



Report to the Subcommittee on Energy
and Water Development, Committee on
Appropriations, House of
Representatives

May 2008

NUCLEAR WEAPONS

NNSA Needs to Establish a Cost and Schedule Baseline for Manufacturing a Critical Nuclear Weapon Component



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Highlights of [GAO-08-593](#), a report to the Subcommittee on Energy and Water Development, Committee on Appropriations, House of Representatives

Why GAO Did This Study

The Department of Energy's National Nuclear Security Administration (NNSA) is responsible for manufacturing pits, a key component in a nuclear warhead. The department lost its ability to manufacture pits in 1989 with the closing of the Rocky Flats Plant. In 1996, the Los Alamos National Laboratory (LANL) was directed to reestablish a pit manufacturing capability, starting with a limited number of pits for the W88 warhead. In recent years, NNSA has considered ways to increase its pit manufacturing capacity, including building a new, large-scale pit manufacturing facility. It has also proposed producing pits for the Reliable Replacement Warhead (RRW). GAO was asked to determine the (1) extent to which NNSA achieved its major goals for reestablishing its pit manufacturing capability, (2) factors that currently constrain its ability to increase its pit manufacturing capacity, and (3) status of its plans for future pit manufacturing. For this review, GAO met with NNSA and LANL officials, reviewed agency documents, and visited the nuclear facility used to manufacture pits.

What GAO Recommends

GAO is making two recommendations to the Administrator of NNSA to ensure that NNSA establishes a cost and schedule baseline to support future pit manufacturing operations. NNSA did not specifically comment on GAO's recommendations but provided general comments on the report.

To view the full product, including the scope and methodology, click on [GAO-08-593](#). For more information, contact Gene Aloise at (202) 512-3841 or aloisee@gao.gov.

NUCLEAR WEAPONS

NNSA Needs to Establish a Cost and Schedule Baseline for Manufacturing a Critical Nuclear Weapon Component

What GAO Found

NNSA achieved its major goals for reestablishing its pit manufacturing capability at LANL as defined by the agency in 2002. Specifically, NNSA's goals were to create a capability to manufacture 10 pits per year starting in 2007 and to deliver a single W88 war reserve pit to the stockpile in 2007. War reserve pits must meet stringent specifications, while other types of pits, such as pits destructively tested for production quality control, may not meet the same standards. NNSA estimated that this effort would cost about \$1.55 billion for fiscal years 2001 through 2007. According to NNSA, LANL produced 11 pits in 2007, eight of which were W88 war reserve pits, and spent about \$1.29 billion for fiscal years 2001 through 2007. However, GAO found that NNSA did not establish clear, consistent goals for the number of W88 war reserve pits it planned to produce. Specifically, some NNSA documents, including budget requests to Congress, called for delivering 10 W88 war reserve pits per year starting in 2007. In addition, NNSA's cost estimate did not include estimates for a variety of activities that directly and indirectly supported the pit manufacturing mission at LANL between 2001 and 2007. These support activities, which included scientific experiments and facility operations and maintenance, totaled over \$1 billion.

Because of three major constraints on pit manufacturing operations at LANL, NNSA will not be able to substantively increase its current pit manufacturing capacity for the foreseeable future. Specifically, GAO found that LANL's building for performing analytical chemistry, which deals with the separation and identification of the components in a pit sample, has major operational and structural limitations. LANL's ability to store pits and associated waste is also constrained by limited vault storage space. Finally, a lack of available floor space in LANL's main nuclear facility limits its ability to install a large-scale, efficient production line for manufacturing pits.

NNSA's plans for future pit manufacturing are still being developed and, as a result, no reliable cost estimates exist. Originally, NNSA and the Department of Defense (DOD) had planned to develop the capability to produce RRW pits beginning about 2014, pending the outcome of a RRW design definition and cost study in 2008. However, in fiscal year 2008 all of NNSA's RRW funding was eliminated. While NNSA and DOD continue to support the RRW program, in the short run, NNSA plans to maintain the existing pit manufacturing capability at LANL. Over the long term, NNSA is planning, with DOD's concurrence, to upgrade the existing LANL facility to achieve a production capacity of up to 80 pits per year. However, NNSA has not established a cost and schedule baseline to support its projected effort.

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Abbreviations

ARIES	Advanced Recovery and Integrated Extraction System
CMR	Chemistry and Metallurgy Research building
DOD	Department of Defense
DOE	Department of Energy
LANL	Los Alamos National Laboratory
MOX	mixed-oxide
NNSA	National Nuclear Security Administration
PF-4	Plutonium Facility-4 building
RRW	Reliable Replacement Warhead
TA-50	Technical Area-50
TA-54	Technical Area-54

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United States Government Accountability Office
Washington, DC 20548

May 23, 2008

The Honorable Peter Visclosky
Chairman
The Honorable David Hobson
Ranking Member
Subcommittee on Energy and Water Development
Committee on Appropriations
House of Representatives

The National Nuclear Security Administration (NNSA), a separately organized agency within the Department of Energy (DOE), is responsible for managing the nation's stockpile of nuclear weapons.¹ As part of its mission, NNSA is responsible for manufacturing a key nuclear weapon component for use in the stockpile. This component, known as a "pit," is manufactured using a man-made radioactive element called plutonium and is needed to begin the chain reaction in a nuclear weapon. Different weapons systems use different types of pits. Pits that can be used in the stockpile, known as war reserve pits, must meet stringent specifications and be certified² by NNSA's nuclear weapons laboratories. Consequently, the capability to produce war reserve pits is critical for replacing pits that are removed from existing warheads for surveillance testing or other purposes. Other types of pits, such as pits that are destructively tested as part of production quality control, may not be required to meet the same standards.

DOE lost its capability to manufacture pits when it ceased operations at DOE's Rocky Flats Plant in Colorado in 1989 because of environmental and regulatory concerns. At that time, Rocky Flats was manufacturing war reserve pits for the W88 warhead, which is used on submarine-launched ballistic missiles. In December 1996, DOE designated the Los Alamos

¹Title 32 of the National Defense Authorization Act for Fiscal Year 2000 established NNSA as a separately organized agency with DOE and made NNSA responsible for the management and security of DOE's nuclear weapons, nuclear nonproliferation, and naval reactor programs.

²Certification is the process through which the nuclear weapons laboratories establish that a particular nuclear warhead or bomb meets its designated military operational specifications. According to NNSA, the term "certified pits" has the same meaning as "pits to the stockpile" or war reserve pits.

National Laboratory (LANL) as the site for reestablishing the capability to manufacture pits. Specifically, DOE's original goals for the pit manufacturing mission were to (1) reestablish the capability to manufacture war reserve pits for the W88 warhead by fiscal year 2001 and demonstrate the capability to produce all pit types for the enduring stockpile, (2) establish a manufacturing capacity of 10 pits per year by fiscal year 2001 and expand to a capacity of up to 50 pits per year by fiscal year 2005, and (3) develop a contingency plan for the large-scale manufacturing of pits (i.e., 150-500 pits per year) at some other DOE site or sites.

In meeting this new mission, LANL faced constraints not faced at the Rocky Flats Plant. Historically, DOE conducted underground nuclear tests to ensure that the nuclear warhead, including the pit, would perform as required. Now, however, the safety and reliability of today's nuclear stockpile, including newly manufactured pits, must be maintained without the benefit of underground nuclear testing because the United States has maintained a moratorium on such testing since 1992. In addition, LANL had to replicate pit manufacturing processes used at the Rocky Flats Plant in a manner compliant with current environmental and safety standards.

In November 1998, we reported on DOE's plans for reestablishing the pit manufacturing mission at LANL.³ We found that DOE had revised its original 1996 goals for pit manufacturing capacity and instead planned to have an interim capacity of only 20 pits per year online by fiscal year 2007. DOE estimated that the total costs for establishing and operating its pit manufacturing mission would be over \$1.1 billion for fiscal years 1996 through 2007. However, we found that this estimate did not include over \$490 million in total costs for other activities—such as construction-related activities at various LANL nuclear facilities—that were needed to support the production of pits, as well as a wide variety of other defense-related activities. In addition, we found that DOE had done little to develop a contingency plan for the large-scale manufacturing of pits.

We also found that the Department of Defense (DOD) and DOE had discussed, but not resolved, important issues regarding DOE's planned pit manufacturing capacity. DOD is responsible for implementing the U.S. nuclear deterrent strategy, which includes establishing the military

³GAO, *Nuclear Weapons: Key Nuclear Weapons Component Issues Are Unresolved*, GAO/RCED-99-1 (Washington, D.C.: Nov. 9, 1998).

requirements associated with planning for the stockpile. In this context, the Nuclear Weapons Council is responsible for preparing the annual Nuclear Weapons Stockpile Memorandum, which specifies how many warheads of each type will be in the stockpile.⁴ We found that officials from various DOD organizations, including U.S. Strategic Command and the Department of the Navy, had expressed concern that DOE's plans for pit manufacturing capacity would not be sufficient to meet the stockpile's needs. Specifically, these DOD organizations had conducted preliminary analyses of the capacity needed to support the stockpile. On the basis of these analyses, some DOD officials believed that the stockpile's needs exceeded the interim capacity of 20 pits per year planned for LANL, or even a capacity of 50 pits per year that DOE indicated it might establish in the future.

NNSA currently funds the pit manufacturing mission through the Pit Manufacturing and Certification Campaign, which includes funding for both the manufacture and the certification of pits at LANL and for related activities at other supporting locations, such as the Lawrence Livermore National Laboratory.⁵ According to NNSA data, over \$234 million was spent on these activities in fiscal year 2007, and NNSA plans to spend almost \$214 million in fiscal year 2008. At LANL, pit manufacturing takes place within the Plutonium Facility-4 building, known as PF-4, which was constructed in 1978 as a multiuse research and development facility. LANL employs approximately 430 full-time equivalent employees associated with the pit manufacturing program, including employees associated with pit manufacturing operations at PF-4 and the manufacture of non-nuclear pit components at other facilities.

Several key events over the past 6 years have affected NNSA's plans for pit manufacturing.

- In May 2002, the Secretary of Energy approved the start of design work for a large-scale manufacturing plant called the Modern Pit Facility. This facility was designed to manufacture all pits in the enduring stockpile at a

⁴The Nuclear Weapons Council coordinates activities jointly managed by DOD and DOE to support the nuclear stockpile. Each year, the President signs a directive giving formal approval to the Nuclear Weapons Stockpile Memorandum, which reflects the production plan of the U.S. nuclear weapons complex.

