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U.S. Nuclear Weapon "Pit" Production Options for Congress

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A Sisyphean History: Failed Efforts to Construct a Building to Restore Pit Production

Beginning in 1952, the United States made pits on a large scale at the Rocky Flats Plant (CO), sometimes over 1,000 ppy. Operations there halted in 1989 as a result of an FBI raid investigating safety and environmental violations. At that point, Rocky Flats was producing pits for the W88 warhead to be carried by Trident II submarine-launched ballistic missiles, but W88 production was not complete. DOE initially considered restarting operations at Rocky Flats, but ultimately decided not to. The United States has not had the capacity to make more than about 10 ppy since 1989.[47]

The history of efforts to restore pit production capacity on a larger scale is voluminous. The key takeaways from the brief summary that follows are: (1) many projects have been proposed over the years; (2) none has been successfully completed; and (3) key parameters, such as cost, schedule, proposed facility site, and capacity, have changed from one proposal to the next.

Complex 21
As the Cold War was winding down, Congress, in Section 3132 of the National Defense Authorization Act for FY1988 and 1989 (P.L. 100-180, December 4, 1987), directed the President to conduct a study on nuclear weapons complex modernization and to "formulate a plan … to modernize the nuclear weapons complex by achieving the necessary size and capacity determined under the study." The report was submitted in January 1989, but as Secretary of Energy James Watkins noted in January 1991,

> dramatic world changes forced further reassessments of the future Nuclear Weapons Complex." A DOE report resulting from the reassessments "presents a plan to achieve a reconfigured complex, called Complex-21. Complex-21 would be smaller, less diverse, and less expensive to operate than the Complex of today. Complex-21 would be able to safely and reliably support nuclear deterrent stockpile objectives set forth by the President and funded by the Congress.[48]

In addition to a No Action alternative, the study proposed two Reconfiguration alternatives. One would downsize existing sites and modernize them in place. "As an exception to the existing site theme, the functions of the Rocky Flats Plant (RFP) would be relocated." The second, "maximum consolidation," would

> relocate RFP and at least one other NMP&M [Nuclear Materials Production and Manufacturing] facility to a common location. The Pantex Plant and the Oak Ridge Y-12 Plant are candidates for collocation with the Rocky Flats functions, either singly or together. … The probable outcome of this option would be an integrated site which could consolidate much of the NMP&M elements at a single site.

As part of this effort, DOE would develop a Programmatic Environmental Impact Statement "to analyze the consequences of alternative configurations for the Complex," with completion of that statement expected in early FY1994. "Complex-21 should be fully operational early in the 21st century and will sustain the nation's nuclear deterrent until the middle of that century."[49]

What emerged was a two-pronged approach to restore pit production. After conducting an environmental impact statement (EIS) process, DOE issued a Record of Decision (ROD) on Stockpile Stewardship and Management in December 1996 that included reestablishing pit production capability at PF-4 while raising the prospect of a larger-capacity facility.[50] Los Alamos would build a small number of pits for W88s so DOE could replace W88 pits destroyed in an ongoing surveillance program that monitored their condition. Producing these pits, and certifying them as "war

reserve," i.e., meeting standards for use in the nuclear stockpile, took many years; PF-4 produced its first war reserve W88 pits, 11 of them, in 2007. This small capacity would also serve as a pilot plant for developing production techniques for a larger plant. Since the total number of additional W88 pits required was small, about 30, there was no need for PF-4 to achieve high manufacturing rates. Producing these pits and certifying them as war reserve without nuclear testing was a major early challenge for the stockpile stewardship program.

Modern Pit Facility

The second prong was to build a facility able to produce large numbers of pits. This was the Modern Pit Facility (MPF). NNSA approved Critical Decision 0 (mission need) for MPF in FY2002. The capacity of MPF was left to be decided, for reasons a National Environmental Policy Act (NEPA) document of May 2003 noted:

> Classified studies have examined capacity requirements that would result from a wide range of enduring stockpile sizes and compositions, pit lifetimes, emergency production needs (referred to as "contingency" requirements), and facility full-production start dates. Although the precise future capacity requirements are not known with certainty, enough clarity has been obtained through these ongoing classified studies that the NNSA has identified a range of pit production capacity requirements (125-450 ppy) that form the basis of the capacity evaluations in this EIS. The EIS evaluates the impacts of a MPF designed to produce three capacities: 125 ppy, 250 ppy, and 450 ppy. A pit lifetime range of 45-60 years is assumed.[51]

Congress initially supported MPF, but became increasingly concerned with the lack of study of alternatives, a lack of clarity on the production capacity required, and uncertainty on pit aging and pit life. Finally, Congress eliminated funds for MPF in the FY2006 budget cycle.

