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MODERNIZING THE NUCLEAR SECURITY ENTERPRISE

NNSA's Budget Estimates Increased but May Not Align with All Anticipated Costs

Accessible Version

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Abbreviations

DOD	Department of Defense
DOE	Department of Energy
LEP	life extension program
NNSA	National Nuclear Security Administration

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Nuclear weapons are an integral part of the nation's defense strategy. The National Nuclear Security Administration (NNSA)—a separately organized agency within the Department of Energy (DOE)—is responsible for designing, producing, and maintaining the country's nuclear weapon stockpile. This work is largely executed at eight government-owned, contractor-operated sites, collectively known as the nuclear security enterprise.[1] Since 1992, the United States has observed a moratorium on underground testing of nuclear weapons and has shifted from producing new nuclear weapons to maintaining the stockpile through refurbishment. The United States has also experienced a decline in the condition of its weapon production infrastructure. The 2010 *Nuclear Posture Review*—which outlines U.S. nuclear policy, strategy, capabilities, and force posture—identified long-term modernization goals, including sustaining a secure and effective nuclear arsenal through the life extension of existing nuclear weapons; increasing investments to rebuild and modernize the nation's nuclear infrastructure; and strengthening the science, technology, and engineering base.[2] To meet these modernization goals, NNSA is refurbishing nuclear weapons in the stockpile through alterations and life extension programs (LEP);[3] replacing or renovating decades-old weapons-related facilities; conducting simulations and laboratory experiments to ensure that existing weapons remain safe and reliable; and recruiting and training personnel

[1]NNSA oversees three national nuclear security laboratories—Lawrence Livermore National Laboratory in California, Los Alamos National Laboratory in New Mexico, and Sandia National Laboratories in New Mexico and California. It also oversees four nuclear weapons production plants—the Pantex Plant in Texas, the Y-12 National Security Complex in Tennessee, the National Security Campus at Kansas City in Missouri, and tritium operations at DOE's Savannah River Site in South Carolina. NNSA also oversees the Nevada National Security Site, formerly known as the Nevada Test Site.

[2]Department of Defense, *Nuclear Posture Review Report* (Washington, D.C.: Apr. 6, 2010).

[3]LEPs extend, through refurbishment, the operational lives of weapons in the nuclear stockpile by 20 to 30 years and certify these weapons' military performance requirements without underground nuclear testing. Much like a nuclear weapon LEP, a weapon alteration refurbishes components to ensure that a weapon can continue to meet military requirements. However, an alteration generally refurbishes fewer components than an LEP and is typically intended to fix a particular issue or extend the life of a particular component.

with the specialized skills to sustain the nation's nuclear weapons program and maintain the stockpile.

In addition to NNSA, two other organizations are responsible for the nation's nuclear weapons program. First, the Department of Defense (DOD) is responsible for implementing the U.S. nuclear deterrent strategy, which includes establishing the military requirements associated with planning for the stockpile. Second, the Nuclear Weapons Council, which is composed of representatives from DOD and DOE, facilitates high-level coordination to secure, maintain, and sustain the nuclear weapons stockpile.

NNSA's modernization plans and the budget estimates to implement these plans are described in two key policy documents, updated annually, that together comprise NNSA's nuclear security budget materials.[4] First, NNSA's *Stockpile Stewardship and Management Plan* is the agency's formal means of communicating to Congress information on modernization and operations plans and budget estimates over the next 25 years. Second, NNSA's annual justification of the President's budget request provides program information and budget estimates for the next 5 years. This 5-year plan is called the Future-Years Nuclear Security Program, and the budget estimates in this plan are the basis for the funding levels approved by the Office of Management and Budget. These estimates are identical to those presented in the first 5 years of the *Stockpile Stewardship and Management Plan*. To implement NNSA's modernization plans, the agency's February 2015 justification of the President's budget request included about $47.2 billion for 2016 through 2020, of which about $8.8 billion was for 2016. In addition to these documents, DOD and DOE together produce a third, integrated document on plans for the nuclear deterrent that includes information on DOD and DOE's modernization budget estimates. This annual report, which DOD and DOE are required to submit jointly to the relevant Senate and House committees and subcommittees, is referred to as the section 1043 report or the DOD-DOE

[4]NNSA refers to the cost figures included in its budget materials during the Future-Years Nuclear Security Program period as budget requirements and those after that period as budget requirements estimates. We refer to these figures as budget estimates throughout this report.

joint report.[5] The report is to address, among other things, the plan for the nuclear weapons stockpile and its delivery systems, and is to include a 10-year range of modernization budget estimates.[6]

NNSA's 2016 budget consists of four appropriations accounts: (1) Defense Nuclear Nonproliferation, (2) Naval Reactors, (3) Federal Salaries and Expenses, and (4) Weapons Activities. NNSA's activities in the *Stockpile Stewardship and Management Plan* are funded by the Weapons Activities appropriation account. The Future-Years Nuclear Security Program also includes information on all of NNSA's appropriations accounts.

The National Defense Authorization Act for Fiscal Year 2011 contains a provision that GAO study and report annually on whether NNSA's nuclear security budget materials provide for funding that is sufficient to modernize and refurbish the nuclear security enterprise as well as recapitalize its infrastructure.[7] This is the fifth year we have undertaken work in response to this provision.[8] This report assesses (1) the extent to which NNSA's budget estimates and plans for modernization activities reflected in its fiscal year 2016 nuclear security budget materials differ, if at all, from those in its fiscal year 2015 budget materials and (2) the extent to which the fiscal year 2016 nuclear security budget materials align with modernization plans as presented in the *Stockpile Stewardship and Management Plan*.

[5]Department of Defense and Department of Energy, *Fiscal Year 2016 Report on the Plan for the Nuclear Weapons Stockpile, Nuclear Weapons Complex, Nuclear Weapons Delivery Systems, and Nuclear Weapons Command and Control System Specified in Section 1043 of the National Defense Authorization Act for Fiscal Year 2012* (Washington, D.C.: Apr. 2, 2015). We refer to this report as the DOD-DOE joint report.

[6]The National Defense Authorization Act for Fiscal Year 2013 included a provision that GAO review each joint report for accuracy and completeness with respect to the budget estimates. We most recently reported on the DOD-DOE joint report in December 2015. See GAO, *Nuclear Weapons Sustainment: Improvements Made to Budget Estimates Report, but Opportunities Remain to Further Enhance Transparency*, GAO-16-23 (Washington, D.C.: Dec. 10, 2015).

[7]Ike Skelton National Defense Authorization Act for Fiscal Year 2011, Pub. L. No. 111-383, § 3113, 124 Stat. 4137, 4509 (codified as amended at 50 U.S.C. § 2455).

[8]The results of last year's review are found in GAO, *Modernizing the Nuclear Security Enterprise: NNSA Increased Its Budget Estimates, but Estimates for Key Stockpile and Infrastructure Programs Need Improvement*, GAO-15-499 (Washington, D.C.: Aug. 6, 2015). In that report, we also assessed the extent to which NNSA's 2015 budget estimates addressed the agency's goal of stopping the growth of its deferred maintenance backlog.

To address these objectives, we reviewed NNSA's 2016 budget materials, specifically for its Weapons Activities appropriation account. This scope is consistent with that of our August 2015 review.[9] We focused our review on major modernization efforts—that is, refurbishment of nuclear weapons through LEPs and alterations and major construction efforts to replace aging facilities for plutonium and uranium. To determine the extent to which NNSA's budget estimates and plans for modernization activities differed from those in the 2015 budget materials, we compared the information in the 2016 budget materials with the information in the 2015 materials. We also interviewed agency officials to discuss changes in the materials from 2015 to 2016. To determine the extent to which NNSA's budget materials align with its modernization plans, we compared information on the budget estimates in the 2016 budget materials with the information on modernization plans in the same documents. We also interviewed NNSA officials to obtain further information on changes to modernization plans and discussed any perceived misalignments with them.