⁵Starting in fiscal year 2009, NNSA will transfer funding associated with the Pit Manufacturing and Certification Campaign to the Directed Stockpile Work and Science Campaign program areas.

capacity of 125 pits per year. However, the conference report accompanying the fiscal year 2006 NNSA appropriation stated that it provided no funding for the Modern Pit Facility and directed NNSA to focus on improving its manufacturing capability at LANL. As a result, NNSA suspended the Modern Pit Facility project indefinitely.

- In 2005, the Nuclear Weapons Council approved the creation of a Reliable Replacement Warhead (RRW) program to study a new approach for providing a credible nuclear warhead deterrent over the long term.⁶ The RRW program would redesign weapon components, in particular the pit, to be easier to manufacture, maintain, dismantle, and certify without nuclear testing, potentially allowing NNSA to transition to a smaller and more efficient weapons complex. In March 2007, the Nuclear Weapons Council approved a RRW design by the Lawrence Livermore National Laboratory to provide a replacement warhead for a portion of the nation's submarine-launched ballistic missiles. NNSA had planned to complete a detailed design definition and cost study of the RRW during 2008. However, the explanatory statement accompanying the fiscal year 2008 NNSA appropriation stated that the bill provided no funding for the RRW program and directed NNSA to focus on assessing a new strategic nuclear deterrent mission for the twenty-first century in order to define the associated stockpile requirements and determine the scope of the weapons complex modernization plans. According to NNSA officials, NNSA has ceased all activities associated with the RRW program for fiscal year 2008 but plans to continue to fund some elements of the RRW design for fiscal year 2009 under activities associated with its Directed Stockpile Work and Science Campaign programs.
- Finally, in October 2006, NNSA offered a proposal to address long-standing problems with the condition and responsiveness of the nuclear weapon production facilities. Under its plan—which NNSA currently refers to as “Complex Transformation”—NNSA proposed to build a new, consolidated plutonium center at an existing DOE site that would replace the interim plutonium production facility at LANL. A key responsibility of the plutonium center would be to manufacture pits for a RRW-based stockpile. Although NNSA had planned to begin design work on the plutonium center during 2008, the explanatory statement accompanying the fiscal year 2008 NNSA appropriation stated that no funding was

⁶The conference report accompanying DOE's fiscal year 2005 appropriations act stated that funds appropriated were made available for the RRW program. H.R. Rep. No. 108-792, Div. C, at 951 (2004), accompanying the fiscal year 2005 Consolidated Appropriations Act, Pub. L. No. 108-447.

provided for the plutonium center and directed NNSA to focus on developing a modern nuclear weapons strategy, including the required pit production capacity defined by nuclear stockpile requirements. As a result, NNSA has suspended its work on the plutonium center.

In this context, you asked us to determine the (1) extent to which NNSA achieved its major goals for reestablishing its pit manufacturing capability, (2) factors that currently constrain NNSA's ability to increase its pit manufacturing capacity, and (3) status of NNSA's plans for future pit manufacturing.

In conducting our work, we met with NNSA and contractor officials; reviewed agency documents; and visited the pit manufacturing plant (PF-4) and other supporting facilities at LANL. We also visited the pit manufacturing facility at the United Kingdom's Atomic Weapons Establishment to determine its relevance to manufacturing practices at LANL. In addition, we performed the following work:

- To determine the extent to which NNSA achieved its major goals for reestablishing its pit manufacturing capability, we interviewed NNSA and LANL officials; reviewed NNSA and LANL plans related to pit manufacturing; and analyzed NNSA and LANL data on expenditures.
- To determine the current constraints on NNSA's ability to increase its pit manufacturing capacity, we interviewed NNSA and LANL officials; analyzed LANL data on the major constraints of each phase of the pit manufacturing process; and reviewed NNSA and LANL plans for addressing these constraints.
- To determine the status of NNSA's plans for future pit manufacturing, we interviewed officials from NNSA, LANL, and the Lawrence Livermore National Laboratory. We reviewed NNSA and LANL's plans related to manufacturing pits for the RRW and other pit types, as well as the Nuclear Weapons Stockpile Memorandum and related Nuclear Weapons Council plans on the future size and composition of the stockpile. We also reviewed NNSA's plans for developing new pit manufacturing technologies and compared these plans with our previous work on technology readiness levels,⁷ which DOD uses for measuring and communicating

⁷GAO, *Department of Energy: Major Construction Projects Need a Consistent Approach for Assessing Technology Readiness to Help Avoid Cost Increases and Delays*, [GAO-07-336](#) (Washington, D.C.: Mar. 27, 2007).

technology readiness for first-of-a-kind technology applications. In addition, we consulted with an outside expert to obtain additional information on the adequacy of NNSA's plans for technology development. We visited research and development facilities at the Lawrence Livermore National Laboratory that are used to support new pit manufacturing technologies. Finally, we interviewed officials from the Office of the Assistant to the Secretary of Defense (Nuclear and Chemical and Biological Defense Programs) and the Nuclear Weapons Council.

We conducted this performance audit from April 2007 to May 2008 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Results in Brief

NNSA achieved its major goals for reestablishing its pit manufacturing capability at LANL as defined by the agency in 2002. However, NNSA did not establish clear, consistent goals for the number of W88 war reserve pits it planned to produce. In addition, NNSA's cost estimate did not include estimates for a variety of activities that directly and indirectly supported the pit manufacturing mission at LANL. Specifically, according to NNSA officials, NNSA established the first complete schedule, production, and cost baseline to guide the pit manufacturing mission at LANL in 2002. NNSA's schedule and production goals were to: (1) establish a capability to manufacture 10 pits per year by 2007, (2) deliver one W88 war reserve pit to the stockpile by 2007, and (3) certify LANL-produced W88 pits for use in the stockpile by 2007. NNSA officials said they believe that LANL exceeded its 2002 schedule and production goals by manufacturing 11 W88 pits, 8 of which were war reserve pits, in fiscal year 2007. However, we found that NNSA did not have a clear, consistent set of production goals for manufacturing W88 war reserve pits. For example, while NNSA's baseline plan called for the production of a single W88 war reserve pit by 2007, other NNSA plans related to pit manufacturing called for the production of 10 W88 war reserve pits per year at LANL starting in 2007. Furthermore, when NNSA issued final requirements for the total production of W88 war reserve pits at LANL in February 2007, it did not specify the number of war reserve pits that LANL would be required to manufacture each year. With respect to costs, NNSA estimated that pit manufacturing and certification expenditures for fiscal years 2001 through 2007 would be about \$1.55 billion. According to NNSA

data, LANL's expenditures for fiscal years 2001 through 2007 were about \$260 million under its baseline estimate. However, NNSA's cost baseline did not include almost \$300 million in costs for a number of activities, such as conducting plutonium experiments to certify LANL-produced pits, which were directly associated with the pit manufacturing and certification mission for fiscal years 2001 through 2007. In addition, NNSA's baseline did not include some portion of over \$1 billion in costs for other activities—including facility operations and maintenance, waste processing, construction, and security—that were needed to support the production of pits, as well as a wide variety of other defense-related activities, for fiscal years 2001 through 2007.

Because of three major constraints on pit manufacturing operations at LANL, NNSA will not be able to substantively increase its pit manufacturing capacity for the foreseeable future. Specifically, we found the following:

- LANL's building for performing analytical chemistry has major operational and structural limitations. LANL analyzes samples from the pits it manufactures to accurately determine their chemical composition and to provide assurance that a pit will meet its performance specifications. The Chemistry and Metallurgy Research (CMR) building, constructed in the early 1950s, currently houses most of LANL's analytical chemistry capabilities. However, the CMR building can only handle small amounts (i.e., less than about 200 grams) of plutonium at a time because of its age and deteriorating condition. Moreover, LANL officials discovered the existence of a seismic fault trace beneath one of the wings of the CMR building in the late 1990s, which has further complicated efforts to upgrade the building's infrastructure.
- LANL's ability to store pits and associated waste is constrained by limited vault space. LANL maintains a storage vault in PF-4 that is used to store pits, plutonium residues, and waste material containing plutonium—all of which are radioactive and extremely hazardous to human health. However, because PF-4 was built to support research and development, the storage vault is not designed to store the large amounts of pits and waste material that result from large-scale pit manufacturing operations. For example, according to LANL officials, LANL had to temporarily cease pit manufacturing operations in August 2007 when it ran out of room in the storage vault to store pits.
- The lack of available floor space in the PF-4 building also limits LANL's ability to install a large-scale, efficient production line for manufacturing pits. Pit manufacturing and certification operations occupy about 35

percent of the available space in PF-4. The remaining space is used to support about eight other NNSA and DOE programs, including several programs that are not associated with nuclear weapons production.

NNSA's plans for future pit manufacturing are still being developed and, as a result, no reliable cost estimates exist. Originally, NNSA and DOD had planned to develop the capability to produce RRW pits beginning around 2014, pending the outcome of an RRW design definition and cost study in 2008. At about the same time, the Nuclear Weapons Council began considering a variety of scenarios based on different stockpile sizes and the degree to which the stockpile would include RRW-type warheads. However, the explanatory statement accompanying the fiscal year 2008 NNSA appropriation stated that the bill provided no funding for the RRW program. While NNSA and DOD continue to support the RRW program, in the short run, NNSA plans to maintain the existing pit manufacturing capability at LANL. Over the long term, NNSA is planning, with DOD's concurrence, to upgrade the existing PF-4 building to achieve a production capacity of up to 80 pits per year. However, NNSA has not established a reliable cost and schedule baseline to support its projected efforts. Using the best available data, we estimate that NNSA's plans would entail spending about \$1.5 billion over the next 5 years to continue funding activities associated with the Pit Manufacturing and Certification Campaign and up to \$500 million to install a second pit manufacturing line at PF-4 by the 2014 time frame. In addition, we identified an additional \$4 billion that NNSA plans to spend on activities that are needed to support the production of pits and other plutonium programs at LANL over the next decade. Of these activities, the largest single cost is associated with constructing the proposed CMR Replacement facility, which would house LANL's analytical chemistry equipment and provide a new storage vault for plutonium. While NNSA has not established a cost and schedule baseline for the construction of this facility, NNSA estimated in its fiscal year 2009 budget request that this project could cost over \$2 billion. NNSA officials said that NNSA does not expect to reach a final decision regarding the design of this facility or the expected date of operation until it issues a record of decision as part of its Complex Transformation planning effort, which is expected later in 2008.