Consolidated Nuclear Production Center

Another effort to reconfigure the nuclear weapons complex began in 2004, when the House Appropriations Committee sought to have DOE link the nuclear weapons stockpile with the nuclear weapons complex that would support it:

> During the fiscal year 2005 budget hearings, the Committee pressed the Secretary on the need for a systematic review of requirements for the weapons complex over the next twenty five years, and the Secretary committed to conducting such a review. The Secretary's report should assess the implications of the President's decisions on the size and composition of the stockpile, the cost and operational impacts of the new Design Basis Threat, and the personnel, facilities, and budgetary resources required to support the smaller stockpile. The report should evaluate opportunities for the consolidation of special nuclear materials, facilities, and operations across the complex to minimize security requirements and the environmental impact of continuing operations.[52]

The Secretary of Energy Advisory Board (SEAB) formed the Nuclear Weapons Complex Infrastructure Task Force to carry out this study. The task force issued its report in July 2005. It recommended immediate design of a Reliable Replacement Warhead (RRW). RRW was a concept in which Cold War aspects of nuclear weapon design, notably maximizing the explosive yield of the weapon per unit weight (the "yield-to-weight ratio"), would be traded off for design features more suitable to the post-Cold War world, such as ease of manufacture, enhanced confidence without nuclear testing, reduced use of hazardous materials, and enhanced surety features.[53] The task force envisioned RRW as a "family of weapons," with RRWs ultimately making up most if not all of the future stockpile. The task force also recommended a Consolidated Nuclear Production Center (CNPC), "a modern set of production facilities with 21st century cutting-edge nuclear component production, manufacturing, and assembly technologies, all at one location … When operational, the NPC will produce and dismantle all RRW weapons."[54] CNPC would have an SNM manufacturing facility, part of which would support plutonium operations. "All of the functions currently identified in the proposed Modern Pit Facility (MPF) will be located in this building" except for plutonium R&D.[55] CNPC would not manufacture non-nuclear components.[56] Regarding capacity, the report stated:

> A classified Supplement analyzes the issue of timing for the CNPC for a stockpile of 2200 active and 1000 reserve [weapons] and the expected pit manufacturing capacity of the future Complex. The conclusion is that if the NNSA is required to: 1) protect a pit lifetime of 45 years, 2) support the above stockpile numbers, and 3) demonstrate production rates of 125 production pits to the stockpile per year, the CNPC must be functional by

2014. If one accepts the uncertainty of pit lifetime of 60 years, the CNPC can be delayed to 2034. In either case TA-55 is assumed to be producing 50 production pits to the stockpile per year.[57]