All figures in the report are presented in nominal, or current, dollars, which include projected inflation, unless otherwise noted. To assess the reliability of the data underlying NNSA's budget estimates, we reviewed the data to identify missing items, outliers, or obvious errors; interviewed NNSA officials knowledgeable about the data; and compared the figures in the congressional budget justification with those in the *Fiscal Year 2016 Stockpile Stewardship and Management Plan* to assess the extent to which they were consistent. We determined that the data were sufficiently reliable for our purposes, which were to report the total amount of budget estimates and those estimates dedicated to certain programs and budgets and to compare them to last year's estimates. All years are in fiscal years, unless otherwise noted. A detailed description of the scope and methodology of our review can be found in appendix I.

We conducted this performance audit from May 2015 to March 2016 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.

[9]GAO-15-499.

Background

Congress funds NNSA's modernization efforts through various programs and activities within the Weapons Activities appropriations account that generally address the following four areas:

- The **stockpile area** includes weapons refurbishments through LEPs and other major weapons alterations and modifications;[10] surveillance efforts to evaluate the condition, safety, and reliability of stockpiled weapons; maintenance efforts to perform certain minor weapons alterations or to replace components that have limited lifetimes; and core activities to support these efforts, such as maintaining base capabilities to produce uranium and plutonium components. NNSA allocates funds to activities that directly support the stockpile area through Directed Stockpile Work within the Weapons Activities appropriation account.

- The **infrastructure area** includes government-owned, leased, and permitted physical infrastructure and facilities supporting weapons activities. NNSA's 2016 nuclear security budget materials include information on two major types of infrastructure activities: (1) Infrastructure and Safety and (2) Readiness in Technical Base and Facilities, which includes two major construction projects. First, the Uranium Processing Facility is a construction project to replace enriched uranium capabilities currently located in the aging Building 9212 at the Y-12 National Security Complex. This project is part of a larger strategy to maintain NNSA's enriched uranium capability by relocating enriched uranium operations performed in Building 9212 into other existing buildings by 2025 and by constructing a series of smaller buildings.[11] Second, the Chemistry and Metallurgy Research Replacement construction project at Los Alamos National Laboratory,[12] which is part of NNSA's broader plutonium infrastructure strategy, is

[10]The *Fiscal Year 2016 Stockpile Stewardship and Management Plan* contains budget estimates for the W88 Alteration 370 as well as the following LEPs: W76-1, B61-12, B61-13, W80-4, IW-1, IW-2, and IW-3.

[11]In 2014, cost and schedule growth within the Uranium Processing Facility project led the NNSA Administrator to charter an independent review team to develop an alternate approach to completing the project, which was originally slated to be a single consolidated facility. GAO has previously issued reports examining the project. See, for example, GAO, *Nuclear Weapons: Some Actions Have Been Taken to Address Challenges with the Uranium Processing Facility Design*, GAO-15-126 (Washington, D.C.: Oct. 10, 2014).

[12]NNSA modified this construction project following the cancellation of the Chemistry and Metallurgy Research Replacement Nuclear Facility subproject in 2014.

composed of subprojects to move analytical chemistry and materials characterization capabilities into two existing facilities. NNSA's broader plutonium infrastructure strategy also includes the construction of at least two additional modular structures that the *Fiscal Year 2016 Stockpile Stewardship and Management Plan* reports will achieve operating capacity by 2027. The Uranium Processing Facility and the Chemistry and Metallurgy Research Replacement construction projects are both part of NNSA's major modernization efforts.

- The **research, development, testing, and evaluation area** is composed of programs that are technically challenging, multiyear, multifunctional efforts to develop and maintain critical science and engineering capabilities. These capabilities enable the annual assessment of the safety and reliability of the stockpile, improve understanding of the physics and materials science associated with nuclear weapons, and support the development of code-based models that replace underground testing.

- The **other weapons activities area** includes budget estimates associated with nuclear weapon security and transportation, as well as legacy contractor pensions,[13] among other things.

The four areas are interconnected. For example, experiments funded under the research, development, testing, and evaluation program area can contribute to the design and production of refurbished weapons, which is funded under the stockpile program area. The infrastructure program area offers critical support to both the stockpile and the research, development, testing, and evaluation program areas by providing a suitable environment for their various activities, such as producing weapons components and performing research and experimentation activities.

The U.S. nuclear weapons stockpile is composed of seven different weapons types, including air-delivered bombs, ballistic missile warheads, and cruise missile warheads (see table 1).

[13]NNSA is responsible for contributing to the pensions of certain employees and annuitants of the University of California who worked as contractors for NNSA until the mid-2000s.

Table 1: Types of Nuclear Weapons Currently in the U.S. Stockpile and Refurbishment Activities Planned from 2016 to 2040

Warhead or bomb type	Delivery system	Life extension program (LEP) or major alteration planned during 2016 to 2040	Description of LEP or major alteration, where applicable
B61-3/4/10 B61-7/11	Tactical bomb Strategic bomb	Yes	The National Nuclear Security Administration (NNSA) is consolidating the 3, 4, 7, and 10 modifications of the B61 bomb into a single B61-12 modification during an ongoing LEP.[a]
W76-0/1	Submarine-launched ballistic missile warhead	Yes	NNSA is replacing all W76-0 nuclear warheads with W76-1 warheads, which are currently being produced as part of an ongoing LEP.
W78	Intercontinental ballistic missile warhead	Yes	Together with the W88 warhead, this warhead will constitute the first interoperable option, the IW-1. An interoperable warhead is designed to be used on multiple delivery systems.
W80-4	Air-launched cruise missile warhead	Yes	This LEP is intended to provide a warhead for a future long-range standoff missile that will replace the Air Force's current air-launched cruise missile warhead.
B83-1	Strategic bomb		
W87	Intercontinental ballistic missile warhead	Yes	NNSA plans to refurbish the W87 as part of a future interoperable warhead LEP.
W88	Submarine-launched ballistic missile warhead	Yes	Together with the W78 warhead, this warhead will constitute the first interoperable warhead option, the IW-1.

Source: GAO analysis of National Nuclear Security Administration information. | GAO-16-290

[a]The *Fiscal Year 2016 Stockpile Stewardship and Management Plan* also includes budget estimates for studies related to a B61-13 LEP, beginning in 2038, to replace the B61-12 LEP.

Overall Budget Estimates and Plans for Modernization Differed Little from the Previous Year's, but Certain Programs Changed to a Greater Degree

NNSA's 2016 budget estimates for modernization total $297.6 billion over 25 years, which is a slight increase from the 2015 estimates of $293.4 billion; however, for certain program areas or individual programs, budget estimates changed more significantly. The overall increase was moderated by a shift of two counterterrorism programs to another area of NNSA's budget. Program areas increased by as much as 13.2 percent or decreased by as much as 18.1 percent. Within the stockpile program area, which experienced the biggest increase, budget estimates for some LEPs and an alteration increased significantly because of changes in production schedules and scope, among other things.