We are recommending that the Administrator of NNSA establish a cost and schedule baseline that it can use to manage future pit manufacturing operations in an efficient and cost-effective manner. We provided a draft of this report to NNSA and DOD for their review and comment. NNSA did not specifically comment on our recommendations but provided two general comments on our findings. First, NNSA stated that the pit

manufacturing mission should not be accountable for certain costs directly associated with the pit manufacturing and certification project, such as activities at the Nevada Test Site, or the costs associated with support facilities, such as PF-4, because these facilities and their capabilities would be required to address other program requirements, regardless of the presence of the pit manufacturing program. Second, NNSA stated that the main purpose of the pit manufacturing and certification project was to reconstitute pit manufacturing with a limited manufacturing capacity. According to NNSA, the exact number of pits to be manufactured was immaterial to the scope and purpose of the project. However, we continue to believe that in order for NNSA to be able to successfully manage future pit manufacturing missions, such as those proposed in NNSA's Complex Transformation documents, it will need a cost baseline that accounts for all costs, including an appropriate portion of necessary support costs, as well as clear, well-defined production goals. NNSA also provided technical comments, which we have incorporated in this report as appropriate. DOD did not have any comments on our report.

Background

The U.S. nuclear weapons stockpile consists of nine weapon types. (See table 1.) These weapons include gravity bombs deliverable by dual-capable fighter aircraft and long-range bombers; cruise missiles deliverable by aircraft and submarines; submarine-launched ballistic missiles; and intercontinental ballistic missiles.

Table 1: Current U.S. Nuclear Weapon Types

Warhead or bomb type	Description	Delivery system	Laboratory	Military service
B61-3/4/10	Tactical bomb	F-15, F-16, Tornado	Los Alamos/ Sandia	Air Force
B61-7/11	Strategic bomb	B-52, B-2	Los Alamos/ Sandia	Air Force
W62	ICBM warhead ^a	Minuteman III ICBM	Lawrence Livermore / Sandia	Air Force
W76	SLBM warhead ^b	D5 missile, Trident submarine	Los Alamos/ Sandia	Navy
W78	ICBM warhead	Minuteman III ICBM	Los Alamos/ Sandia	Air Force
W80-0 W80-1	TLAM/N ^c ALCM, ACM ^d	Attack submarine B-52	Lawrence Livermore / Sandia	Navy Air Force
B83-0/1	Strategic bomb	B-52, B2	Lawrence Livermore / Sandia	Air Force
W87	ICBM warhead	Minuteman III ICBM	Lawrence Livermore / Sandia	Air Force
W88	SLBM warhead	D5 missile, Trident submarine	Los Alamos/ Sandia	Navy

Source: Nuclear Weapons Council.

^aICBM = Intercontinental Ballistic Missile.

^bSLBM = Submarine Launched Ballistic Missile.

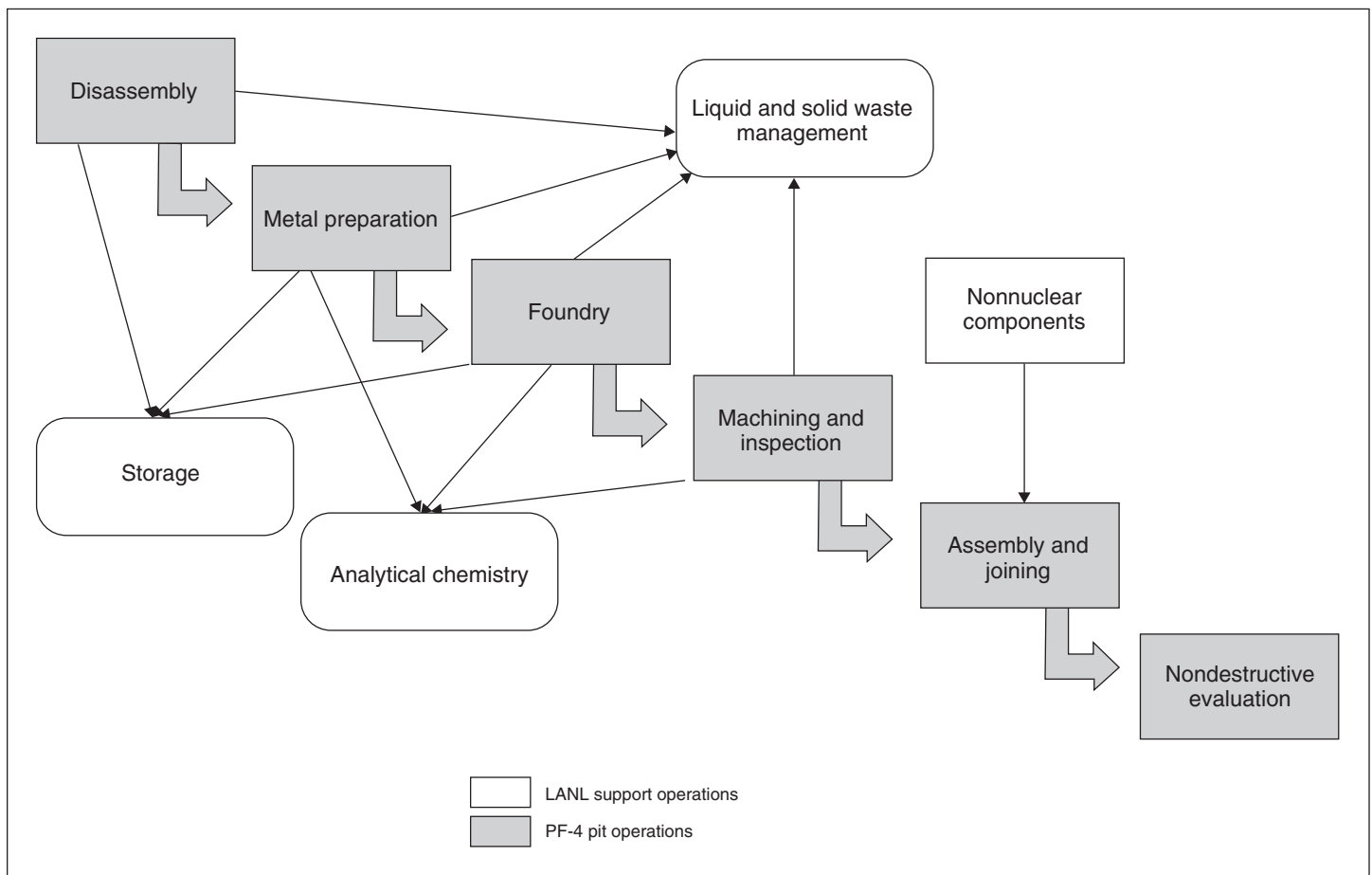
^cTLAM/N = Tomahawk Land Attack Missile/Nuclear.

^dALCM = Air Launched Cruise Missile; ACM = Advanced Cruise Missile.

There are seven major phases associated with pit manufacturing operations at LANL (see fig. 1).

- *Disassembly*—takes a source of plutonium (e.g., an existing pit) and extracts the plutonium metal.
- *Metal preparation*—uses various chemical or electro-refining processes to remove impurities from the plutonium metal.
- *Foundry*—heats up the plutonium metal and casts it into the desired shape.
- *Machining and inspection*—removes unwanted material from the cast shape and inspects the machined shape for any defects.
- *Nonnuclear components*—manufactures, tests, and qualifies nonnuclear subcomponents for pit manufacturing.
- *Assembly and joining*—assembles the various pit components and nonnuclear components into a finished pit.
- *Nondestructive evaluation*—inspects assembled pits to assure that final product specifications have been met.

Figure 1: Major Phases of Pit Manufacturing at LANL



Source: GAO analysis of LANL data.

In addition, three operations support these major phases (as shown in fig. 1).

- *Liquid and solid waste management*—Pit manufacturing operations generate transuranic⁸ liquid and solid waste, which must be disposed of in a safe, secure manner.

⁸Transuranic wastes can include discarded rags, tools, equipment, soils, or other solid materials that have been contaminated by man-made radioactive elements, such as plutonium. Inhaling or ingesting even miniscule quantities of some transuranic elements can cause cancer in humans.

-
- *Storage*—Pits and associated waste materials from pit operations must be stored in a safe, secure environment to minimize their effect on human health and to ensure that they do not initiate a nuclear chain reaction.
 - *Analytical chemistry*—Samples are taken from pits to accurately determine their chemical composition and to provide assurance that a pit will meet its performance specifications.

Other operations are also required to support pit manufacturing, including quality assurance measures (e.g., calibration of equipment), maintenance of infrastructure, and support of facilities.

Pit manufacturing at LANL occurs in the PF-4 building, which was constructed in 1978 as a multiuse, plutonium research and development facility. Other pit-related facilities at LANL include the following:

- The CMR building, which was constructed in the early 1950s, houses most of LANL's analytical chemistry equipment.
- The Radioactive Liquid Waste Treatment Facility in Technical Area-50 (TA-50), which has been in operation since 1963, processes transuranic liquid waste.
- The Solid Waste Facility in Technical Area-54 (TA-54) stores transuranic solid waste pending disposal off site at the Waste Isolation Pilot Plant in New Mexico.
- The Sigma and machine shop buildings carry out nonnuclear manufacturing and equipment installation.

In addition to these facilities, the Superblock buildings at the Lawrence Livermore National Laboratory in California are used for plutonium research and development.

NNSA oversees the pit manufacturing program at LANL through its Pit Manufacturing and Certification Campaign, which is composed of the following three subprograms: (1) Pit Manufacturing, (2) Pit Manufacturing Capability, and (3) Pit Certification. However, starting in fiscal year 2009, NNSA will transfer funding associated with the first two subprograms to the Directed Stockpile Work program, while activities associated with Pit Certification will be transferred to the Science Campaign program.