Complex 2030

The FY2007 National Defense Authorization Act, P.L. 109-364, directed the Secretary of Energy to develop a plan for transforming the nuclear weapons complex to provide a responsive infrastructure by 2030, and to submit this plan to Congress. The report was submitted in October 2006.[58] The goal was to implement U.S. policy on strategic deterrence as called for in the 2001 Nuclear Posture Review, which recognized the need to transform U.S. nuclear forces from deterring the U.S.S.R. to responding to emerging threats.[59] Regarding the stockpile, NNSA envisioned a smaller stockpile that, by 2030, would be composed mainly if not entirely of RRWs. While the nuclear weapons complex of 2030, "Complex 2030," would continue to have eight sites, quantities of SNM requiring high levels of security would be "only present at production and testing sites."[60] As to labs, in Complex 2030 "No laboratory operations require Category I/II SNM levels of security. Laboratory facilities are not used for nuclear production missions."[61] Unlike the SEAB report, Complex 2030 would not have a Consolidated Nuclear Production Complex but would have "full operations of a consolidated plutonium center at an existing Category I/II SNM site in the early 2020s."[62] Further, "By 2022, LANL will not operate facilities containing CAT I/II quantities of SNM. The location and operator of the consolidated plutonium center will be determined following completion of appropriate National Environmental Policy Act (NEPA) reviews."[63] NNSA would "Plan, construct, and startup a consolidated plutonium center for long-term R&D, surveillance, and manufacturing operations. Plan the consolidated plutonium center for a baseline capacity of 125 units [i.e., pits] per year net to the stockpile by 2022." NNSA would "Upgrade LANL plutonium facilities at Technical Area 55 to support an interim production rate of 30 to 50 RRW war reserve pits per year net to the stockpile by 2012."[64] Regarding another building, NNSA would "Complete and operate the Chemistry and Metallurgy Research Replacement (CMRR) as a CAT I/II facility up to 2022 (use as a CAT III/IV facility and focal point and for material science thereafter) to support plutonium operations at LANL, closure of existing LANL Chemistry and Metallurgy Research (CMR) facility, and the removal of CAT I/II quantities of plutonium from LLNL [Lawrence Livermore National Laboratory]."[65]

Importantly, the plan for Complex 21 shifted capacity from a range of 125 to 450 ppy examined in the MPF EIS to a baseline of 125 ppy.

Chemistry and Metallurgy Research Replacement Project

While nuclear weapons production was at issue, so was R&D on SNM, with a focus at LANL on plutonium. The CMR building had significant problems due to aging and design. As described in a Government Accountability Office report of 2013,

> DOE's and NNSA's plans for replacing the CMR have changed over the past several decades. In 1983, DOE first decided that the CMR was outdated and began making plans to replace it. Over the next nearly 2 decades, several large replacement projects were proposed, but none progressed beyond conceptual stages. … NNSA has taken a number of steps to develop the CMRR nuclear facility or some facility to replace the CMR, but its plans have continued to change over time.[66]

One such project was the Special Nuclear Materials Research and Development Laboratory Replacement Project at LANL. It would have replaced CMR, and would have included a laboratory and facilities for laboratory support, offices, utilities, and waste pretreatment. According to a LANL document of 1990, funding was $10 million for FY1988 and $22 million for FY1989. Anticipated milestones included completion of preliminary design in January 1990, completion of an EIS in 1991, site work start in mid-1991, and construction completed in the fall of 1994.[67]

This project did not happen. Instead, it eventually morphed into the Chemistry and Metallurgy Research Replacement (CMRR) project. In 2002, NNSA reached Critical Decision 0, approve mission need, for the project. In 2003, NNSA completed an environmental impact statement on the project, and in 2004 NNSA issued a Record of Decision (ROD) on it.[68] The preferred option in the ROD included two buildings. The Chemistry and Metallurgy Research Replacement Nuclear Facility (CMRR-NF) was to be a laboratory building that would have provided support, such as AC, for pit production. A separate building, RLUOB, would have provided offices, utilities for both buildings, and laboratory space for R&D. Because the amount of plutonium RLUOB would have held under then-current regulations was so small, at most 6 grams of WGPu, it was expected to do only a small amount of AC to support weapons production work. In 2005,

"NNSA authorized the preliminary design (Critical Decision 1 or CD-1) for the CMRR project."[69] In 2008, NNSA issued an ROD to keep plutonium manufacturing and R&D at Los Alamos and to build CMRR-NF there to support these tasks.[70] RLUOB was completed in FY2010, but CMRR-NF was still in preliminary design at that time.