Overall Budget Estimates for Modernization Increased Slightly from Those in 2015 Plans but with Some Significant Realignments and Changes within Program Areas

According to the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, NNSA's estimates for the next 25 years total $297.6 billion for modernization activities—an increase of approximately $4.2 billion, or 1.4 percent (in nominal, or current dollar, values), from the $293.4 billion NNSA reported in the 2015 plan.[14] These budget estimates, which are for activities in the Weapons Activities area, are provided in the four areas discussed above: stockpile; infrastructure; research, development, testing, and evaluation; and other weapons activities. The overall increase was moderated by the shift of two counterterrorism programs from the Weapons Activities budget into NNSA's separate Defense Nuclear Nonproliferation budget. The two counterterrorism programs that were moved out of the Weapons Activities budget together totaled approximately $8 billion. According to NNSA's 2016 budget justification, this realignment is intended to provide greater clarity regarding the total funding and level of activity in the counterterrorism area. The realignment of these programs, along with other smaller decreases in the other weapons activities category, together accounted for an 18.1 percent decrease in the other weapons activities category during the 25-year period covered by the plan. Without the realignment of the two counterterrorism programs, the increase in NNSA's overall Weapons Activities budget in the 2016 plan would have been considerably larger, totaling approximately $12.3 billion, or 4.2 percent, over the 2015 Weapons Activities budget. Table 2 details the changes in NNSA's 25-year budget estimates from 2015 to 2016 for the four main areas in which modernization efforts are funded under Weapons Activities.

Table 2: Changes in National Nuclear Security Administration's (NNSA) 25-Year Estimates for Nuclear Weapon Modernization for 2015 and 2016

Dollars in billions

[14]By comparison, the $293.4 billion requested over 25 years in NNSA's *Fiscal Year 2015 Stockpile Stewardship and Management Plan* reflects an increase of approximately $17.6 billion, or 6.4 percent, from the $275.8 billion NNSA requested in 2014. NNSA did not submit a 2013 plan to Congress because analytic work conducted by DOD and NNSA to evaluate future needs for modernization activities across the nuclear security enterprise was not complete. The *Fiscal Year 2012 Stockpile Stewardship and Management Plan* stated that NNSA's budget estimates for 2012 through 2031 totaled $184 billion over that 20-year period.

Area	2015 25-year budget estimates (2015 to 2039)	2016 25-year budget estimates (2016 to 2040)	Difference	Percentage change
Stockpile	$103.5	$117.2	$13.7	13.2%
Infrastructure[a]	83.7	81.9	-1.8	-2.2%
Research, development, testing, and evaluation[b]	59.2	60.0	0.9	1.4%
All other weapons activities[c]	47.0	38.5	-8.5	-18.1%
Total	**$293.4**	**$297.6[d]**	**$4.2**	**1.4%**

Source: GAO analysis of Department of Energy data. | GAO-16-290

Notes: Because of rounding, numbers presented may not total exactly. The overall increase from the 2015 plan to the 2016 plan was moderated by the shift in 2016 of two counterterrorism programs from the Weapons Activities budget into NNSA's separate Defense Nuclear Nonproliferation budget. The two programs together totaled approximately $8 billion and were included in the all other weapons activities area. Further, budget estimates in the *Fiscal Year 2015 Stockpile Stewardship and Management Plan* cover 2015 to 2039, while those in the 2016 plan cover 2016 to 2040. We compared the two sets of estimates by summing up the current dollar values for each, which is how NNSA reports the estimates. The total from the 2016 plan is different from the 2015 plan's total in that the former includes the year 2040 and excludes the year 2015. Because of the effect of inflation, this comparison could make the difference between the 2016 projection and the 2015 projection appear higher than it would be in the case of a comparison of the two series in real dollar values or in a comparison that looks strictly at the years that overlap from each plan.

[a]Activities that had been funded in Readiness in Technical Base and Facilities in past years are now funded in either Readiness in Technical Base and Facilities or in Infrastructure and Safety. The Infrastructure total combines both these amounts.

[b]The *Fiscal Year 2014 Stockpile Stewardship and Management Plan* used science, technology, and engineering capabilities for this category, but the 2015 plan changed the name to research, development, testing, and evaluation.

[c]All other weapons activities include budget estimates associated with nuclear weapon security and transportation as well as legacy contractor pensions, among other things, that are also included in the Department of Energy's Weapons Activities.

[d]In the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, we found that NNSA omitted $214 million in budget estimates for the Chemistry and Metallurgy Research Replacement line item construction project in the years beyond the Future-Years Nuclear Security Program. An NNSA official confirmed that this amount—which was reported in the 2016 congressional budget justification—should have been included and its omission was the result of a data entry error. The budget estimates above reflect the revised data, which differ from the estimates contained in the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*.

In addition, budget estimates changed significantly for certain program areas and individual programs. Notably, the 2016 budget materials estimate that during the next 25 years, $117.2 billion will be needed for the stockpile area, which is an increase of $13.7 billion, or 13.2 percent, over the prior year's budget materials. Part of this increase resulted from the addition of approximately $3 billion to support the Domestic Uranium

Enrichment program,[15] as well as increases in estimates for weapons refurbishment activities, particularly LEPs, as discussed later in this report. The 2016 budget materials indicate a decrease of approximately $1.8 billion for infrastructure activities during the next 25 years, compared with the 2015 estimates, in part because of reductions in recapitalization and site operation budget estimates. The 2016 budget materials increased proposed spending on research, development, testing, and evaluation activities by approximately $900 million during the same period. This increase resulted in part from an increase in estimates for the Inertial Confinement Fusion Ignition and High Yield program.

Budget estimates in the *Fiscal Year 2015 Stockpile Stewardship and Management Plan* cover 2015 to 2039, while those in the 2016 plan cover 2016 to 2040. We compared the two sets of estimates by summing up the current dollar values for each, which is how NNSA reports the estimates. The total from the 2016 plan is different from the 2015 plan's total in that the former includes the year 2040 and excludes the year 2015. Because of the effect of inflation, this comparison could make the difference between the 2016 projection and the 2015 projection appear higher than it would be in the case of a comparison of the two series in real dollar values or in a comparison that looks strictly at the years that overlap from each plan.[16]

Budget Estimates for Some Major Modernization Efforts Have Increased Significantly

In the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, estimates for some major modernization projects increased significantly from those in 2015. Specifically, regarding the weapons refurbishment efforts—which are captured within the stockpile category in the budget—the 2016 budget materials indicate that during the next 25 years, $49.8 billion will be needed to support LEPs and other weapons alteration activities, which is an increase of $8.2 billion, or 19.6 percent, compared

[15]The Domestic Uranium Enrichment program is an effort to support the development of reliable and economic domestic uranium enrichment capability in order to support tritium production through unobligated low-enriched uranium, among other things.

[16]In a comparison that looks strictly at the years that overlap from each plan—that is, 2016 to 2039—the change in estimates is a decrease of 1 percent from 2015 to 2016. As noted, the *Stockpile Stewardship and Management Plan* is intended as a budgetary planning guide—a strategic program of record—for the next 25 years. Consequently, comparing the activities and the budget estimates intended to support those activities across the 25-year periods in the different plans provides insights for budgeting planning purposes as to how NNSA's nuclear security budget materials have changed from one plan to the next.

with the prior year's estimate of $41.7 billion.[17] This increase resulted partly from the change in the scope and schedule for some programs, as discussed below.

- The W88 Alteration 370 effort expanded to include a conventional high explosive replacement while retaining the original schedule for a first production unit in 2020.[18] To support this replacement, NNSA shifted planned spending for other programs—including $15.1 million originally planned for the W76-1 LEP—toward this effort. The *Fiscal Year 2016 Stockpile Stewardship and Management Plan* reported that the agency also shifted planned spending intended for surveillance of B61 and B83 bombs into the conventional high explosive replacement effort. The *Fiscal Year 2016 Stockpile Stewardship and Management Plan* estimated the total cost for the W88 Alteration 370 at $2 billion over the 25-year period covered by the plan, while the 2015 plan estimated the total cost at $1.2 billion, for an increase of approximately $0.8 billion.

- The cruise missile warhead LEP (renamed the W80-4 LEP) now has a first production unit planned for 2025—2 years earlier than the first production unit in the 2015 plan. This shift in schedule is intended to align with revised Air Force plans for the carrier missile. The *Fiscal Year 2016 Stockpile Stewardship and Management Plan* estimated the total cost for the LEP at $8.2 billion over 25 years, while the 2015 plan estimated the total cost at $6.8 billion, for an increase of approximately $1.5 billion.