NNSA Met Its Cost and Schedule Goals but Did Not Establish Clear, Consistent Goals for the Number and Type of W88 Pits It Planned to Produce

NNSA achieved its major goals for reestablishing its pit manufacturing capability at LANL as defined by the agency in 2002. Specifically, NNSA's schedule and production goals were to: (1) establish a capability to manufacture 10 pits per year by 2007, (2) deliver one W88 war reserve pit to the stockpile by 2007, and (3) certify LANL-produced W88 pits for use in the stockpile by 2007. In addition, NNSA estimated that pit manufacturing and certification expenditures for fiscal years 2001 through 2007 would be about \$1.55 billion. NNSA officials said they believe that LANL exceeded its 2002 schedule and production goals by manufacturing 11 W88 pits, 8 of which were war reserve pits, in fiscal year 2007. In addition, according to NNSA data, LANL's expenditures related to pit manufacturing and certification activities for fiscal years 2001 through 2007 were about \$260 million under its original cost estimate. However, NNSA did not have a consistent set of production goals for W88 pit manufacturing between 2002 and 2007 and never specified the number of war reserve pits that LANL would be required to manufacture each year. In addition, NNSA's cost estimate did not include almost \$300 million in costs for a number of activities that were directly associated with the pit manufacturing and certification mission. Finally, NNSA's cost estimate did not include a portion of over \$1 billion in costs for other activities that were needed to support the production of pits, as well as a wide variety of other defense-related activities, at LANL for fiscal years 2001 through 2007.

NNSA Met Its 2002 Schedule and Cost Goals

According to NNSA officials, LANL first identified the activities necessary to manufacture and certify a W88 pit in a 1998 project plan entitled, "Integrated Pit Manufacturing and Certification Program Plan." According to the plan, the pit manufacturing mission would require a total of about \$1.25 billion for fiscal years 1996 through 2007 to fund three types of activities: (1) establishing the capability to manufacture W88 pits, (2) construction projects to support the pit manufacturing mission, and (3) engineering and physics tests to certify the LANL-produced W88 pits. In addition, the plan contained the following schedule and production milestones: (1) complete the first W88 war reserve pit in 2001, (2) complete a W87 manufacturing development unit in 2002, (3) establish a capacity to produce 10 war reserve pits per year by 2005, and (4) establish the capacity to produce 20 war reserve pits per year by 2007.

However, according to NNSA officials, NNSA recognized in 2000 that it needed to establish a better baseline of the cost, schedule, and scope needed to guide the pit manufacturing mission at LANL. As a result of this effort, LANL issued a pit manufacturing plan—entitled "W88 Pit Manufacturing and Certification Integrated Project Plan"—in March 2001.

The 2001 plan estimated that it would cost a total of about \$1.55 billion for fiscal years 2001 through 2007 to manufacture and certify a W88 pit. In addition, the 2001 plan contained the following milestones: (1) establish a capability to manufacture 10 pits per year by 2007, (2) certify LANL-produced W88 pits for use in the stockpile by 2009, and (3) deliver a war reserve W88 pit to the stockpile by 2009. However, according to NNSA officials, NNSA revised the last two milestones in 2002. Specifically, NNSA moved up the milestones for LANL to deliver a war reserve W88 pit to the stockpile and certify LANL-produced W88 pits to fiscal year 2007.

NNSA officials said that LANL exceeded its 2002 schedule and production goals by manufacturing a total of 11 pits during fiscal year 2007. Of these 11 pits:

- NNSA plans to use 8 pits to replace existing W88 pits that will be taken out of the stockpile for use in its stockpile surveillance testing program. Specifically, surveillance testing involves destructive and nondestructive analysis to identify any defects or failures in pits. NNSA uses these tests to help maintain confidence in the safety and reliability of the stockpile without nuclear testing. According to NNSA officials, these 8 pits have been designated as war reserve quality.
- NNSA plans to use 2 pits for its shelf life program, which examines how a pit ages over time. According to NNSA officials, these pits may, but are not required to, meet all of the quality standards of war reserve pits and, therefore, have not been designated as war reserve pits.
- NNSA plans to subject 1 pit to destructive testing as part of LANL's manufacturing quality control. According to NNSA officials, this pit may, but is not required to, meet all of the quality standards of war reserve pits and, therefore, has not been designated as a war reserve pit.

In addition, according to NNSA officials, LANL's costs related to pit manufacturing were less than it estimated in its 2001 plan. According to NNSA data, the expenditures for the pit manufacturing and certification elements of the Pit Manufacturing and Certification Campaign for fiscal years 2001 through 2007 were about \$1.29 billion. This amount is approximately \$260 million under than the cost estimate in NNSA's 2001 plan.

NNSA Did Not Establish Clear, Consistent Requirements for W88 Pit Production

While LANL's 2001 plan contained goals related to a capability to manufacture 10 W88 pits per year and the delivery of a single war reserve pit to the stockpile, the 2001 plan did not define NNSA's requirements for the total number of war reserve W88 pits that LANL needed to manufacture. In that regard, the capability to manufacture 10 W88 war reserve pits per year is different from the capability to produce 10 pits per year that are not of war reserve quality. According to NNSA officials, other types of pits, such as pits that are destructively tested as part of production quality control, may not meet the same standards and may be of lower production quality.

NNSA only recently established final requirements for the exact number and type of W88 pits to be manufactured at LANL. Specifically, NNSA issued a memorandum in February 2007 that established a total pit production requirement for LANL of 31 W88 pits for the following purposes:

- 18 pits will be designated as war reserve quality and will replace existing W88 pits in the stockpile for use in NNSA's stockpile surveillance testing program,
- 7 pits will be used for NNSA's shelf life program,
- 4 pits will be used for LANL's manufacturing quality control program, and
- 2 pits will be used as spares.

However, the 2007 memorandum did not specify the number of war reserve pits that LANL would be required to manufacture each year.

Moreover, NNSA was inconsistent in the way it communicated this goal internally and to Congress. For example, according to NNSA's 2002 baseline, a key milestone for the pit manufacturing program was to deliver a single war reserve W88 pit to the stockpile by 2007. However, in accordance with NNSA policies, officials in the NNSA pit manufacturing program office have also issued a number of program plans and implementation plans since 2002. Program plans are strategic in nature and identify the long-term goals, high-level milestones, and resources needed to support a particular program over a 7-year period, while implementation plans establish performance expectations for the program and each participating site for the current year of execution. According to NNSA's most recent program and implementation plans for the Pit Manufacturing and Certification Campaign, a key objective of the pit

manufacturing program is to establish an interim pit manufacturing capacity of “10 war reserve W88 pits per year” at LANL starting in fiscal year 2007. In addition, NNSA has established a number of annual performance targets for the pit manufacturing program, which it reports to Congress as part of its annual budget request. In particular, in its fiscal year 2008 congressional budget request, NNSA established as a performance target to produce “10 certified W88 pits” per year at LANL. According to NNSA, the term “certified pits” has the same meaning as “pits to the stockpile” or war reserve pits.

NNSA officials in the pit manufacturing office said that it was never NNSA’s intention that every pit produced by LANL would be designated as war reserve. Moreover, the officials said that there was some uncertainty in the beginning as to whether LANL would be required to manufacture any war reserve pits. However, they acknowledged the importance of clarifying the exact number of war reserve pits that LANL will required to manufacture. They said that they are more careful now in how they write the key milestones for the pit manufacturing program. For example, they said that they will write future milestones in terms of war reserve pits to clearly distinguish between requirements for war reserve pits and requirements for other types of pits.

NNSA’s Plan Did Not Include a Variety of Costs Associated with Pit Manufacturing

According to officials in NNSA’s pit manufacturing office, they generally relied on the 2001 plan to oversee activities associated with the Pit Manufacturing and Certification Campaign. However, the 2001 plan did not include cost estimates for a number of activities that were directly associated with the Pit Manufacturing and Certification Campaign. These include costs associated with the (1) support activities at the Nevada Test Site, (2) activities associated with the Pit Manufacturing Capability subprogram, and (3) activities associated with the design of the Modern Pit Facility, a large-scale pit manufacturing plant. For example, support activities at the Nevada Test Site included experiments with plutonium that supported LANL’s pit certification effort. In addition, the Pit Manufacturing Capability subprogram supported the development of pit manufacturing processes necessary to establish the capability to manufacture other stockpile pits by fiscal year 2009. As shown in table 2, the cost for these activities was almost \$300 million for fiscal years 2001 through 2007.

Table 2: Costs for Activities That Directly Supported the Pit Manufacturing Mission at LANL, Fiscal Years 2001-2007

Dollars in millions	
Activity	Cost
Support activities at the Nevada Test Site ^a	\$164.3
Pit manufacturing capability	\$88.2
Modern Pit Facility	\$43.5
Total costs	\$296.0

Source: NNSA.

^aNNSA was only able to provide data on specific costs associated with support activities at the Nevada Test Site starting in fiscal year 2003.

In addition, the 2001 plan did not include some portion of the costs of other activities that were needed to support the production of pits, as well as a wide variety of other defense-related activities, at LANL between fiscal years 2001 and 2007. These activities include (1) operations and maintenance of key facilities, including PF-4, CMR, and waste processing facilities at TA-50 and TA-54; (2) processing of waste material containing plutonium; and (3) physical security. Specifically:

- *Operations and maintenance* includes all labor, equipment, and projects required to maintain the facilities as “mission capable” to perform programmatic tasks. In this case, the key facilities are PF-4, CMR, and waste processing facilities at TA-50 and TA-54. NNSA funds these activities using the budget category Readiness in Technical Base and Facilities, Operations of Facilities. In addition, NNSA provides funding for deferred maintenance at these facilities using the budget category Facilities and Infrastructure Recapitalization Program.
- *Processing of waste material* from plutonium operations includes the cost of processing, packaging, and shipping the waste from each facility. For example, when liquid waste is generated by plutonium operations (including pit manufacturing) at PF-4, LANL transfers this waste to TA-50. Once this liquid waste is processed at TA-50 into solid waste, LANL transfers the solid waste to TA-54 for final packaging. Finally, this solid waste is shipped off site to the Waste Isolation Pilot Plant in New Mexico.
- *Physical security* includes the protective forces, consisting of armed uniformed officers, and physical security systems—including intrusion detection and assessment barriers, access controls, tamper protection monitoring, and performance testing and maintenance of security systems—at the TA-55 site, which houses the PF-4 building.

