production to replace pits in the deployed stockpile due to plutonium aging is not required, nor is it planned to occur.” LANL talking points provided to Congress, week of 6 Dec 2012, verbatim at http://www.lasg.org/documents/PF-4_documents/LANL_comments_LASG_paper_6Dec2012.html. See comments at http://www.lasg.org/LASG_comments_LANS_ltr_12Dec2012.html. Some additional pit aging materials are collected at <http://www.lasg.org/MPF2/PlutoniumPits-Aging.html>.

⁹ NNSA: “Pit Sources for Life Extension Programs (LEPs), 2015, <http://www.lasg.org/MPF2/documents/PitChart2015.png>. The IW-1 program is now a W78 LEP. There are roughly 780 W78 pits, which DOE and DoD (op. cit.) said in 2008 will last until the 2060s at a minimum. See Mello, U.S. plutonium pit population estimates, 2 Mar 2010, http://www.lasg.org/MPF2/Mello_pit_recommendations_p19_Mar2010.pdf.

¹⁰ DOE, FY 2014 Congressional Budget Request, Vol. 1 (NNSA), April 2013, p. WA-211.

<http://www.lasg.org/budget/FY2014/Volume1.pdf>.

(MFFF), which according to NNSA is the cheapest and fastest option overall, in new facilities elsewhere at SRS, or in new or refurbished facilities at the Idaho National Laboratory (INL).¹¹ We believe that for fundamental geologic, topographic, institutional, geographic, and cultural reasons, a new plutonium pit production facility at LANL will prove impractical to build and to operate.

9. For these same reasons and others, LANL may not be able to successfully undertake industrial plutonium missions at all, or in fact any dangerous industrial-scale missions.
10. That said, there is no benefit in rushing to bring an 80+ ppy facility, or combination of facilities, on line at any site within the statutory timeframe, even if such a rush could be successful (which the schedule estimates in the AoA suggest is unlikely to be the case).¹² Rushing is a high-risk strategy. Methodically building a somewhat higher capacity on a slower timetable would have a much greater chance of success. The marginal cost of an additional capacity increment to make up for a few years' delay would be low.¹³ A few years of delay in meeting deadlines – likely necessary given the all-but-impossible 90-day demonstration of 80 ppy required for 2027 – would be more than compensated by higher confidence, higher average production rate, greater operational flexibility, and greater surge capacity. In any case, if planning is not very methodical and soundly-based, the risk of failure is high.
11. As will be discussed below, and notwithstanding the requirements in paragraphs 1. and 2. above, there is currently no political or managerial consensus on the future of the MFFF – and hence on the best path forward for stockpile pit production. Engineering issues related to compatibility of as-yet-unknown (!) mission assignments at SRS and LANL are other problems, the solutions to which are unknown at this times and certainly have not been widely vetted or accepted by stakeholders. Any recommendation you make at this point is therefore going to be contingent on the subsequent development of a supporting political consensus, which will take time. The risks associated with proceeding in the absence of fairly broad political support, and engineering peer review, are great.
12. Notwithstanding the requirements in paragraphs 1. and 2., it would be good policy (and would have no impact on the stockpile) to modify the investment plan at LANL to include only pilot-scale, technology-preserving, pit production functions. LANL's pit production roles are important for the coming decade and include technology development and demonstration, training, preservation and advancement of skills and knowledge, interim pit rebuilding as needed, as well as related stockpile surveillance and actinide research functions. After 2030 some of these roles may diminish. In the meantime, investments in production *capacity*, as opposed to *capability*, will likely conflict with reestablishing safe conduct of operations and waste monies better invested elsewhere. LANL may well fail, for perfectly predictable reasons, to reach even a steady 30 ppy using any combination of facilities (current, planned, and possible). The production levels, reliability, and duration realistically attainable at LANL, over any time period, will not be significant for the stockpile.
13. If an 80+ ppy capacity is to be built at another site, why is there a parallel need to increase LANL beyond its planned capacity of 10 ppy by 2024,¹⁴ at a cost of billions, with a high risk of failure? (At

¹¹ NNSA, pit production AoA summary, pp.8-9.

¹² The estimated times required for the two refurbishment options shown in the AoA are not dissimilar from the circa “14 years” estimated in Branstetter, op. cit., p.4. The new-facility timeline given in the AoA is obviously longer.