- The *Fiscal Year 2016 Stockpile Stewardship and Management Plan* included a budget estimate for the B61-13 LEP that did not appear in the 2015 plan. This LEP, which NNSA officials stated is intended to replace the B61-12 LEP, is currently planned to begin in 2038, with an estimated cost of approximately $1.2 billion from 2038 through 2040.

- Budget estimates for the three interoperable warhead LEPs—the IW-1, 2, and 3—together accounted for an increase of $5.6 billion over 25 years when compared with the *Fiscal Year 2015 Stockpile Stewardship and Management Plan* budget estimates. According to

[17]Because of rounding, numbers presented may not total exactly.

[18]The "first production unit" is the first complete warhead from a production line certified for deployment.

the plan, this increase resulted from updated estimates developed through an expanded methodology that incorporated additional stakeholder input into the process that NNSA used to arrive at the estimates, and which resulted in a better understanding of schedule and cost uncertainty.[19] NNSA officials stated that they continue to use stakeholder input to update and assess the cost estimate methodology.

- The budget estimates for the B61-12 and W76-1 LEPs together accounted for a decrease of almost $1 billion when compared with 2015 estimates. NNSA officials stated that this decrease is the result of the LEPs' costs winding down as the programs come to an end.

Table 3 shows the changes in budget estimates for the weapons refurbishment activities under way during the 25-year period covered by the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*.

Table 3: Changes in Life Extension Programs' (LEP) and Alteration Activities' 25-Year Estimates for Nuclear Weapon Modernization for Fiscal Years 2015 and 2016

Then-year dollars in billions

LEP or alteration	Fiscal year 2015 estimates	Fiscal year 2016 estimates	Change in estimates from 2015 to 2016
W88 Alteration 370	$1.2	$2.0	$0.8
W80-4	6.8	8.2	1.5
B61-13	—	1.2	1.2
IW-1	10.9	13.4	2.5
IW-2	8.8	12.1	3.2
IW-3	6.5	6.3	-0.1
B61-12	6.4	5.7	-0.6
W76-1	1.2	0.8	-0.3
Total	**$41.7**	**$49.8**	**$8.2**

Source: GAO analysis of Department of Energy data. | GAO-16-290

Note: Because of rounding, numbers presented may not total exactly.

[19]For fiscal year 2016, NNSA included contributions from nuclear security enterprise contractors and federal program managers for planning LEPs, which was a change from how the agency had prepared estimates for fiscal year 2015. NNSA officials said that input from these experts helped NNSA address program uncertainty.

Milestone dates for most major modernization projects generally remained the same in the 2016 plan compared with the previous year. The 2010 *Nuclear Posture Review* included discussion of a number of planned major modernization efforts for NNSA, while other efforts have been identified in later versions of the *Stockpile Stewardship and Management Plan* and in the 2011 update to the DOD-DOE joint report. Table 4 shows key milestone dates for LEPs and major construction efforts as they have changed since 2010.

Table 4: Changes in Schedules for the National Nuclear Security Administration's (NNSA) Major Modernization Efforts, According to Agency Planning Documents, Fiscal Years 2010-2016

	2010 Nuclear Posture Review	2011 Update to the Joint NNSA and Department of Defense report[a]	2012 Stockpile Stewardship and Management Plan	2013 NNSA congressional budget justification[b]	2014 Stockpile Stewardship and Management Plan	2015 Stockpile Stewardship and Management Plan	2016 Stockpile Stewardship and Management Plan
W76-1 Life extension program (LEP) end of production date[c]	2017	2018	2018	Not provided[d]	2019	2019	2019
B61-12 LEP first production unit date[e]	2017	2017	2017	Not provided[d]	2019	2020	2020
W88 Alteration 370 first production unit date[e]	Not discussed	Not provided	2018[f]	Not provided	2019	2020	2020
Cruise missile (W80-4) LEP first production unit date[e]	Not discussed	Not discussed	2031	Not provided	2024	2027	2025
W78/88-1 / Interoperable warhead-1 (IW-1) LEP first production unit date[e]	Initiate study	Study options	Study options[g]	2023[h]	2025	2030	2030
IW-2 LEP first production unit date[e]	Not discussed	Not discussed	Not discussed	Not discussed	2031	2034	2034
IW-3 LEP first production unit date[e]	Not discussed	Not discussed	Not discussed	Not discussed	2037	2041	Not specified
Uranium Processing Facility operational date[i]	2021	2024	2024	2022	Phase 1: 2025 Begin phases 2 and 3 in 2030	Phase 1: 2025 Begin phases 2 and 3 in 2030	Completion of all activities by 2025

	2010 Nuclear Posture Review	2011 Update to the Joint NNSA and Department of Defense report[a]	2012 Stockpile Stewardship and Management Plan	2013 NNSA congressional budget justification[b]	2014 Stockpile Stewardship and Management Plan	2015 Stockpile Stewardship and Management Plan	2016 Stockpile Stewardship and Management Plan
W76-1 Life extension program (LEP) end of production date[c]	2017	2018	2018	Not provided[d]	2019	2019	2019
B61-12 LEP first production unit date[e]	2017	2017	2017	Not provided[d]	2019	2020	2020
W88 Alteration 370 first production unit date[e]	Not discussed	Not provided	2018[f]	Not provided	2019	2020	2020
Cruise missile (W80-4) LEP first production unit date[e]	Not discussed	Not discussed	2031	Not provided	2024	2027	2025
W78/88-1 / Interoperable warhead-1 (IW-1) LEP first production unit date[e]	Initiate study	Study options	Study options[g]	2023[h]	2025	2030	2030
Chemistry and Metallurgy Research Replacement / plutonium strategy operational date[i]	2021	2023	2023	Deferred to 2028 or later	Deferred. Alternative strategy in development	Deferred. Alternative strategy in development	Construct at least two modular structures that will achieve full operating capacity by 2027[j]

Source: GAO analysis of NNSA planning documents cited above. | GAO-16-290

[a]This document is the update to the fiscal year 2011 joint NNSA Department of Defense report, which was the first set of long-term budget estimates made available subsequent to the release of the 2010 *Nuclear Posture Review*.

[b]NNSA did not publish a *Stockpile Stewardship and Management Plan* for 2013. Instead, we report data from NNSA's 2013 congressional budget justification.

[c]For the W76-1 LEP, we report the date from the end of production rather than for the first production unit because the first production unit was completed in 2008.

[d]NNSA's 2013 congressional budget justification stated that completion of production would be discussed in the 2013 *Stockpile Stewardship and Management Plan*, which was never published.

[e]The first production unit is the first complete warhead from a production line certified for deployment.

[f]The first production unit schedule discussed is for a W88 program of smaller scope than the W88 Alteration 370.

[g]The *Fiscal Year 2012 Stockpile Stewardship and Management Plan* included separate schedules for first production units of LEPs for the W88 and W78 warheads if a single, interoperable warhead was not to be pursued. In June 2012, the Nuclear Weapons Council authorized a study for a W78/88-1 interoperable warhead, now known as the IW-1.

[h]The option presented in NNSA's 2013 congressional budget justification is for a W78 LEP.

[i]The Uranium Processing Facility construction project began as a single large project but was later broken up into three separately phased projects. The current Uranium Processing Facility line item construction project is intended to replace activities in an aging building at Y-12.

[j]The new strategy is intended to cease operations in the Chemistry and Metallurgy Research building at Los Alamos National Laboratory in 2019, and the construction of the modules by 2027 is intended to support the goal of achieving a capability of 50 to 80 pits per year by 2030.