In addition, the following eight construction projects supported the pit manufacturing mission, as well as other LANL missions, between fiscal years 2001 and 2007:

- CMR Upgrades project—activities associated with upgrading various infrastructure systems at CMR, including ventilation, fire, and emergency lighting controls.
- CMR Replacement project—activities associated with the planned construction of a replacement for the CMR building.
- TA-55 Reinvestment project, Phase I—activities associated with upgrading the major facility and infrastructure systems at PF-4.
- TA-55 Radiography Facility—activities associated with the planned construction of a high-energy radiography facility at TA-55.
- Radioactive Liquid Waste Treatment Plant Upgrade project—activities associated with renovating and constructing new buildings associated with LANL’s radioactive liquid waste treatment and disposal capability.
- TRU Waste Facility—activities associated with the planned construction of a new transuranic solid waste facility.
- Nuclear Materials Safeguards and Security Upgrades project, Phases I and II—activities associated with upgrading the security features at TA-55.

Table 3 provides examples, based on expenditure data provided by LANL, of these types of expenditures for fiscal years 2001 through 2007, which total over \$1.3 billion.

Table 3: Examples of Costs for Activities That Supported the Pit Manufacturing Mission, Fiscal Years 2001-2007

Dollars in millions	
Activity	Cost
Operations and maintenance of key facilities	\$842.9
Waste processing	\$116.8
Security ^a	\$146.5
Line-item construction	\$262.0
Total costs	\$1,368.2

Source: LANL.

^aSecurity costs only include costs incurred at the TA-55 site for fiscal years 2004 through 2007. According to LANL's Security Program Manager, LANL did not calculate or track security costs at this level until 2004.

Previous pit manufacturing plans contained estimates for some of these types of activities. For example, the 1998 pit manufacturing project plan identified about \$136 million in planned expenditures to support construction projects directly related to pit manufacturing operations for fiscal years 1996 through 2008. These projects were primarily designed to upgrade equipment and facility infrastructure at the TA-55 site. The 1998 plan also identified about \$439 million in planned expenditures primarily to maintain the infrastructure at the TA-55 site and the CMR building for fiscal years 1996 through 2008. According to the plan, these costs would support the execution of the pit manufacturing mission but were not directly attributable to pit production.

LANL officials said that they recognize the importance of accurately tracking and accounting for these kinds of supporting costs. For example, one LANL official said that LANL plans to implement a new cost distribution model in fiscal year 2009 that will enable the laboratory to allocate the cost of shared infrastructure activities, such as the cost associated with radiological control technicians, across the various programs and missions that reside in TA-55 and CMR. This cost distribution model will use the percentage of space occupied by the tenant programs in TA-55 and CMR as the basis for distributing the shared costs. According to the model, as of September 1, 2007, the pit manufacturing and certification program occupied about 35 percent of the space in TA-55 and 30 percent of the space in CMR. However, NNSA pit manufacturing program officials noted that these types of costs support the total program portfolio at LANL, including defense-related and nondefense-related activities. They also said that they purposely did not include the costs associated with these activities in the Pit Manufacturing and Certification Campaign to ensure a tight focus on the objectives of the campaign.

Several Factors Constrain NNSA's Ability to Increase Its Pit Manufacturing Capacity

Because of three major constraints on pit manufacturing operations at LANL, NNSA will not be able to substantively increase its pit manufacturing capacity for the foreseeable future. First, LANL's existing facility for performing analytical chemistry has major operational and structural limitations. Second, LANL's ability to store pits and associated waste is constrained by limited vault space. Finally, large-scale pit manufacturing operations are constrained by the lack of available floor space within the PF-4 building and by the facilities that process waste material containing plutonium.

LANL's Existing Facility for Analyzing Pit Samples Has Major Operational Limitations

LANL analyzes plutonium from pit subcomponents, feed materials, and waste streams for a variety of purposes. These analyses provide the (1) data required to certify the material control and accountability of the plutonium feed and waste materials, (2) chemical accuracy for quality control of the product, and (3) assurance that the pit will meet its performance specifications. The CMR building, which was constructed in the early 1950s, houses most of LANL's analytical chemistry capabilities. According to LANL estimates, for each pit that is produced at PF-4, the pit manufacturing program generates an average of about 10 to 15 samples that have to be sent to CMR for analytical chemistry analyses. Chemists at CMR take each sample and conduct multiple analyses or "instrument runs." As a result, each pit generates an average of about 100 to 150 instrument runs at CMR.

According to LANL estimates, CMR currently contains enough analytical chemistry instruments to support a pit production rate of 20 pits per year. However, because of several limiting factors, LANL officials estimate that the CMR building can only support a pit production capacity of between 10 to 15 pits per year. The major factor limiting analytical chemistry operations in CMR is the need to impose safety restrictions on CMR's operations that involve plutonium. In 1992, DOE began a planning process aimed at upgrading many of the safety, security, and safeguards features of CMR. Later, in 1997 and 1998, a series of operational, safety, and seismic issues surfaced that affected the long-term viability of CMR. For example, studies identified a seismic fault trace beneath one of the wings of the CMR building that increased the level of structural integrity required to meet current structural seismic code requirements for a Hazard Category 2 nuclear facility.⁹

DOE decided that it would be too difficult and costly to correct the CMR building's defects by performing repairs and upgrades. Instead, DOE decided to perform only the upgrades necessary to ensure the safe and reliable operation of the CMR building through 2010. In addition, LANL imposed a number of restrictions on the CMR facility's operations and capabilities. For example, the areas within CMR that perform analytical

⁹DOE defines the CMR building as a Hazard Category 2 nuclear facility, which is one in which a hazard analysis identified the potential for significant on-site consequences. A hazard analysis is the determination of material, system, process, and plant characteristics that can produce undesirable consequences. The hazard analysis examines the complete spectrum of potential accidents that could expose members of the public, on-site workers, facility workers, and the environment to hazardous materials.

chemistry analyses are limited to handling no more than approximately 200 grams of plutonium material (equivalent to Pu-239) at a time. Moreover, according to LANL officials, the analytical chemistry areas in CMR may not be available for programmatic work for as much as 25 percent of the time due to the age and deteriorating condition of the building. A final limiting factor is that the pit manufacturing program at LANL does not have dedicated analytical chemistry instruments within the CMR building. Specifically, while pit manufacturing accounts for almost 60 percent of the analytical chemistry work at CMR, the rest of the work is conducted for other programs within PF-4, including programs associated with NNSA's Office of Defense Nuclear Nonproliferation and DOE's Office of Nuclear Energy.

LANL's Ability to Store Pits and Associated Wastes Is Constrained by Limited Vault Space

LANL maintains a storage vault in PF-4 to store old pits, newly manufactured pits, pit residues, and waste material containing plutonium. The storage vault is about 4,500 square feet in size and was designed to provide adequate storage for special nuclear materials in a research and development setting. As a result, the storage vault was not designed to store large amounts of pits and waste material that result from large-scale pit manufacturing operations. By comparison, the Rocky Flats Plant, which manufactured pits for DOE until 1989, had a storage area of about 8,000 to 10,000 square feet.

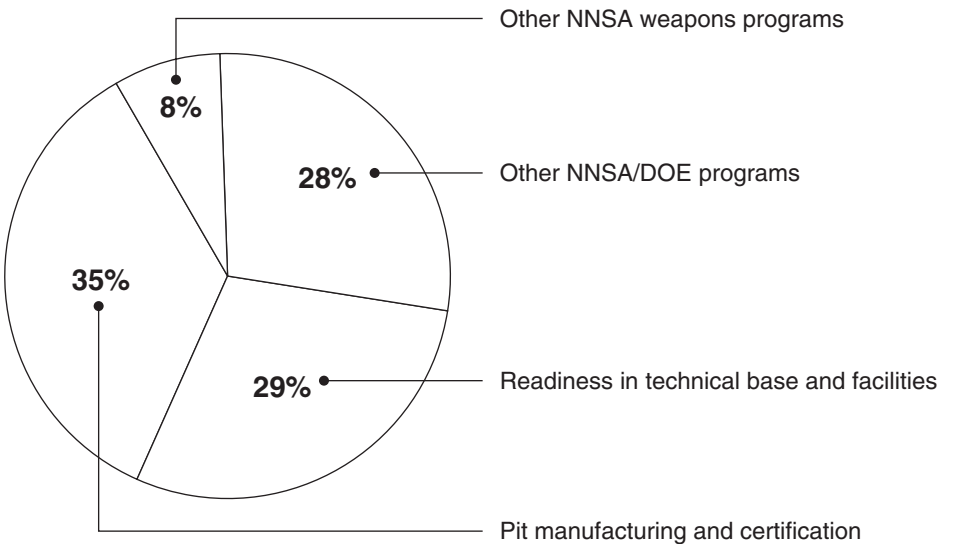
According to LANL officials, vault space within PF-4 was one of the major limiting factors for pit production in fiscal year 2007. For example, in August 2007, LANL officials had to temporarily cease pit manufacturing operations because they had no more room in the vault to store pits. In particular, the lack of vault space has led to significant amount of "on-the-floor" storage of material, whereby materials are stored in safes on the process floor, over the past 10 years. According to LANL officials, the vault in PF-4 is currently operating at 120 percent of its originally designed capacity.

Pit Manufacturing Operations at LANL are Constrained by Lack of Additional Floor Space

PF-4 was originally designed as a research and development facility to support multiple DOE nuclear research programs. As a result, PF-4 houses a variety of programs. Specifically, as shown in figure 2, operations related to pit manufacturing and certification occupy about 35 percent of the available space in PF-4. Another 29 percent is used by the Readiness in Technical Base and Facilities program, which operates and maintains NNSA program facilities in a safe, secure, reliable, and compliant condition. In particular, this program is responsible for facility operations

and maintenance and addressing environment, safety, and health issues. The remaining 36 percent of available space in PF-4 is used by other programs. (See table 4 for a description of these programmatic areas.)

Figure 2: Percentage of Space in PF-4 Occupied by Various Programs as of September 1, 2007



Source: LANL.

Table 4: Description of Programmatic Areas Occupying Space in PF-4

Program	Description
Other NNSA weapons programs	
Pit surveillance	This program takes pits from the stockpile and subjects them to destructive and nondestructive tests to ensure that no changes that might affect performance are occurring in the pits.
Plutonium research and development	This program supports all defense-related programs by maintaining the capability to address new and unusual issues that arise during the execution of the other plutonium-related programs.
Special recovery line	This program processes retired stockpile components to recover tritium-contaminated plutonium.
Other NNSA/DOE programs	
Pu-238 heat source fabrication	This program designs and fabricates general purpose heat source units and radioisotope heater units for the National Aeronautics and Space Administration.