Congress initially approved the project, but concerns grew as the cost escalated and the schedule slipped. Concurrently, the need to replace CMR became more urgent. Michael Anastasio, then Director of LANL, testified that CMR "is at the end of its useful life," that CMRR "is critical to sustaining the nation's nuclear deterrent" and to other missions, and that "to successfully deliver this project, it will be important to have certainty in funding and consistency of requirements throughout the project."[71] Also, as noted earlier, CMR was "decrepit" and not seismically robust. In an effort to secure Senate approval of the New START Treaty, the Administration issued a report in November 2010 stating that it "is committed to fully fund the construction of the Uranium Processing Facility (UPF) and the Chemistry and Metallurgy Research Replacement (CMRR)" and set out a ten-year funding profile for both facilities.[72] The New START resolution of ratification included provisions related to the nuclear weapons complex in general and to CMRR and UPF in particular.[73] The Administration requested the amount indicated in its November 2010 report in the FY2012 budget. However, in the FY2013 request, the Administration eliminated funding for CMRR-NF and "deferred" it "for at least five years" on grounds that the CMRR facility, UPF, and a life extension project for the B61 bomb were unaffordable concurrently and that there were alternative ways of accomplishing the tasks that CMRR-NF was to perform.[74] However, Section 3114 of the FY2013 National Defense Authorization Act (P.L. 112-239) directed the Secretary of Energy to "construct at Los Alamos National Laboratory, New Mexico, a building to replace the functions of the existing Chemistry and Metallurgy Research Building at Los Alamos National Laboratory associated with Department of Energy Hazard Category 2 special nuclear material operations." This provision also barred any funds to be spent on a plutonium strategy for NNSA "that does not include achieving full operational capability of the replacement project by December 31, 2026." However, Congress appropriated no funds for CMRR-NF for FY2013.

For FY2014, the Administration requested no funds for CMRR-NF, and Congress authorized and appropriated no funds for it. However, Section 3117 of the FY2014 National Defense Authorization Act (H.R. 3304, P.L. 113-66) included an exception to the plutonium strategy provision just noted. It authorized NNSA to spend funds on a modular building strategy, i.e., "constructing a series of modular structures, each of which is fully useable, to complement the function of the plutonium facility (PF–4) at Los Alamos National Laboratory, New Mexico, in accordance with all applicable safety and security standards of the Department of Energy." Option 12 describes the modular strategy.

Two Other Failed Attempts

As a further illustration of difficulties in building facilities to handle plutonium, this section presents two facilities that were built, found to be unusable, and demolished.

Nuclear Materials Storage Facility (NMSF): This building was built at LANL. According to the DOE FY1984 budget request, "This project provides for the construction of a repository for long and intermediate storage of large quantities of source and special nuclear materials. It will be designed to meet security, safety, and safeguards requirements for the storage and handling of nuclear materials. The new 29,100-square-foot building will contain a vault area of approximately 13,000 square feet."[75] A 1997 report by the DOE Inspector General was scathing:

> We found that the NMSF, which was originally completed in 1987, was so poorly designed and constructed that it was never usable and that DOE officials were proposing to renovate the entire facility. Departmental and contractor officials discovered numerous design, construction and operational deficiencies after the facility was occupied in February 1987. These deficiencies included: (1) the inability to control and balance the heating, ventilation and air conditioning (HVAC) system to maintain acceptable negative pressures within the facility; (2) the inability to dissipate the heat generated by radioactive decay of the materials to be stored; (3) the inability to limit personnel radiation exposures to "as low as reasonably achievable;" (4) a peeling of the "Placite" decontamination epoxy coating throughout the facility; and (5) the inability to open and secure the Safe Secure Trailer (SST) doors due to the inadequate width of the garage once the SSTs were parked in the garage.[76]

Because of these and other deficiencies, "This structure was never used for storage of nuclear materials, and a decision was made in 2006 to demolish the structure."[77] Demolition was completed by the end of FY2008.[78]

Building 371: A press report tells the story of a plutonium project at Rocky Flats:

> One striking example of a construction project that turned out to be a failure was a $225 million plutonium processing building at the Rocky Flats Plant near Golden, Colo. The processing plant, Building 371, was started in 1973, completed in 1981 and operated for a month in 1982 before being shut because the new processing technology did not work. The
> Energy Department has estimated that it will cost nearly $400 million and take eight years to make the equipment in the building work.
>
> "The fact of the matter is that Building 371 is a fiasco," said Joseph F. Salgado, the Deputy Secretary of Energy. "It's a horror story. It's unacceptable."
>
> Building 371 was intended to replace another, much older processing plant, Building 771. …The Energy Department shut Building 771 on Oct. 8 after three employees were exposed to plutonium dust, which can be extremely dangerous if it is inhaled. The closing of Building 771 was, [sic] the nation's sole source of reprocessed plutonium, which is used in triggers for thermonuclear bombs. The closing has brought most of the plant's operations at the Rocky Flats Plant to a halt.[79]