Estimates for the two major construction projects we reviewed—the Uranium Processing Facility and the Chemistry and Metallurgy Research Replacement construction project—did not change or saw a reduction in estimates along with a recategorization of costs. These projects, included in the infrastructure category in NNSA's budget materials, support NNSA's uranium and plutonium strategies, respectively. The Uranium Processing Facility project budget line in the *Fiscal Year 2016 Stockpile Stewardship and Management Plan* stayed the same as reported in the 2015 plan, with a total estimated budget of $5.2 billion from 2015 through the project's planned completion in 2025.[20]

The 2016 budget estimates for the Chemistry and Metallurgy Research Replacement construction project decreased, and in comparison to the 2015 budget materials, these estimates also shifted from one budget category to another. The *Fiscal Year 2015 Stockpile Stewardship and Management Plan* included a line for budget estimates for this project; however, the estimates were zero for each year except for 2012.[21] The 2015 plan included budget estimates that totaled $3.1 billion in the program readiness subcategory under the infrastructure category, which NNSA officials stated were ultimately intended for the Chemistry and Metallurgy Research Replacement construction project. In the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, NNSA shifted $1.7 billion in planned spending out of program readiness and into the construction project's line item, also under the infrastructure category. This shift appears to be an increase in the total amount for major construction activities in the 2016 budget materials. However, as noted above, the overall total for infrastructure declined slightly, in part because NNSA officials said that they determined that the remainder of the $3.1 billion from program readiness is not required to support the project. Nevertheless, the $1.7 billion reported in the *Fiscal Year 2016 Stockpile Stewardship and Management Plan* is $214 million lower than the total estimates that NNSA reported in its 2016 congressional budget justification, which

[20]NNSA's 2016 budget justification notes that the budget for the project is not to exceed $6.5 billion.

[21]The 2015 plan shows $200 million in estimates for the construction line item for 2012 and zeroes for 2013 through 2019.

included a more detailed construction project data sheet for the project. An NNSA official confirmed that this amount should have been included in the plan and its omission was the result of a data entry error. Consequently, the amount for the project in the construction line item should be approximately $1.9 billion.

The *Fiscal Year 2016 Stockpile Stewardship and Management Plan* includes a goal to stop the growth of the agency's deferred maintenance backlog.[22] The plan notes that there has been limited availability for capital and maintenance funding in recent years, but NNSA officials stated that they are working to ensure that there is no increase in deferred maintenance relative to the level at the end of 2015. In August 2015, we found that NNSA's infrastructure budget estimates were not adequate to address its deferred maintenance backlog and that the backlog would continue to grow.[23] We recommended that in instances where budget estimates do not achieve DOE benchmarks for maintenance and recapitalization investment over the 5-year budget estimates, NNSA identify in the budget materials the amount of the shortfall and the effects, if any, on the deferred maintenance backlog. We also recommended that until improved data about the importance of facilities and infrastructure to mission are available, NNSA clarify in the budget materials for the Future-Years Nuclear Security Program the amount of the deferred maintenance backlog that is associated with facilities that have little to no effect on programmatic operations and is therefore low priority to be addressed. NNSA concurred with our recommendations. Specifically, NNSA agreed to include more information on maintenance, recapitalization, and deferred maintenance on excess facilities and stated that it will address them in the 2017 budget request or budget support materials as appropriate. Similarly, NNSA officials agreed that until improved data about the importance of facilities and infrastructure to the mission are available, they plan to clarify in the budget materials for the Future-Years Nuclear Security Program the amount of the deferred maintenance backlog that is associated with facilities that have little to no effect on programmatic operations and is therefore low priority to be addressed.

[22]In general, deferred maintenance consists of maintenance activities that were not performed when they should have been or were scheduled to be and therefore are put off or delayed for a future period.

[23]GAO-15-499.

Budget Estimates Do Not Reflect All Elements of Modernization Plans, although the Full Cost Difference May Be Difficult to Assess

The estimates in NNSA's 2016 nuclear security budget materials may not align with plans for some major modernization efforts for several reasons. In particular, the *Fiscal Year 2016 Stockpile Stewardship and Management Plan* includes several major modernization efforts that may require more funding in some years than the plan reflects, raising questions about the alignment of NNSA's modernization plans with potential future budgets. In addition, for some nuclear weapon refurbishment programs, the low end of NNSA's internally developed cost ranges exceeds the estimates included in the budget materials. Further, some costs, such as those for certain infrastructure upgrades, are not included in NNSA's budget estimates, and dependency on other NNSA programs could lead to increases in program costs. NNSA officials provided various reasons for the discrepancies, which they said could be addressed in future planning.

Major Modernization Efforts Beyond the Future-Years Nuclear Security Program May Cost More Than Budget Estimates Reflect

The *Fiscal Year 2016 Stockpile Stewardship and Management Plan*'s estimates for Weapons Activities are $4.4 billion higher than the out-year projections for funding levels in the President's budget provided in the DOD-DOE joint report. Specifically, for the years 2021 through 2025—the 5 years after the 2016 Future-Years Nuclear Security Program—the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*'s Weapons Activities budget estimates total $56.6 billion. However, these budget estimates exceed a set of out-year projections for nuclear modernization and sustainment activities over the same time period. Specifically, the DOD-DOE joint report included additional information on out-year projections in the 2016 President's budget for Weapons Activities through 2025. These out-year projections total $52.2 billion from 2021 to 2025, or $4.4 billion less than DOE's budget estimates over the same time period (see table 5).[24]

Table 5: Comparison of the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*'s Weapons Activities Budget Estimates and Out-Year Projections in the President's Budget from the 2016 Department of Defense (DOD) and Department of Energy (DOE) Joint Report, Fiscal Years 2021-2025

Dollars are in billions

Fiscal year	2021	2022	2023	2024	2025	2021–2025 (total)

[24]An NNSA official told us that the President's budget out-year projections were provided by the Office of Management and Budget.

Fiscal year	2021	2022	2023	2024	2025	2021–2025 (total)
Fiscal Year 2016 Stockpile Stewardship and Management Plan's Weapons Activities budget estimates	$10.8	$11.0	$11.5	$11.5	$11.8	**$56.6**[a]
DOD-DOE joint report's out-year projections in the President's budget	10.0	10.2	10.4	10.6	10.9	**$52.2**
Amount the plan's estimates exceed out-year projections in the President's Budget	$0.8	$0.8	$1.0	$0.9	$0.9	**$4.4**

Source: GAO analysis of *Fiscal Year 2016 Stockpile Stewardship and Management Plan* data and out-year projections in the President's budget. | GAO-16-290

Notes: Because of rounding, numbers presented may not total exactly. DOE stated that amounts identified in the DOD-DOE joint report as out-year projections in the President's budget were provided by the Office of Management and Budget.

[a]In the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, we found that the National Nuclear Security Administration (NNSA) omitted $214 million in budget estimates for the Chemistry and Metallurgy Research Replacement construction project in the years beyond the 2016 Future-Years Nuclear Security Program. An NNSA official confirmed that this amount—which was reported in the 2016 congressional budget justification—should have been included and its omission was the result of a data entry error. The budget estimates above reflect the revised data, which differ from the estimates contained in the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*.

This misalignment between the *Fiscal Year 2016 Stockpile Stewardship and Management Plan* and the estimates described as out-year projections in the President's budget in the DOD-DOE joint report corresponds to a challenging period for NNSA modernization efforts, as the agency plans to simultaneously execute at least four LEPs along with several major construction projects, including efforts to modernize NNSA's uranium and plutonium capabilities. The differences between these two sets of numbers raise questions about the alignment of NNSA's modernization plans with potential future budgets. NNSA notes this issue in the *Fiscal Year 2016 Stockpile Stewardship and Management Plan* and states that it will need to be addressed as part of fiscal year 2017 programming. According to an NNSA official from the office that coordinated production of the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, the additional line of out-year projections in the 2016 President's budget was included in the 2016 DOD-DOE joint report at the request of the Office of Management and Budget. This official told us that the out-year projections included in the DOD-DOE joint report represent DOE's evaluation of what modernization activities will cost for these years based on current plans and available information. NNSA officials also stated that the President's budget information was included in the 2016 DOD-DOE joint report to show that the administration has not

yet agreed to fund these activities beyond the Future-Years Nuclear Security Program at the level reflected in NNSA's budget estimates. In addition, NNSA officials stated that there is a high level of uncertainty in the budget estimates beyond the Future-Years Nuclear Security Program, which makes planning beyond 5 years difficult.