Program	Description
ARIES/pit disassembly	The Advanced Recovery and Integrated Extraction System (ARIES) disassembles legacy pits and removes and oxidizes the plutonium, which can be used as a feed metal for the mixed-oxide (MOX) fuel polishing activities described below. The purpose of the ARIES line is to develop and demonstrate the technologies to be used in the Pit Disassembly and Conversion Facility at the Savannah River Site.
MOX fuel polishing	This program purifies plutonium from the ARIES project to specifications that would allow direct use of the plutonium in the fabrication of MOX fuel (which could be used in a nuclear reactor).
Oxide fuels/ceramics research and development	This program analyzes and processes plutonium-bearing oxides and ceramics that could be used as fuel in a nuclear reactor.

Source: GAO analysis of LANL data.

Because the majority of the space in PF-4 is occupied by other programs, NNSA is limited in its ability to expand its pit manufacturing operations into other areas in PF-4. In order for the pit manufacturing mission to acquire new space, NNSA Office of Defense Programs officials have to negotiate with the departmental sponsor of the other programs. For example, in June 2007, the NNSA Office of Defense Programs signed a memorandum of agreement with the DOE Office of Nuclear Energy to consolidate the activities conducted by the ceramic fuels program into a single room, thereby freeing up an additional room for use by NNSA. However, because NNSA has not issued a record of decision on its efforts to transform the nuclear weapons complex, the Office of Defense Programs has not reached a decision on whether to make the space available for pit manufacturing operations, for analytical chemistry analyses, or for the consolidation of special nuclear materials from other sites in the nuclear weapons complex. In addition, it will take several years for NNSA to consolidate the ceramic fuels program, decontaminate the room, and install the necessary new gloveboxes and equipment.

Pit Manufacturing Operations at LANL Are Also Constrained by Waste Processing Facilities

Pit manufacturing operations at PF-4 generate liquid and solid transuranic waste. Liquid waste is processed at the Radioactive Liquid Waste Treatment Facility at TA-50, which has been in operation since 1963. This facility treats approximately 80,000 liters of transuranic waste a year. According to LANL officials, the facility can currently process enough liquid waste to support a pit capacity of about 30 pits per year using a single shift of operations. However, the Radioactive Liquid Waste Treatment Facility processes waste from PF-4, CMR, and at least seven

other nuclear research, production, and support facilities. As a result, the transuranic waste stream is influenced by multiple programs at LANL that support nuclear research and production and varies significantly in volume on a daily basis—potentially constraining pit capacity.

Transuranic solid waste is placed in drums at the generating facilities—PF-4 being the largest source of transuranic drums at LANL—and sent to LANL's TA-54 area for inspection and characterization. This waste is ultimately shipped to the Waste Isolation Pilot Plant in New Mexico for final storage. According to LANL officials, the main limiting factor in LANL's ability to process and ship solid waste is its ability to stage and store drums of solid waste before they are shipped off-site. In fiscal year 2007, TA-55 generated about 450 drums of transuranic solid waste. Of this amount, roughly half came from pit manufacturing operations. According to LANL estimates, TA-54 can currently support a pit manufacturing capacity of between 20 to 30 pits per year. However, under an agreement with the state of New Mexico, DOE will close significant portions of TA-54, including operations involving transuranic solid waste, by 2010. NNSA has initiated a TA-50 transuranic waste consolidation project to establish the necessary capabilities to handle solid waste after TA-54 is no longer available. According to LANL, this facility needs to be operational in the 2011-2013 time frame.

In commenting on our report, NNSA officials agreed that they will not be able to increase LANL's pit manufacturing capacity to larger levels (e.g., 50 to 80 pits per year) without improvements to supporting facilities. However, they said that they had some flexibility to achieve a modest increase in LANL's pit manufacturing capacity to address a specific requirement for additional pits. In that regard, they said that they could apply more shifts, add equipment to PF-4, move some material out of the storage vault in PF-4, and make some adjustments to analytical chemistry requirements. However, NNSA officials did not provide any details on how many additional pits they would be able to produce if they performed these activities.

NNSA Has Not Established a Cost and Schedule Baseline for Its Future Pit Manufacturing Mission

NNSA's plans for future pit manufacturing are still being developed and, as a result, no reliable cost estimates exist. Over the past few years, NNSA and DOD had planned to develop the capability to produce RRW pits beginning about 2014. However, the explanatory statement accompanying the fiscal year 2008 NNSA appropriation stated that the bill provided no funding for the RRW program. While NNSA and DOD continue to support the RRW program, in the short run, NNSA plans to maintain the existing pit manufacturing capability at LANL. Over the long term, NNSA is planning, with DOD's concurrence, to upgrade the PF-4 facility to achieve a production capacity of up to 80 pits per year. However, NNSA has not established a cost and schedule baseline to support its projected efforts. Using the best available data, we estimated that NNSA's plans entail spending several billion dollars at LANL over the next decade.

NNSA Has Changed Its Strategy for Manufacturing Future Pit Types over the Past Few Years

One of NNSA's original goals for the pit manufacturing mission was to develop the technology and demonstrate the processes required to manufacture all pit types in the enduring stockpile by the end of fiscal year 2009. NNSA planned to achieve this milestone by first demonstrating the key manufacturing processes for the W87 and B61-7 pits. However, with the creation of the RRW program, NNSA's strategy changed. Specifically,

- In April 2006, NNSA issued guidance to the nuclear weapons complex to demonstrate the capacity to manufacture and certify an RRW by 2012.
- In October 2006, as part of its Complex Transformation effort, NNSA issued a planning document¹⁰ describing its vision for the nuclear weapons complex of the future. According to the document, NNSA wanted to establish an RRW-based stockpile plan by the end of 2007 with a majority of intercontinental ballistic missile, submarine-launched ballistic missiles, bombs, and cruise missiles transitioning to RRW-types by 2030.
- In February 2007, NNSA established a planning target of "2014 plus or minus two years" to produce an RRW first production unit.¹¹ In particular,

¹⁰NNSA, *Complex 2030: An Infrastructure Planning Scenario for a Nuclear Weapons Complex Able to Meet the Threats of the 21st Century* (Washington, D.C.: Oct. 23, 2006).

¹¹A first production unit corresponds to phase 5 of the traditional nuclear weapons development and production cycle, in which NNSA and the nuclear weapons complex certify a weapon, initiate production, and implement quality control and inspection procedures.

by March 2007, NNSA planned to manufacture an RRW first production pit by the end of fiscal year 2012.

- In December 2007, as part of its Complex Transformation planning effort, NNSA issued a draft plan¹² stating that the first RRW was being considered as a possible replacement for the Navy's W76 warhead starting as early as the 2014 time frame.

At the same time, the Nuclear Weapons Council began considering a variety of scenarios based on different stockpile sizes and the degree to which the stockpile would incorporate new RRW designs. According to a senior DOD official on the Nuclear Weapons Council staff, while the council has not issued a final decision as to the size and composition of the future stockpile, the council has considered how large the stockpile needs to be in order to maintain a sufficiently large, responsive manufacturing infrastructure—comprised of people and equipment that can be responsive to future global geopolitical events. In addition, the council has considered the number of warheads that will need to be either refurbished or replaced in the coming decades.

However, the explanatory statement accompanying the fiscal year 2008 NNSA appropriation stated that the bill provided no funding for the RRW program. NNSA and DOD officials still support the goals of the RRW program. For example, in recent testimony before the House Armed Services Subcommittee on Strategic Forces, the Commander of the U.S. Strategic Command stated that his agency supports the continuation of the RRW design definition and cost study to explore a replacement for aging warheads in the stockpile.¹³ However, in the short term, NNSA has shifted its strategy for pit manufacturing. Specifically, in its fiscal year 2009 budget request to Congress, NNSA stated that three of its key objectives for the pit manufacturing mission were to (1) establish the capability to manufacture replacement pits for warheads other than the W88, (2) improve manufacturing processes used to manufacture all pit types, and (3) develop the processes and equipment necessary to manufacture pits for future requirements. According to NNSA officials in the pit

¹²NNSA, *Draft Complex Transformation Supplemental Programmatic Environmental Impact Statement: Summary* (Washington, D.C.: December 2007).

¹³Chilton, Kevin P., Commander, U.S. Strategic Command. Statement before Strategic Forces Subcommittee, Committee on Armed Services, House of Representatives, Feb. 27, 2008.

manufacturing office, their activities in 2009 will focus on continuing to manufacture W88 pits, documenting the processes necessary to manufacture other pit types, and developing the technology necessary to increase the capacity for pit manufacturing beyond 10 pits per year. Moreover, they said that the mission for the pit manufacturing program going forward is to maintain the existing capability and the quality control infrastructure to be able to manufacture whatever the DOD requires.

NNSA Has Changed Its Plans for Future Pit Capacity Over the Past Few Years

NNSA's initial goals for large-scale pit manufacturing focused on the construction of a new production facility. For example, in May 2002, the Secretary of Energy approved the start of design work for a large-scale manufacturing plant called the Modern Pit Facility. This facility was designed to address the long-term pit manufacturing capability and capacity required to support the nuclear weapons stockpile. Specifically, it would be able to manufacture pits at a production capacity of 125 pits per year. However, the conference report accompanying the fiscal year 2006 NNSA appropriation stated that it provided no funding for the Modern Pit Facility and directed NNSA to focus on improving its manufacturing capability at LANL. As a result, NNSA suspended the Modern Pit Facility indefinitely.

In October 2006, NNSA offered a new proposal to address the need for a large-scale pit manufacturing facility. Specifically, in its Complex Transformation plan, NNSA proposed to build a new, consolidated plutonium center at an existing DOE site that would replace the interim pit facility at LANL by 2022. As with the planned capacity of the Modern Pit Facility, NNSA planned to design the consolidated plutonium center for a production capacity of 125 pits per year to support an RRW-type stockpile. In addition, NNSA planned to upgrade the manufacturing operations at LANL in order to achieve a production capacity of up to 50 RRW pits per year by 2012. It planned to maintain this capacity at LANL until 2022, when pit operations at LANL would cease, and the consolidated plutonium center would begin operations. However, the explanatory statement accompanying the fiscal year 2008 NNSA appropriation stated that no funding was provided for the consolidated plutonium center and directed NNSA to focus on developing a modern nuclear weapons strategy, including the required pit production capacity defined by nuclear stockpile requirements. As a result, NNSA suspended work on the consolidated plutonium center.