¹³ Ibid. The DPAG study found that a single-shift capacity of 150 ppy could be increased to 225 ppy (a 50% increase) with only a 10% increase in hardened (Cat I) floor space.

¹⁴ For example, see NNSA, FY16 SSMP, p. 2-34, “Continue acquiring and installing pit production equipment to replace old, end-of-service-life machines, as well as additional equipment to increase war reserve production capacity from 10 pits per year in 2024

present and for the immediately-foreseeable future, LANL has a pit production capacity of zero, because of a) infrastructure, management, and training issues at PF-4, b) waste management bottlenecks and failures, and c) the lack of any safe facility in which to conduct AC operations. This is why NNSA documents refer to a *future*, not a *present*, 10 to 30 ppy capacity at LANL.)

14. At this point, NNSA's normative pit production strategy should be characterized by a) surveillance and watchfulness, b) technology and skills preservation, c) thorough planning as mentioned, and d) hedging if necessary. Peremptory major investments in "yesterday's priorities" have repeatedly failed. The cost to the nuclear arsenal and US nuclear posture from these failures has been zero however, because there never was any need to produce new pits in the first place – as there is none today. A "strategic pause" would allow time to reconsider policies we (LASG and others) consider to be poor national security choices, regardless of their legal status. We believe such a pause could be managed to produce higher confidence in pit production if and when production becomes necessary, with higher morale, and program and infrastructure benefits to the sites in the meantime.
15. We believe an executive branch *decision*, as opposed to a *recommendation*, to either
 - a. invest in any facility or facilities to produce pits at any location other than at LANL, or
 - b. expand pit production operations at LANL beyond "about 11,400 sq. ft." within PF-4¹⁵, or
 - c. produce pits at LANL at any rate higher than 20 ppy,would be a major new federal action which contravenes prior formal decisions, have significant impact on the environment, and which therefore would require, prior to any such decision, an environmental impact statement (EIS) compliant with the National Environmental Policy Act (NEPA).
16. Separately, we believe any decision to build new plutonium or pit-related facilities, or to use existing facilities for substantially different uses (as in the case of the Radiological Laboratory, Utility, and Office Building, RLUOB, which NNSA now proposes to use as a Hazard Category 3 Nuclear Facility in support of pit production¹⁶) would also require an EIS, in our view.¹⁷
17. If past precedent is a guide, a decision to conduct pit production operations at any site other than LANL, or a decision to produce pits at LANL at a rate higher than 50 ppy, might also require a

to 30 pits per year in 2026." For an overview of recent War Reserve production at LANL see Bradford Storey, LANL, "Pit Manufacturing Fiscal Year 2012 Program: Report to the University of California," LA-UR-12-25400, 9 Oct 2012, http://www.lasg.org/MPF2/LA-UR-12-25400_Pit_manuf_rpt_UC_FY2012.pdf.

¹⁵ See DOE, Record of Decision [ROD]: Site-Wide Environmental Impact Statement [SWEIS] for Continued Operation of Los Alamos National Laboratory, Los Alamos, NM, Fed. Reg. Vol. 64, No. 181, 20 Sep 1999, at p. 50803.

This limitation was reaffirmed 9 years later to New Mexico communities and tribes in DOE: NNSA: Record of Decision: Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, NM, Fed. Reg. Vol. 73, No. 188, 26 Sep 2008, pp. 55833ff.

It was reaffirmed again to New Mexico communities and tribes the following year in DOE: NNSA: Record of Decision: Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, NM, Fed. Reg. Vol. 74, No. 131, 10 Jul 2009, pp 33232ff.

¹⁶ For a decade, throughout the NEPA process and litigation and in many public presentations, NNSA consistently told New Mexico communities and tribes that RLUOB would never house more than 8.4 grams of Pu-239 equivalent (e). Now NNSA proposes to house up to 2,610 g Pu-239e in RLUOB, which was not built to nuclear facility standards.