Estimates for Some Major Modernization Efforts in NNSA's Budget Materials Were Lower Than Its Program-Specific Estimates

On the basis of our analysis of NNSA's internally developed cost ranges for certain major weapon modernization efforts, we found that the low end of these ranges sometimes exceeded the estimates that NNSA included for those programs in its budget materials. We analyzed NNSA's budget estimates for nuclear weapon refurbishments over the 25 years covered in the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*—the W76-1, the B61-12, the B61-13, the W80-4, and the IW-1, 2, and 3 LEPs, as well as the W88 Alteration 370. The Directed Stockpile Work category in the plan and in the 2016 Future-Years Nuclear Security Program contain detailed budget information on weapon refurbishment efforts that includes specific budget estimates for each effort as well as high and low cost ranges that NNSA developed for them.[25] For each effort, we assessed the extent to which the budget estimates aligned with its high-low cost estimates.[26] Specifically, we examined instances where the low end of the cost range estimates was greater than the budget estimates.

We found that the annual budget estimates are generally consistent with NNSA's internal cost estimates; that is, in most years, the annual budget estimates for each weapon refurbishment effort fall within the high and low cost ranges that NNSA developed for each program. However, in some years, NNSA's budget estimates for some refurbishment efforts may not align with modernization plans. Specifically, for some years, the low end of cost ranges that NNSA developed for some LEPs exceeds the budget estimates.[27] This indicates potential misalignment between plans and

[25]According to NNSA, because the W76-1 LEP is the only weapon program that has been through the development phase and the majority of the production phase, NNSA uses it as the primary basis for modeling cost range estimates for all future LEPs. NNSA does not prepare high and low cost range estimates for it.

[26]Because NNSA does not prepare high and low cost estimates for the W76-1, we compared the budget estimates for each fiscal year with the internal cost estimates NNSA developed for the LEP.

[27]NNSA officials noted that the values in these cost ranges reflect idealized funding profiles and do not account for the practical constraints of the programming and budgeting cycle.

budget estimates for those programs in those years, or the possible need for NNSA to increase budget estimates for those programs in the future. For instance, see the following:

- The B61-12 LEP's budget estimates during the 5-year period covered by the Future-Years Nuclear Security Program align with plans. However, the low cost range estimate of $195 million for the final year of production in 2025 exceeds the budget estimate of $64 million. NNSA officials said that this difference is not a concern because this misalignment occurs during the final year of the LEP effort and this estimate may overstate costs for the end of B61-12 program.

- The W88 Alteration 370's low cost range estimate exceeds its budget estimate for 2020. The budget materials report that the program's budget estimate that year is $218 million; however, the low point of the cost range is $247 million. NNSA officials stated that this is not a concern because there is flexibility to address possible misalignments in future programming cycles. NNSA officials also stated that the total estimates for this program are above the total of the midpoint cost estimates for 2016 through 2020 and that funding for 2016 to 2019 is fungible and could be carried over to cover any potential shortfall in 2020.

- The W80-4 LEP's low range cost estimate of $476 million exceeds its budget estimates of $459 million for 2020. NNSA officials stated that because the budget estimates for this LEP are above the low point of its estimated cost range during other years, the misalignment in 2020 represents a small incongruity in an otherwise sound LEP profile.

- The budget estimates for the IW-1 LEP are within the high and low estimated cost ranges for most years. However, the IW-1's low cost range estimate of $175 million exceeds its budget estimate of $113 million in 2020, which is its first year of funding. NNSA officials said that by shifting funding projected for 2021 to 2020, the IW-1 budget estimates would still be within the cost ranges.

For the W76-1 LEP, we compared the budget estimates in the 2016 Future-Years Nuclear Security Program and the *Fiscal Year 2016 Stockpile Stewardship and Management Plan* with internal cost estimates NNSA developed for the LEP. We found that the budget estimates for all years within the Future-Years Nuclear Security Program, except for 2018, are below NNSA's internal cost estimates for that program, raising questions about whether the budget for the LEP is aligned with anticipated costs. According to NNSA officials, the W76-1 LEP is nearing

completion, and the model used to develop internal cost estimates for the W76-1 is predicting the LEP's end-of-program costs in a way that may not reflect the rate at which the program winds down. For more information on the LEPs and their budget estimates and cost ranges in the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, see appendix II.

NNSA officials stated that the intent in providing budget estimates and cost range estimates for each weapon refurbishment effort is to show general agreement between the two sets of estimates. Notwithstanding the differences we identified between budget estimates and low-end cost range estimates for certain efforts in certain years, NNSA officials stated that the budget estimates and the cost range estimates are in general agreement for each LEP and alteration in terms of total costs and trend. In addition, NNSA officials stated that there is some flexibility in the funding for these efforts, and that the programs may carry over some funds from one year to the next if needed to cover costs, depending on the reason for the misalignment, among other things.

In our August 2015 report on NNSA's nuclear security budget materials, we found that not including information that identifies potential misalignments in LEP budget estimates compared with the LEP internal cost estimates can potentially pose risks to the achievement of program objectives and goals, such as increase in program costs and schedule delays. NNSA agreed with our recommendation from that report to provide more transparency with regard to shortfalls in its budget materials. Specifically, NNSA said that it would include, as appropriate, statements in future *Stockpile Stewardship and Management Plans* on the effect of funding an LEP effort at less than suggested by a planning estimate cost range. NNSA officials also said that the agency plans to incorporate this recommendation, among others, into its 2017 budget materials.

Some Costs Are Not Included in Modernization Budget Estimates, and Dependency on Other Programs Could Lead to Increases in Estimates

We identified instances where certain modernization costs were not included in budget estimates or may be underestimated. For example, see the following:

- The budget estimates for the W88 Alteration 370 with a conventional high explosive replacement—or refresh—are understated, according to NNSA officials. The budget estimates for the refresh reported in the 2016 budget materials are roughly $300 million less than the refresh requires. Officials told us that the initial budget planning for the refresh contained a cost of approximately $500 million. However, NNSA found that this estimate was incorrect and increased it to

approximately $800 million. NNSA officials stated that this project is still in the process of establishing a new, official baseline, which officials expect to complete in 2016.

- The 2016 budget materials may not contain all necessary costs for NNSA's efforts to maintain its enriched uranium capability, which include relocating select operations performed in Building 9212 to other existing buildings and constructing a series of smaller buildings. Specifically, NNSA officials stated that the budget estimates in the 2016 budget materials for these efforts do not include the costs associated with infrastructure upgrades (such as ceiling repairs and heating, air conditioning, and other controls systems) in two existing buildings at the Y-12 site. NNSA officials stated that the scope to maintain operations in the existing facilities is being developed and prioritized into a multiyear effort among multiple programs, separate from the Uranium Processing Facility project. According to another NNSA official, these costs were still under development, but the official estimated that the upgrades may cost tens of millions of dollars for each building.

- The costs of the plutonium infrastructure strategy—in which NNSA is currently preparing to move analytical chemistry and materials characterization capabilities into existing facilities as part of the Chemistry and Metallurgy Research Replacement construction project while also considering constructing new modular buildings under a separate project—are also uncertain and possibly underestimated. This uncertainty is due to the fact that NNSA has not yet determined the number of additional modular buildings that may be required, although the *Fiscal Year 2016 Stockpile Stewardship and Management Plan* calls for at least two. NNSA officials also stated that estimated costs for these efforts have not yet been baselined and that the cost of such a project cannot be estimated with any certainty until it has proceeded further into the planning process and established a baseline.