Since the issuance of its 2006 planning document, NNSA's strategy for large-scale pit manufacturing has changed. Specifically, in December 2007,

as part of its Complex Transformation planning effort, NNSA issued a draft plan establishing various alternatives for the future of its pit manufacturing mission. One alternative remained the construction of a consolidated plutonium center with a capacity of 125 pits per year for a single shift of operations. However, NNSA listed as its preferred alternative an upgrade of the existing PF-4 building at LANL to produce up to 80 pits per year. According to the plan, the actual time frame for reaching this capacity will depend on an operational date for new analytical chemistry and vault storage space at LANL.

DOD officials have only recently agreed to support NNSA's plan to manufacture up to 80 pits per year at LANL. According to the 2007 Nuclear Weapons Stockpile Memorandum,¹⁴ the Nuclear Weapons Council stated that NNSA will need to provide a pit manufacturing capacity of 125 pits per year going forward. According to a senior DOD official on the Nuclear Weapons Council staff, the council voted on February 20, 2008, to support a baseline production capacity of 50 to 80 pits per year. However, at that meeting, the council stated that future changes to stockpile size, military requirements, and risk factors may ultimately lead to a revised capacity rate. According to the senior DOD official, it is possible that this revised capacity rate will ultimately be larger than 80 pits per year.

NNSA's Current Plans Are Draft and Do Not Contain Reliable Cost Estimates

Given the amount of uncertainty surrounding NNSA's strategy for its future pit manufacturing mission, NNSA's current plans have been in a state of flux over the past year and remain in draft. For example, LANL issued a draft "Pit Manufacturing Program Execution Plan" in September 2007 to identify the scope, schedule, and budget necessary to execute NNSA's strategy for manufacturing RRW pits around the 2014 time frame. The draft plan stated that the laboratory had not completed fundamental planning and scheduling activities—which would include the development of a fully integrated, resource-loaded schedule and risk management assessment—to validate budget and schedule requirements. As a result, LANL considered its plan to be preliminary. However, when the explanatory statement accompanying the fiscal year 2008 NNSA appropriation stated that the bill provided no funding for the RRW program, LANL revised the plan to support an upgrade of the existing PF-4

¹⁴The Nuclear Weapons Council is responsible for preparing the annual Nuclear Weapons Stockpile Memorandum, which specifies how many warheads of each type will be in the stockpile over a projected period of time.

building to produce up to 80 pits per year, as reflected in NNSA's current Complex Transformation planning effort. According to NNSA program officials, LANL is still on track to issue a final plan by the summer of 2008, which will reflect the program's new strategy. However, they currently do not have a final baseline for the plan's cost, schedule, and scope.

Using the best available data, we estimate that NNSA's current strategy would entail spending over \$1 billion on activities directly associated with the pit manufacturing mission at LANL over the next 5 years. Specifically, according to NNSA's fiscal year 2009 budget request and out-year funding schedule, NNSA plans to fund the following activities from fiscal years 2009 through 2013:

- Over \$730 million on activities associated with pit manufacturing operations, and
- Over \$258 million on activities associated with pit manufacturing capability, which is associated with the capability to manufacture pits for other warhead types beside the W88 and to develop the technology necessary to manufacture pits at higher rates with reduced costs.

For fiscal year 2009, NNSA also plans to spend almost \$43 million on activities associated with pit certification. However, because NNSA realigned all activities associated with the Pit Manufacturing and Certification Campaign in its fiscal year 2009 budget request, we were not able to account for the costs of these activities in NNSA's out-year funding schedule (from fiscal years 2010 through 2013).

NNSA's plans also call for spending hundreds of millions of dollars to install a second manufacturing line for producing pits. Specifically, in a 2006 study,¹⁵ LANL estimated that it could cost up to approximately \$500 million to install a new manufacturing line and upgrade the electrorefining equipment in PF-4 by the 2014 time frame. However, according to NNSA program officials, it could cost as much as \$1 billion to perform the necessary research and development work, procure and install the necessary equipment, and upgrade the PF-4 infrastructure, among other things.

¹⁵LANL, *Alternatives for Increasing Pit Production Capacity at the Los Alamos Plutonium Facility (U)* (Los Alamos, N.M.: Apr. 10, 2006).

In this report, we previously identified four types of activities that are needed to support the production of pits, as well as a wide variety of other defense-related activities at LANL. These activities include (1) operations and maintenance of key facilities, including PF-4, CMR, and waste processing facilities at TA-50 and TA-54; (2) processing of waste material containing plutonium; (3) physical security; and (4) construction projects.

Operations and maintenance of key facilities: According to LANL estimates, NNSA plans to spend about \$846 million between fiscal years 2009 and 2013 on operations and maintenance activities at PF-4, CMR, and waste processing facilities at TA-50 and TA-54. In addition to these costs, NNSA is considering a plan to extend the life of the CMR building beyond 2010, which is the year when the building's safety basis¹⁶ expires. According to a 2006 LANL study,¹⁷ it will cost approximately \$100 million to continue operations at CMR from 2009 to 2013. Beyond 2013, LANL estimated that it would cost an additional \$160 million to \$240 million to upgrade some of CMR's major systems, such as its electrical and heating systems. As a result, LANL estimated that it could cost between \$240 million to \$360 million to maintain the CMR building up to and beyond the 2013 time frame.

However, in October 2007, the Defense Nuclear Facilities Safety Board, which monitors safety operations at CMR and other nuclear facilities, sent a letter to NNSA expressing concern about NNSA's plan. Specifically, the board stated:

"The Board understands that LANL plans to develop a CMR facility safety basis for post-2010 operations, with approval and implementation of this new safety basis in 2009. It is unlikely that this effort will eliminate or mitigate the safety risks of operating the CMR facility beyond 2010 without significant facility upgrades or mission changes. This timetable leaves little time for NNSA to complete any necessary safety system upgrades or identify alternative strategies for meeting national security priorities."¹⁸

¹⁶ A safety basis is the documented safety analysis and hazard controls that provide reasonable assurance that a DOE nuclear facility can be operated safely in a manner that adequately protects workers, the public, and the environment.

¹⁷ LANL, *Options for Plutonium-Related Missions and Associated Facilities Between 2007 and 2022* (Los Alamos, N.M.: Oct. 10, 2006).

¹⁸ Defense Nuclear Facilities Safety Board letter, Oct. 23, 2007.

According to NNSA officials, if NNSA cannot develop a satisfactory plan to extend operations at CMR beyond 2010, NNSA would have to find a new location at LANL or LLNL to perform analytical chemistry operations to support pit manufacturing. They said that NNSA is still working through this process with the Defense Nuclear Facilities Safety Board.

Processing of waste material containing plutonium: According to LANL estimates, NNSA plans to spend about \$87 million for fiscal years 2009 through 2013 to process, package, and ship transuranic waste at the waste processing facilities at TA-50 and TA-54.

Physical security: According to LANL estimates, LANL plans to spend about \$179 million on security at the TA-55 site for fiscal years 2009 through 2013.

Construction projects: The largest single cost is associated with the proposed CMR Replacement project, which would house LANL's analytical chemistry equipment and provide a new storage vault for plutonium and other special nuclear material. The CMR Replacement project has been in the planning stages since 2001. According to current designs, the CMR Replacement project will include a storage vault of about 13,000 square feet in size. However, the current design work did not account for NNSA's strategy to support a larger pit production rate of up to 80 pits per year at PF-4. One NNSA official stated that a new design for a larger CMRR Replacement facility, which would include an additional 9,000 square feet of laboratory space, could add as much as \$500 million to the total cost.

NNSA has not established a baseline for the cost and schedule of the CMR Replacement project. In its fiscal year 2008 budget request, NNSA estimated that this project would cost over \$837 million and start operations by the end of fiscal year 2014. However, in its fiscal year 2009 budget request, NNSA estimated that this project could cost over \$2 billion and did not provide a planned date for the start of operations. NNSA officials said that NNSA does not expect to reach a final decision regarding the design of this facility or the expected date of operations until it issues a record of decision as part of its Complex Transformation planning effort, which is expected later in 2008.

Finally, table 5 shows the costs associated with the remaining construction projects that will support a variety of missions, including the pit manufacturing mission, at LANL over the next decade. These costs total to over \$500 million.

Table 5: Estimated Costs of Other Construction Projects That Will Support a Variety of Missions, Including Pit Manufacturing, at LANL

Dollars in millions		
Project and description	Estimated cost	Estimated completion date
<i>Nuclear materials safeguards and security upgrades project, phase II:</i> selective upgrades to the physical security systems at the TA-55 site.	\$239	2011
<i>TA-55 reinvestment project:</i> selective replacements and upgrades of major facility and infrastructure systems in PF-4.	\$144	To be determined
<i>Radioactive liquid waste treatment facility upgrade:</i> upgrades to current facility systems at TA-50.	\$88	2010
<i>TRU waste facilities:</i> construction of new transuranic waste storage and process facilities.	\$46	To be determined
<i>TA-55 radiography facility:</i> construction of a new radiography facility at the TA-55 site to take high-energy X-ray pictures of pits.	\$38	To be determined
Total costs	\$555	

Sources: GAO analysis of data from LANL's Integrated Construction Project Plan and NNSA's fiscal year 2009 budget request.

Conclusions

The capability and capacity to manufacture pits for nuclear warheads is important to maintaining the nation's nuclear weapons deterrent, either through supporting the current nuclear stockpile or producing any new warheads, such as the proposed RRW. As such, NNSA's reestablishment of a W88 pit manufacturing capability at LANL represents a positive step. However, NNSA's long-term strategy for the pit manufacturing mission, and its attendant costs and schedule, is in a state of flux. In our 1998 report on pit manufacturing, we recommended that DOD provide DOE with its views on the pit manufacturing capacity needed to maintain the then existing stockpile. Since then, the two agencies have reached a decision to support a future pit manufacturing capacity of up to 80 pits per year at LANL. However, DOD and NNSA have shifted their focus from the existing stockpile to a potential stockpile of new RRWs. Whether DOD, NNSA, and Congress commit to supporting the replacement of warheads in the existing stockpile or the production of RRW-type warheads, NNSA will need to take two key actions before it can complete any draft plans for pit manufacturing and project future costs and schedules with any precision. Specifically, building on its agreement with DOD, NNSA will need to establish clear, well-defined production goals for the type and number of war reserve pits to be produced each year at LANL. In addition, using these production goals, NNSA will need to fully account and plan for all costs associated with the pit manufacturing mission, including supporting costs associated with operation and maintenance, waste processing, security, and construction. Without these actions, we believe

that NNSA will not have a sufficient baseline against which to manage future pit manufacturing missions.