¹⁷ We will explain this further later this month in comments on DOE Environmental Assessment 2052. See <https://www.energy.gov/nepa/ea-2052-proposed-changes-analytical-chemistry-and-materials-characterization-radiological>.

programmatic environmental impact statement (PEIS).¹⁸ It could also be argued that because NNSA decisions regarding plutonium programs in Defense Programs are now intertwined with plutonium disposition decisions in Defense Nuclear Nonproliferation, and affect decisions and programs in DOE Environmental Management, with reasonable alternatives that could impact operations and the environment at five or more NNSA and DOE sites, a DOE-wide plutonium PEIS might be helpful to you – and warranted.¹⁹

18. We have not reviewed the NEPA considerations bearing on a repurposed MFFF, with pit production as a new and possibly additional mission for the SRS site. Isn't a new or supplemented project-specific EIS, and a new or supplemented SWEIS essential? NNSA would do well to take full advantage of the NEPA process to vet its proposals, rather than shoot for the lowest NEPA rung.
19. There is as yet no clarity regarding plutonium disposition policy – or even a consensus as to whether the US should have a plutonium disposition policy at this time. To the extent pit production strategy depends on clarity about Pu disposition, the time is not ripe for a decision about pit production strategy.
20. In passing, we wish to state that pit disassembly and conversion on an industrial scale (e.g. 34 metric tons) at PF-4 is not a viable option. As noted above, industrial missions generally are probably not viable at LANL. The fact that LANL continues to tout PF-4 for this mission, and NNSA continues to consider PF-4 as the site of record for pit disassembly and conversion, casts a dark shadow over the credibility of all current plutonium plans, and over LANL's case for pit production in particular.
21. There have been 19 local government and tribal resolutions in northern New Mexico expressing concern and/or condemnation regarding LANL's mission, environmental impact, and/or pit production.²⁰ There has been one local government resolution in New Mexico (in Los Alamos County),

¹⁸ The pit production demonstration and technology preservation mission was assigned to LANL in 1996. DOE, Record of Decision: Programmatic Environmental Impact Statement for Stockpile Stewardship and Management [SSMPEIS], Fed. Reg. Vol. 61, No. 249, 26 Dec 1996, p. 68014ff.

DOE said at the time, "The technological capability to manufacture all the pit designs in the enduring stockpile provides an inherent capacity to manufacture about 50 pits per year in single shift operations." (p. 68023) "With regard to reestablishing pit manufacturing capability, DOE does not intend to establish a greater manufacturing capacity than is inherent in reestablishing the basic manufacturing capacity." (p. 68026).

Thus in 1996 DOE thought the minimum "capability-based capacity" for pit production was "about 50" ppy. The actual capability-based capacity appears, in subsequent experience, to be much less.

In 1999 DOE wrote: "DOE will establish, over time, a pit production capability at LANL with a capacity of nominally 20 pits per year; this decision reflects an intent to establish a pit production capability at LANL within the existing floor space set aside for this operation (about 11,400 ft.² [1060 m²])....While this does not change the 50-pit-per-year mission assignment made in the [SSMPEIS] ROD, it does suspend full implementation of that decision until an undetermined time in the future." (20 Sep 1999 SWEIS ROD, op. cit., p. 50803)

In 2008 DOE wrote: "With respect to plutonium manufacturing, NNSA is not making any new decisions regarding production capacity until completion of a new Nuclear Posture Review in 2009 or later" and "...the net production at LANL will be limited to a maximum of 20 pits per year." DOE: NNSA: Record of Decision for the Complex Transformation Supplemental Programmatic Environmental Impact Statement – Operations Involving Plutonium, Uranium, and the Assembly and Disassembly of Nuclear Weapons, Fed. Reg. Vol. 73, No. 245, 19 Dec 2008, pp. 77648 and 77651; ROD begins on p. 77644.

¹⁹ The five are: the sites said to provide reasonable alternatives in the pit production AoA (LANL, SRS, and INL) plus the Waste Isolation Pilot Plant (WIPP), which would be heavily affected by plutonium disposition choices and by pit production, and Pantex, which is storing surplus pits pending disposition.