In addition to some costs not being included in budget estimates, the estimates for some NNSA modernization efforts could increase in the future because of their dependency on successful execution of other NNSA programs. Specifically, NNSA managers for the LEPs stated that some of these programs could incur future cost increases or schedule

delays because of other NNSA programs supporting the LEPs.[28] For instance, NNSA officials told us that the W80-4 LEP will require a new insensitive high explosive to support the system. This is because the B61-12 LEP is consuming the currently available stocks of insensitive high explosive. As a result, NNSA is developing a new insensitive high explosive to meet the needs of the W80-4 LEP. However, NNSA officials told us that the performance of the new explosive currently being produced is not comparable to the quality of existing explosive being consumed by the B61-12 LEP. Consequently, these officials stated that the costs of the W80-4 LEP could rise because of additional funding that may be required to further develop the new explosive. The *Fiscal Year 2016 Stockpile Stewardship and Management Plan* notes that as design options are down selected, the budget estimate for the W80-4 may shift in response.

An NNSA official also stated that the IW-1 LEP budget estimates in the 2016 budget materials are predicated on NNSA successfully modernizing its plutonium pit production capacity.[29] The official stated that if there are delays in the current plutonium infrastructure strategy, the IW-1 LEP will bear costs that are greater than currently estimated to produce the number of additional plutonium pits it needs to support the program. The *Fiscal Year 2016 Stockpile Stewardship and Management Plan* notes that estimates for programs in their earlier stages, such as the IW-1 LEP, are subject to uncertainty. We previously found that NNSA has experienced significant cost increases and schedule delays in its earlier strategies to modernize its plutonium pit production support facilities at Los Alamos

[28]We found in December 2013 that the budget estimates for stockpile modernization do not represent the total cost for maintaining the stockpile. Because of the interconnected nature of NNSA's activities, some budget estimates to support the stockpile are included in the infrastructure area and in the research, development, testing, and evaluation area of the NNSA budget. For example, some of the budget estimates for the LEPs include, where applicable, "other program money," which is funding from other offices in NNSA to support the LEPs through activities such as technology maturation and component development, among other things. See GAO, *Modernizing the Nuclear Security Enterprise: NNSA's Budget Estimates Do Not Fully Align with Plans*, GAO-14-45 (Washington, D.C.: Dec. 11, 2013).

[29]This capacity is consistent with NNSA's updated plutonium infrastructure strategy, which includes ceasing operations in the Chemistry and Metallurgy Research building at the Los Alamos National Laboratory by 2019 and achieving plutonium pit production through a combination of new and existing buildings.

National Laboratory.[30] We have ongoing work examining the Chemistry and Metallurgy Research Replacement construction project in more detail.

Agency Comments

We provided a draft of this report to DOE and NNSA for their review and comment. NNSA provided written comments, reproduced in appendix III, in which it stated that it will continue to enhance information on potential funding levels in future budget supporting materials.

NNSA also provided technical comments separately, which we incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Secretary of Energy, the Administrator of NNSA, and other interested parties. In addition, the report is available at no charge on the GAO website at http://www.gao.gov.

If you or your staff members have any questions about this report, please contact me at (202) 512-3841 or trimbled@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 IV.

David C. Trimble
Director, Natural Resources and Environment

[30]GAO, *Modernizing the Nuclear Security Enterprise: New Plutonium Research Facility at Los Alamos May Not Meet All Mission Needs*, GAO-12-337 (Washington, D.C.: Mar. 26, 2012).

List of Committees

The Honorable John McCain
Chairman
The Honorable Jack Reed
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Lamar Alexander
Chairman
The Honorable Dianne Feinstein
Ranking Member
Subcommittee on Energy and Water Development
Committee on Appropriations
United States Senate

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The Honorable Adam Smith
Ranking Member
Committee on Armed Services
House of Representatives

The Honorable Mike Simpson
Chairman
The Honorable Marcy Kaptur
Ranking Member
Subcommittee on Energy and Water Development, and Related Agencies
Committee on Appropriations
House of Representatives

Appendix I: Objectives, Scope, and Methodology

Our objectives were to assess (1) the extent to which the National Nuclear Security Administration's (NNSA) budget estimates and plans for modernization activities reflected in its fiscal year 2016 nuclear security budget materials differ, if at all, from those in its fiscal year 2015 budget materials and (2) the extent to which the fiscal year 2016 nuclear security budget materials align with modernization plans as presented in the *Stockpile Stewardship and Management Plan*.

We limited the scope of our review to NNSA's Weapons Activities appropriations account, because NNSA's activities in the *Stockpile Stewardship and Management Plan* are funded by this account. This scope is consistent with that of our August 2015 review.[1] We focused our review on major modernization efforts—that is, the refurbishment of nuclear weapons through life extension programs (LEP) and alterations and major construction efforts to replace existing, aging facilities for plutonium and uranium.[2] The budget projections in the 2015 and 2016 *Stockpile Stewardship and Management Plans* each contain budget dollar figures for 25 years, presented in current dollar values. Our report presents all figures in current, or nominal, dollars, which include projected inflation, unless otherwise noted. Further, all years noted in our report refer to fiscal years, unless otherwise noted.

To determine the extent to which NNSA's budget estimates and plans for modernization activities differed from those in the 2015 nuclear security budget materials, we compared the information in the 2016 materials with the information in the 2015 materials. NNSA's nuclear security budget materials are composed of two key policy documents that are issued annually: the agency's budget justification, which contains estimates for the 5-year Future-Years Nuclear Security Program, and the *Stockpile Stewardship and Management Plan*, which provides budget estimates over the next 25 years. Specifically, we (1) compared differences

[1]GAO, *Modernizing the Nuclear Security Enterprise: NNSA Increased Its Budget Estimates, but Estimates for Key Stockpile and Infrastructure Programs Need Improvement*, GAO-15-499 (Washington, D.C.: Aug. 6, 2015).

[2]LEPs extend, through refurbishment, the operational lives of weapons in the nuclear stockpile by 20 to 30 years and certify these weapons' military performance requirements without underground nuclear testing. Much like a nuclear weapon LEP, a weapon alteration refurbishes components to ensure that a weapon can continue to meet military requirements. However, an alteration generally refurbishes fewer components than an LEP and is typically intended to fix a particular issue or extend the life of a particular component.

between the 2016 and 2015 budget materials in the four broad modernization areas—stockpile; infrastructure; research, development, testing, and evaluation; and other weapons activities—and (2) compared differences between the 2016 and 2015 budget materials for specific weapons refurbishment activities and major construction projects. We interviewed knowledgeable officials from NNSA about changes we identified between the 2016 and 2015 budget materials. We also reviewed a third, integrated document on plans for the nuclear deterrent that includes information on the Department of Defense (DOD) and Department of Energy's (DOE) modernization budget estimates. This annual report that DOD and DOE are required to submit jointly to the relevant Senate and House committees and subcommittees is referred to as the section 1043 report; in our report, we refer to it as the DOD-DOE joint report. We compared the information in the 2016 DOD-DOE joint report with that in the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*.

To determine the extent to which NNSA's budget materials align with its modernization plans, we compared information on the budget estimates in the 2016 budget materials with the information on modernization plans in the materials as well as the DOD-DOE joint report, reviewed prior GAO reports to provide context for the concerns we identified, and interviewed NNSA officials to obtain further information on changes to modernization plans and discussed any perceived misalignments with them.