Recommendations for Executive Action

To ensure that NNSA establishes a sufficient cost and schedule baseline that it can use to manage pit manufacturing operations in an efficient and cost-effective manner, we recommend that the Administrator of NNSA take the following two actions:

- Develop clear, well-defined production goals for the type and number of war reserve pits to be produced each year at LANL and include them in any plan for the future pit manufacturing mission.
- Establish an integrated cost baseline for future pit manufacturing at LANL that accounts for the entire pit-manufacturing mission, including supporting costs associated with operation and maintenance, waste processing, security, and construction of supporting facilities.

Agency Comments and Our Evaluation

We provided a draft of this report to NNSA and DOD for their review and comment. NNSA did not specifically comment on our recommendations. However, NNSA provided general comments on our findings that NNSA had not developed complete cost estimates for the W88 pit manufacturing mission and that NNSA had not developed clear requirements for the number of W88 war reserve pits it planned to manufacture.

With respect to the completeness of NNSA's cost estimate for W88 pit manufacturing, NNSA stated that the pit manufacturing mission should not be accountable for certain costs directly associated with the pit manufacturing and certification project, such as activities at the Nevada Test Site, or the costs associated with support facilities, such as PF-4, because these facilities and their capabilities would be required to address other program requirements, regardless of the presence of the pit manufacturing program. However, we note that NNSA's 1998 pit manufacturing project plan did include both direct costs, such as construction costs directly related to pit manufacturing, as well as support costs, such as those needed to maintain the infrastructure at PF-4. In addition, we found that currently LANL is developing a cost distribution model that will allow the laboratory to allocate the cost of shared activities at facilities such as PF-4 and CMR. Therefore, we continue to believe that in order for NNSA to be able to successfully manage future pit manufacturing missions such as those proposed in NNSA's Complex Transformation documents, it will need a cost baseline that accounts for

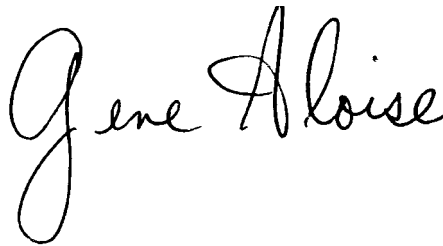
all costs, including an appropriate portion of the necessary supporting costs.

With respect to the need for clear requirements for the number of W88 war reserve pits NNSA planned to manufacture, NNSA stated that the main purpose of the pit manufacturing and certification project was to reconstitute pit manufacturing with a limited manufacturing capacity. NNSA stated that the lack of available pits to support the surveillance program for the W88 warhead was the near term requirement and the driver for the project's schedule. However, according to NNSA, the exact number of pits to be manufactured was immaterial to the scope and purpose of the project. While we agree that NNSA has successfully reestablished the capability to manufacture W88 pits at LANL, as we state in our report, and as acknowledged by NNSA officials responsible for the pit manufacturing program, it is important for NNSA to establish the exact number of war reserve pits that it plans to manufacture in the future. NNSA's ability to determine the specific number of war reserve pits it plans to produce per year is directly tied to decisions Congress will need to make about any future pit manufacturing mission. For example, a projected manufacturing capacity of 50 pits per year would result in a very different estimate for scope, cost, and schedule than a manufacturing capacity of 10 pits per year. Therefore, we continue to believe that NNSA needs to implement our recommendation that it develop clear, well-defined production goals.

NNSA's comments on our draft report are included in appendix I. NNSA also made technical comments, which we incorporated into this report as appropriate. According to the Deputy Assistant to the Secretary of Defense for Nuclear Matters, DOD did not have any comments on this report.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 10 days from the report date. At that time, we will send copies of this report to the Secretaries of Energy and Defense, the Administrator of NNSA, and appropriate congressional committees. We also will make copies available to others on request. In addition, the report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

If you or your staff have any questions on this report, please contact me at (202) 512-3841 or aloisee@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix II.

A handwritten signature in black ink that reads "Gene Aloise". The signature is written in a cursive style with a large, looped "G" and a distinct "Aloise" at the end.

Gene Aloise
Director, Natural Resources and Environment

Appendix I: Comments from the National Nuclear Security Administration



Department of Energy
National Nuclear Security Administration
Washington, DC 20585



April 30, 2008

Mr. Gene Aloise
Director
Natural Resources and Environment
Government Accountability Office
Washington, DC 20548

Dear Mr. Aloise:

The National Nuclear Security Administration (NNSA) appreciates the opportunity to review the Government Accountability Office's (GAO) draft report, GAO-08-593, "NUCLEAR WEAPONS: NNSA Needs to Establish a Cost and Schedule Baseline for Manufacturing a Critical Nuclear Weapon Component." We understand that this work was performed at the request of the House's Subcommittee on Energy and Water Development, Committee on Appropriations to determine if we have achieved goals for reestablishing manufacturing capability, constraints associated to increased capacity, and the status of future manufacturing plans.

NNSA appreciates GAO's acknowledgement that we have achieved our goals for establishing a manufacturing capability within the goals that we had established. Regarding the remainder of the report and the corresponding recommendations, I have attached both general and technical comments for your consideration while preparing GAO's final report.

Should you have any questions about this response, please contact Richard Speidel, Director, Policy and Internal Controls Management at 202.586.5009.

Sincerely,

A handwritten signature in black ink, appearing to read "M.C. Kane", written over a horizontal line.

Michael C. Kane
Associate Administrator
for Management and Administration

Enclosure(s)

cc: Robert Smolen, Deputy Administrator for Defense Programs
Donald Winchell, Revitalization Manager, Los Alamos Site Office
David Boyd, Senior Procurement Executive
Karen Boardman, Director, Service Center



Printed with soy ink on recycled paper

General Comments

1. **NNSA Cost Estimates:** -- The comment is made that “NNSA’s cost estimate did not include estimates for a variety of activities that directly and indirectly supported the pit manufacturing mission at LANL between 2001 and 2007”, implying that full costs of the project were not identified. The referenced costs can be separated into two groups – supporting nuclear facilities and other Pit Manufacturing and Certification Campaign funding lines. With regard to supporting nuclear facilities, NNSA did not include costs for those facilities within the baseline of the pit manufacturing and certification project because those facilities and their capabilities were required to address other program requirements, regardless of the presence of the project. To be able to work with plutonium on any level requires NNSA to have the same supporting facilities that the pit manufacturing and certification project required. Funding for those facilities is identified in the NNSA FYNSP under Required Technical Base and Facilities (RTBF) and no additional funds were required to expand those facilities to meet the objectives of the pit manufacturing and certification project. Reliance upon all support facilities was documented in the March 2001 baseline document, “W88 Pit Manufacturing and Certification Integrated Project Plan”. As with any project it was necessary to ensure the funding identified and managed was directly spent to achieve the scope and schedule in the baseline document. That scope and schedule was to “establish a near term manufacturing capability of 10 pits per year by 2007” and deliver a certified war reserve pit to the stockpile in FY 2007. Both were not only achieved, as the GAO Report states, but were achieved below costs and ahead of schedule from the original 2001 baseline.

The same argument applies to the other Pit Manufacturing and Certification Campaign elements, Pit Capability, Modern Pit Facility, and Nevada Test Site support. None of the Pit Capability and Modern Pit Facility funds were used to achieve the pit manufacturing and certification project scope and objectives. Pit Capability funds have always been used to develop new manufacturing processes for long term manufacturing and to ensure the capability to manufacture all pit types is preserved. These funds were initially directed towards supporting the equipment that would have been introduced into the Modern Pit Facility. Most recently, the same development work is now applicable to long term pit manufacturing within the LANL TA-55/PF-4 facility based upon the preferred alternative within the Complex Transformation Programmatic Environmental Impact Statement. With regard to the Nevada Test Site funding, the funding for the site, like the funding for the other nuclear supporting facilities cited above, is to maintain a minimum capability and is a necessary part of stockpile stewardship, regardless of the presence of the pit manufacturing and certification project. The funding had been in the Directed Stockpile Stewardship (DSW) funding line prior to 2003; however, the Pit Campaign assumed budget authority from 2003 to 2007 because it became the primary customer for the Nevada Test Site subcritical activities during that time frame. Subsequent to 2007, these funds have reverted back to DSW. While NTS activities were not identified in the 2001 baseline, a projectized cost baseline that included NTS support was maintained after 2003. The same project controls and earned value reporting were required consistent with the rest of the project.

- 2. Number of W88 war reserve pits:** -- The baseline scope of the Pit Manufacturing and Certification project, as reflected in its baseline document of March 2001, "W88 Pit Manufacturing and Certification Integrated Project Plan", was to:
- Reestablish the capability to manufacture the W88 pit by 2003;
 - Fabricate a certifiable W88 pit in 2003;
 - Establish a capability to manufacture 10 pits per year by 2007;
 - Certify LANL-produced W88 pits for use in the stockpile by 2009 (later moved up in schedule to 2007); and
 - Deliver a WR pit to the stockpile in 2009 (later moved up in schedule to 2007).

As reflected above, the main purpose of the project was to reconstitute pit manufacturing with a limited manufacturing capacity, a critical production capability lacking to support the stockpile, since the closure of the Rocky Flats Plant. The lack of available pits to support the surveillance program for the W88 pit was the near term requirement and was the driver for the project's schedule with the exact number to be manufactured immaterial to the scope and purpose of the project, but characterized through the rate of pits (10 pits per year) to be manufactured. The pit manufacturing and certification project, however, assumed for planning purposes a total production requirement based on historical precedence for annual surveillance requirements, laboratory requirements for tests, and production quality testing. The actual requirement, established in February 2007, through NNSA and Laboratory agreement, was less than the assumed planning base due to changes in the surveillance program requirement for the W88.

Appendix II: GAO Contact and Staff Acknowledgments

GAO Contact

Gene Aloise, Director, (202) 512-3841, or aloisee@gao.gov

Staff Acknowledgments

In addition to the individual named above, James Noel, Assistant Director; Jason Holliday; and Stephen Marchesani made significant contributions to this report.

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