²⁰ See http://www.lasg.org/MPF2/LocalGovt_resolutions_ltrs.html.

in favor of expanding pit production at LANL.²¹ There have been 11 local government and state-level resolutions in South Carolina in favor of pit production at SRS.²²

22. Since late 1989 DOE, LANL, and NNSA have continuously represented to New Mexico civil society and to Indian tribes that pit production at LANL would not rise above a minimal (“capability-based capacity”) level.²³ This is a de facto three-decade social contract that has helped bring a modicum of harmony to LANL’s community relations.
23. Actually, “Site Y” (now LANL) was chosen in a “crash program” on the basis of an initial assumption that it would be a small facility of about 150 scientists, technicians, families, and guards (total) engaged primarily in research, non-nuclear testing, and very limited weapon assembly.²⁴ In 1946, the director and senior staff of the Los Alamos Scientific Laboratory (LASL, as it was then known) argued for eliminating material processing, pit production, and other industrial, non-research operations from the LASL mission.²⁵ In 1950 an Atomic Energy Commission (AEC) member argued for closing LASL altogether and moving its functions to more suitable and cost-effective locations.²⁶ LANL has never had any enduring industrial mission.
24. Until relatively recently, there was bipartisan opposition to industrial-scale pit production at LANL from New Mexico’s entire congressional delegation, including senators Domenici and Bingaman, as well as from New Mexico’s governor (former Energy Secretary Bill Richardson), from the University of California, and from LANL itself. Former Congressman (now Senator) Tom Udall was among those opposed to expanded pit production at LANL.²⁷ Hundreds of New Mexico businesses as well as churches, interfaith groups, and nonprofit organizations have opposed expanded pit production at LANL²⁸. Popular opposition has continued for close to three decades and is showing no sign of letting up.²⁹ Litigation under NEPA³⁰ prevented construction of an additional Nuclear Facility at LANL’s TA-55; the project was eventually cancelled.³¹

²¹ Ibid.

²² See http://www.lasg.org/MPF2/SC_pit-resolutions_ltrs.html. Not all of the most recent resolutions are posted as of this writing.

²³ In addition to the extensive NEPA processes mentioned above and the formal RODs which proceeded from them, officials have repeatedly denied that LANL would be a large-scale pit production site. Citations are voluminous. In addition to other sources cited here see for example the compilation of media clippings at http://www.lasg.org/Pit_Prod1.html.

²⁴ Roger Meade, LANL, ed., Anon. (LANL), “Notes on Los Alamos,” 1954, LA-UR-17-22764, 5 Apr 2017.

²⁵ Norris Bradbury et. al., 9 Aug 1946, “The Postwar Laboratory,” republished as LA-UR-16-28879, 17 Nov 2016.

²⁶ Walter Hamilton, AEC Memorandum for the Record, 29 Jun 1950, http://www.lasg.org/Hamilton_memo_29Jun1950.pdf

²⁷ See <http://www.lasg.org/MPF2/PitProdOpposition.html>.

²⁸ See http://www.lasg.org/campaigns/The_Call_Business_Endorsers.htm and http://www.lasg.org/campaigns/The_Call_NM_Org_Endorsers.htm.

²⁹ See http://www.lasg.org/CMRR/open_page.htm, http://www.lasg.org/MPF2/first_page.html, http://www.lasg.org/Pit_Prod1.html, and <http://www.lasg.org/archives.htm>.

³⁰ http://www.lasg.org/CMRR/Litigation/CMRR-NF_litigation.html.

³¹ http://www.lasg.org/MPF2/CMRR-NF_cancelled.pdf.