The building was never put into operation. Instead, the buildings at Rocky Flats Plant, including Building 371, were torn down and the site was decontaminated.[80]

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47 In 2007, Los Alamos produced 17 pits, but only 11 were "war reserve" pits, i.e., accepted for use in the stockpile. Of the others, some were scrap, and some were used for engineering tests and did not need to be qualified as war reserve. Los Alamos could have made 10 ppy in subsequent years, but there was no DOD requirement for so doing. As a result, in no other year did the total number of pits exceed 10. Information provided by Los Alamos National Laboratory, email, November 12, 2013.

48 U.S. Department of Energy. *Nuclear Weapons Complex Reconfiguration Study*, DOE/DP-0083, January 1991, cover letter by Secretary of Energy James D. Watkins, Admiral, U.S. Navy (Retired), January 24, 1991.

49 Ibid., pp. 4-5.

50 Department of Energy, "Record of Decision: Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," 61 *Federal Register* 68015, December 26, 1996, http://www.gpo.gov/fdsys/pkg/FR-1996-12-26/pdf/96-32759.pdf.

51 U.S. Department of Energy. *Draft Supplemental Programmatic Environmental Impact Statement on Stockpile Stewardship and Management for a Modern Pit Facility*, DOE/EIS-236-S2, summary volume, May 2003, p. S-27, http://www.energy.gov/sites/prod/files/EIS-0236-S2-DEIS-Summary-2003.pdf.

52 U.S. Congress, House Committee on Appropriations, *Energy and Water Development Appropriations Bill, 2005*,Report to accompany H.R. 4614, 108th Cong., 2nd sess., June 18, 2004, H.Rept. 108-554 (Washington: GPO, 2004), p.111, http://www.gpo.gov/fdsys/pkg/CRPT-108hrpt554/pdf/CRPT-108hrpt554.pdf.

53 For detailed information on the RRW program, see CRS Report RL33748, *Nuclear Warheads: The Reliable Replacement Warhead Program and the Life Extension Program*, by Jonathan E. Medalia.

54 U.S. Department of Energy. Secretary of Energy Advisory Board. Nuclear Weapons Complex Infrastructure Task Force. *Recommendations for the Nuclear Weapons Complex of the Future*, final report, July 13, 2005, p. vii, http://www.doeal.gov/SWEIS/DOEDocuments/049%20SEAB%202005.pdf.

55 Ibid., p. 15.

56 Ibid., p. 14.

57 Ibid., p. 17.

58 U.S. Department of Energy. National Nuclear Security Administration. Office of Defense Programs. *Complex 2030: An Infrastructure Planning Scenario for a Nuclear Weapons Complex Able to Meet the Threats of the 21st Century.* DOE/NA-0013, October 2006, 21 p., http://fissilematerials.org/library/doe06e.pdf.

59 For an unclassified summary of the review, see U.S. Department of Defense. Nuclear Posture Review Report, 3 p.,no date, http://www.defense.gov/news/jan2002/d20020109npr.pdf.

60 Department of Energy, *Complex 2030*, p. 3. Note that SNM quantities meeting the lower threshold of Category II are different for safety and for security.

61 Ibid.

62 Ibid., p. 7.

63 Ibid., p. 10.

64 Ibid., p. 11.

65 Ibid., p. 12.

66 U.S. Government Accountability Office, *Modernizing the Nuclear Security Enterprise: Observations on NNSA's Options for Meeting Its Plutonium Research Needs*, GAO-13-533, September 2013, p. 8.

67 Los Alamos National Laboratory, fact sheet: "Special Nuclear Materials Research and Development Laboratory Replacement Project at Los Alamos National Laboratory, LANL-89-48, January 1990, p. 2.

68 Department of Energy, National Nuclear Security Administration, "Record of Decision: Final Environmental Impact Statement for the Chemistry and Metallurgy Research Building Replacement Project, Los Alamos National Laboratory, Los Alamos, NM," 69 *Federal Register* 6968-6969, February 12, 2004.