25. According to DOE and DoD, there is no need to build entirely new pits for the US arsenal prior to at least the 2060s.^{32,33} All US pits will last, these agencies say, for at least 85-100 years from manufacture, i.e. until at least 2063-2089. There are no warheads currently planned or proposed which require new pits. NNSA is apparently tasked to provide an 80+ ppy (single-shift) capacity by 2030. Such a capacity, if it began operation in 2050 instead of 2030, could replace today's circa 3,800-pit stockpile by 2075 (i.e. 25 years, with a 200-pit allowance for surveillance spares), well ahead of the necessary schedule. A 1,900 pit arsenal could be replaced in 12 years; in that case production would not need to begin in earnest until 2060. A strategic pause of 20 to 30 years in new-pit production investments would save many billions in present-value capital and operating expenses.
26. The US government must recognize that, in many eyes, expensively providing for sufficient pit manufacturing to re-create a circa 4,000 warhead stockpile for *after* the 2063-2089 period will appear to violate Article VI of the Treaty on the Nonproliferation of Nuclear Weapons (NPT).³⁴ And doesn't it? There will be a national security price to pay for any such decision. It will be another factor undermining signatories' faith in the NPT – and in US nonproliferation leadership.
27. Pit production decisions encompass long time periods, which raise special management considerations because nuclear weapons are the quintessential weapons of mass destruction, and therefore repugnant to the human conscience. In official discourses and in practice, DoD, DOE, NNSA, and Congress perennially ignore this fact. This repugnance is a *fact* with which NNSA must deal, not a value judgment or point of view. Government ignores this reality to its management peril. Unpacking this somewhat:
- a. Nuclear weapons have been stigmatized in one way or another by military practice and codes, by the laws of war (humanitarian law), and by most if not all religions. Their use is forbidden in most land areas of the world by nuclear free zone treaties which the US has signed. No state has found it expedient to explode a nuclear weapon in war since 1945, which raises the question of whether the phrase “nuclear weapon” is an oxymoron. The new Treaty on the Prohibition of Nuclear Weapons, which outlaws nuclear possession and threat (deterrence) is gaining states parties; its preamble asserts universal customary international law principles.³⁵
 - b. Nuclear warfare is unlikely to be limited to unpopulated areas, is likely to produce mass slaughter if not global starvation, and has severe effects on people, societies, and economies which are difficult or impossible to contain in space or time.
 - c. These facts, and human reactions to them, make NNSA's management challenge acute – all the more so when combined with the present management and environmental cleanup of dangerous materials that can harm workers and contaminate the environment. This combination of factors is, directly and indirectly, probably the greatest single barrier to pit

³² DOE and DoD, op. cit.

³³ Francis Slakey, American Physical Society, “The Modern Pit Facility (MPF)”, Apr 2004, https://www.aps.org/policy/reports/popa-reports/upload/pit_facility.pdf.

³⁴ “Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control.” <http://www.un.org/en/conf/npt/2005/npttreaty.html>.

³⁵ International Campaign to Abolish Nuclear Weapons (ICAN), “Ban treaty attracts new adherents, 26 Mar 2018, <http://www.icanw.org/campaign-news/ban-treaty-attracts-new-adherents/>. For treaty text and current status see <http://www.icanw.org/the-treaty/>.

production plans. It cannot be wished away. The tremendous energy densities involved in nuclear reactions simply transcend human, biological, and even chemical limits by wide margins.

- d. For these and related reasons, any policy that cannot be convincingly explained as “disarmament” will be perceived, to *some* extent, by *some* potential recruits, *some* current employees, *some* fraction of society and *some* elected representatives (as well as *most* non-nuclear weapon states) as anti-civilizational. Some temporization is possible, but in the long run, and as the inevitable difficulties arise, “narrative control” may not succeed.

For these reasons it may be difficult to manage the nuclear weapons complex, and pit production in particular, over the necessary time period under any but some kind of “disarmament” policy.

28. It may not be possible to preserve plutonium technologies and workforce skills with “made-up” missions. Plutonium is a dangerous material and higher-level skills may not be transferable to the civilian sector. In the absence of very clear mission need, this raises questions of recruitment, morale, and retention that could quickly become problems of safety, quality, and continuity of operations.
29. We beg you: please do not ignore the following, as it is foundational to the decisions NNSA and Congress will make about pit production. The decision to demote climate change from a principal national security threat facing the US is extremely consequential and will become more so should it continue to be tacitly endorsed by Congress. Climate change is on track to become unstoppable within a very short but unknown timeframe, due to growing positive feedbacks from natural systems and greenhouse gas sources, after which the demise of the US (and much else, if not *all* else) would become virtually certain. By “very short timeframe” is meant a period between sometime in the recent past and, at the most, three decades from now, i.e. 2050 at the latest. This is the same timeframe as pit production investments and subsequent operations. *Unless climate change is halted – a daunting task that requiring urgent, focused national attention – there will be no US to defend by the time today’s pits require replacement.*³⁶
30. There are as well other existential dangers to the US which must be addressed in one way or another long before 2063. Some are unavoidable and certain; others, ranging in potential severity, are probabilities (such as antibiotic-resistant pandemic disease). In any case the world of 2063 will be dramatically different than today’s, too different to predict under current assumptions. For example, the world’s (and the US’s) supply of current and potential affordable transportation, mining, and agricultural fuel is far more limited than is widely appreciated. To develop, produce, and bring these fuels to market is already requiring rapidly-increasing capital investments (i.e. debt) – and energy.
31. It is important to emphasize that these exogenous issues are magisterial and commanding, and will affect us in ways we do not understand and will not be able to predict. They present more than just normative choices. They present a conditions of accelerating civilizational change, which is now underway. To take the simplest example, how will losses of forested land, skiing opportunities, and drinking water in northern and central New Mexico – a process already underway – affect residential