69 U.S. Department of Energy. National Nuclear Security Administration. "Chemistry and Metallurgy Research Building Replacement Project," May 2007 p. 3, http://www.doeal.gov/SWEIS/OtherDocuments/427%20NNSA%202007%20CMR%20senate%20report.pdf.

70 National Nuclear Security Administration, "Record of Decision for the Complex Transformation Supplemental Programmatic Environmental Impact Statement—Operations Involving Plutonium, Uranium, and the Assembly and Disassembly of Nuclear Weapons," 73 *Federal Register* 77647, December 19, 2008.

71 "Prepared Statement of Dr. Michael R. Anastasio, Director, Los Alamos National Laboratory, Los Alamos, NM," in ibid., p. 405.

72 U.S. White House. *November 2010 Update to the National Defense Authorization Act of FY2010 Section 1251 Report: New START Treaty Framework and Nuclear Force Structure Plans,* pp. 5, 9, http://www.lasg.org/CMRR/Sect1251_update_17Nov2010.pdf.

The Uranium Processing Facility at the Y-12 National Security Complex (TN) would replace Y-12's 9212 complex, a uranium processing facility; its first buildings were built during World War II. Note that 9212 is sometimes referred to as a building, and sometimes as a complex.

73 This resolution, "Treaty with Russia on Measures for Further Reduction and Limitation of Strategic Offensive Arms" (Treaty Doc. 111–5), as agreed to by the Senate, is available at "Treaty with Russia on Measures for Further Reduction and Limitation of Strategic Offensive Arms—continued," *Congressional Record*, December 22, 2010, pp. S10982-S10985, http://www.gpo.gov/fdsys/pkg/CREC-2010-12-22/pdf/CREC-2010-12-22-pt1-PgS10982.pdf#page=1.

74 U.S. Department of Energy. Office of Chief Financial Officer, *FY 2013 Congressional Budget Request*, Volume 1, National Nuclear Security Administration, DOE/CF-0071, February 2012, p. 185, http://www.mbe.doe.gov/budget/13budget/Content/Volume1.pdf; and Statement of Donald Cook, Deputy Administrator for Defense Programs, National Nuclear Security Administration, in U.S. Congress. Senate. Committee on Armed Services. Subcommittee on Strategic Forces. *Hearing to Receive Testimony on Strategic Forces Programs of the National Nuclear Security Administration and the Department of Energy's Office of Environmental Management in Review of the Department of Energy Budget Request for Fiscal Year 2013*, March 14, 2012, pp. 29-30, http://www.armed-services.senate.gov/Transcripts/2012/03%20March/12-12%20-%203-14-12.pdf.

75 U.S. Department of Energy. Assistant Secretary for Management and Administration. Office of the Controller. *Congressional Budget Request, FY 1984*, Volume 1: Atomic Energy Defense Activities, DOE/MA-0064/1, January 1983, p. 61.

76 U.S. Department of Energy. Office of Inspector General. *Report on Inspection of Alleged Design and Construction Deficiencies in the Nuclear Materials Storage Facility at the Los Alamos National Laboratory*, report. INS-O-97-01, January 16, 1997, p. 3, http://energy.gov/sites/prod/files/ins-9701.pdf. SSTs are DOE trucks specially outfitted to transport nuclear weapons and related components and materials.

77 U.S. Department of Energy. National Nuclear Security Administration. Los Alamos Site Office. *Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico*, Volume 3, Comment Response Document, Book 1, DOE/EIS-0380, May 2008, page 1-8, http://www.doe.gov/sites/prod/files/EIS-0380-FEIS-03-1-2008.pdf.

78 Los Alamos National Laboratory, *Fiscal Year 2008 Institutional Commitments—Final Report*, c. late 2008, p. 4.

79 Keith Schneider, "U.S. Spent Billions on Atom Projects That Have Failed," *New York Times*, December 12, 1988, http://www.nytimes.com/1988/12/12/us/us-spent-billions-on-atom-projects-that-have-failed.html?pagewanted=all&src=pm.

80 U.S. Department of Energy. Office of Legacy Management. Rocky Flats Site. Colorado, "Fact Sheet," p. 1, available via http://www.lm.doe.gov/land/sites/co/rocky_flats/rocky.htm.