³⁶ This is not the place for a fully-referenced discussion of this topic, as important as it is. For an accomplished short overview, please see David Spratt, “1.5°C of warming is closer than we imagine, just a decade away,” 5 Apr 2018, http://www.climatecoderead.org/2018/04/15c-of-warming-is-closer-than-we.html?utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+ClimateCodeRed+%28climate+code+red%29.

desirability, recruitment, and retention, the ability to fund better schools, or to address the region's rampant drug problems?

32. LANL cannot provide an enduring 80 ppy capacity without, at a minimum, replacing PF-4, Sigma, as well as other facilities. This will cost, in today's dollars, at least \$10 B for PF-4 (\$167,000 per sq. ft.)³⁷ and at least \$1 B for Sigma and other facilities (e.g. waste management facilities, which appear to be limiting right now). The total infrastructure bill could be significantly higher; construction of a new, acceptably-modernized version of PF-4 at TA-55, while continuing essential missions, could be difficult in the best case. Given the overall situation, we think it will be impossible.
33. There are many ways to maintain the elements of expertise required for pit production in the absence of industrial-scale pit production itself. These elements should be (and no doubt have been) carefully studied. We are once familiar with some of this literature but have not attempted to re-read or summarize it here. Here is a short list of activities which will help maintain pit production skills, as a placeholder within this important topic:
 - a. Requalification of existing pits in LEPs;
 - b. Rebuilding pits as needed, which requires maintenance of supply chains, replacement and assembly of up to 90% of pit parts, and certification;
 - c. Maintenance, demonstration, and refinement of pit production pilot facilities, including development and qualification pits;
 - d. Pit surveillance;
 - e. Limited experiments with plutonium (e.g. aging experiments, material characteristics, MC);
 - f. Research, development, and demonstration of new processing and manufacturing techniques;
 - g. Plutonium disposition activities;
 - h. Actinide analytical chemistry (AC), necessary to multiple DOE and NNSA programs;
 - i. Plutonium theory and modeling;
 - j. Analysis of pit reuse across type; and
 - k. Multi-site peer review of all these activities.

An expansive plutonium research program is not however desirable, as the JASON defense advisors noted a quarter-century ago.³⁸

34. Simple potential hedge activities comprise another area which could be considered in lieu of rushing into another multibillion-dollar construction program. Hedge activities might include pit disassembly and conversion, metal purification, investing in engineered safety and other measures to avoid safety-

³⁷ See LASG, "CMRR cost history, Aug 8, 2012," http://www.lasg.org/CMRR/CMRR_cost_history.pdf; LASG, \$4.3 Billion in Additional Construction, Equipment Proposed for Los Alamos Plutonium Factory," 28 Aug 2014, http://www.lasg.org/press/2014/press_release_28Aug2014.html.

³⁸ Sid Drell et. al, "Science-Based Stockpile Stewardship," Mitre Corp., JS-94-345, Nov 1994, <https://fas.org/irp/agency/dod/jason/sbss.pdf>.

related infrastructure roadblocks later, planning for contingency expansion in adequately-sized facilities, and keeping the appropriate facilities – such as MFFF – in “mothballed,” cold-standby condition.

35. If decades of surveillance, experiments, and theory are totally wrong, and a warhead pit type in the stockpile were to fail, what pit production capacity would be needed, and how quickly? How much warning would there be? If pit production were actually needed, some significant and flexible capacity would be required. It does not make sense to provide, at significant cost, a minimal (“just-right”) space for a modest (~30 ppy) production capacity that cannot be expanded. But we do not believe LANL will be able to acquire a reliable 30 ppy capacity in any case.

These conclude our comments for now. We will be able add depth to these issues, and take up others, in the next iteration.

Thank you for your attention.