For weapons refurbishment efforts under way during the 25 years covered by the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, we analyzed NNSA's budget estimates for all those to be conducted over the 25-year period by comparing them against NNSA's internally developed cost ranges for each LEP. According to DOE officials, for all LEPs besides the W76-1, DOE uses two different approaches to estimate the costs of LEPs. Under the first approach, according to officials, DOE develops specific budget estimates by year through a bottom-up process. DOE officials describe this as a detailed approach to developing the LEP budget estimates, which, among other things, integrates resource and schedule information from site participants. Under the second approach, which DOE refers to as a top-down process, DOE uses historical LEP cost data and complexity factors to project high and low cost ranges for each LEP distributed over the life of the program using an accepted cost distribution method. Officials noted that the values in these cost ranges reflect idealized funding profiles and do not account for the practical constraints of the programming and budgeting cycle. For the W76-1 LEP, DOE has developed specific budget estimates by year. Because the

W76-1 LEP is the basis of DOE's top-down model, DOE does not develop high and low cost ranges for it. Instead, DOE published the W76-1 LEP estimates in the *Fiscal Year 2016 Stockpile Stewardship and Management Plan* as a comparison between the Future-Years Nuclear Security Program request and a single LEP model line. For the W76-1 LEP, we compared the budget estimates with the LEP model line.

For all LEPs besides the W76-1, we assessed the extent to which the specific bottom-up budget estimates were aligned with the high-low cost ranges developed through the top-down model. Specifically, we examined where the specific budget estimates were under the low end of the cost range predicted by the top-down model. We did this by reviewing charts in the *Fiscal Year 2016 Stockpile Stewardship and Management Plan* and the underlying data for those charts. In instances where the low cost range exceeded the budget estimates, we followed up with NNSA officials for additional information.

To assess the reliability of the data underlying NNSA's budget estimates, we reviewed the data to identify missing items, outliers, or obvious errors; interviewed NNSA officials knowledgeable about the data; and compared the figures in the congressional budget justification with those in the *Fiscal Year 2016 Stockpile Stewardship and Management Plan* to assess the extent to which they were consistent. We determined that the data were sufficiently reliable for our purposes, which were to report the total amount of budget estimates and those estimates dedicated to certain programs and budgets and to compare them to last year's estimates.

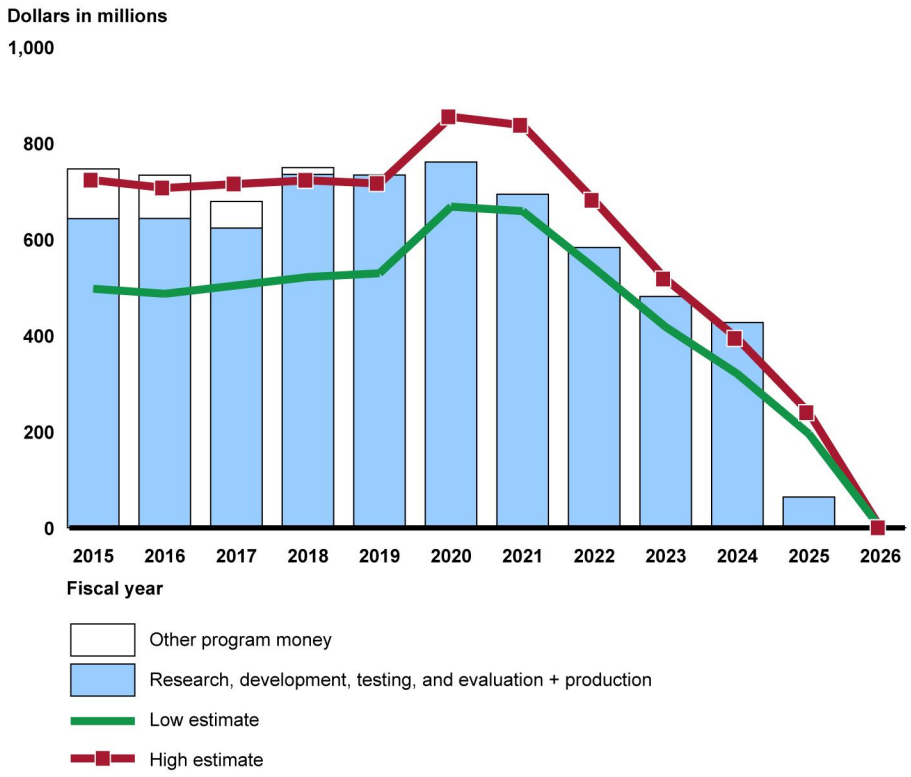
We conducted this performance audit from May 2015 to March 2016 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: Figures Showing Life Extension Program and Alteration Budget Estimates and Cost Ranges from the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*

The National Nuclear Security Administration (NNSA) has developed budget estimates for its nuclear weapons life extension programs (LEP) and major alterations: the B61-12, the W76-1, the W80-4, the IW-1, the IW-2, the IW-3, and the B61-13 LEPs, as well as for the W88 Alteration 370. The estimates include NNSA's internally developed high and low cost ranges for each program. The budget estimates appear as bars for each year, while the high and low cost ranges are represented by lines across the figures. The following figures present budget estimates for each LEP and alteration. Similar figures also appear in the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*.

B61-12: The B61 bomb is one of the oldest nuclear weapons in the stockpile. The B61-12 LEP will consolidate and replace the B61-3, -4, -7, and -10 bombs. According to the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, this consolidation will enable a reduction in the number of gravity bombs, which is consistent with the objectives of the 2010 *Nuclear Posture Review.* The first production unit of the B61-12 is planned for 2020; the program is scheduled to end in 2026. In the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, NNSA estimates that the B61-12 LEP will require a total of $5.7 billion from 2016 to 2026. See figure 1 for an illustration of budget estimates against projected cost ranges.

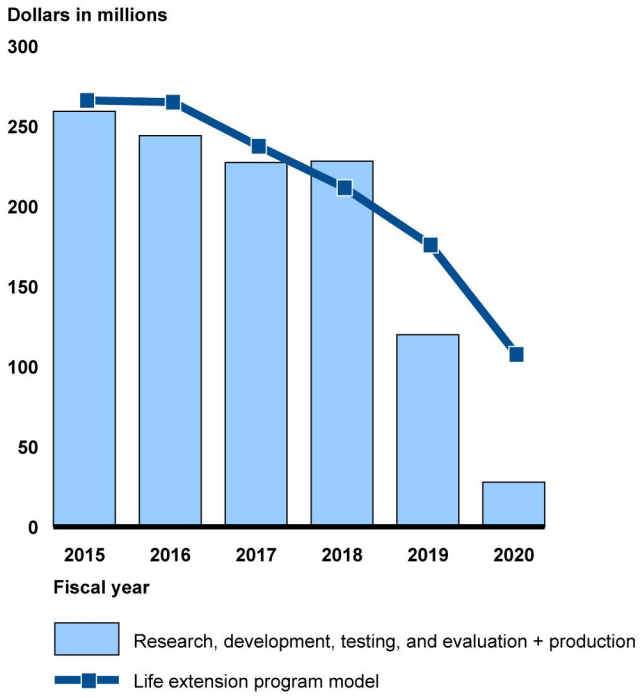
Figure 1: B61-12 Life Extension Program Budget Estimates from 2015 to Completion



Source: GAO analysis of National Nuclear Security Administration data. | GAO-16-290

W76-1: The W76 warhead was first introduced into the stockpile in 1978 and is deployed with the Trident II D5 missile on the Ohio-class nuclear ballistic missile submarines. The W76-1 LEP is intended to extend the original warhead service life and address aging issues, among other things. The first production unit was completed in September 2008, and the program will end in calendar year 2020. In the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, NNSA estimates that approximately $847 million will be required for this program from 2016 to 2021. See figure 2 for an illustration of budget estimates against projected cost ranges.

Figure 2: W76-1 Life Extension Program Budget Estimates from 2015 to Completion

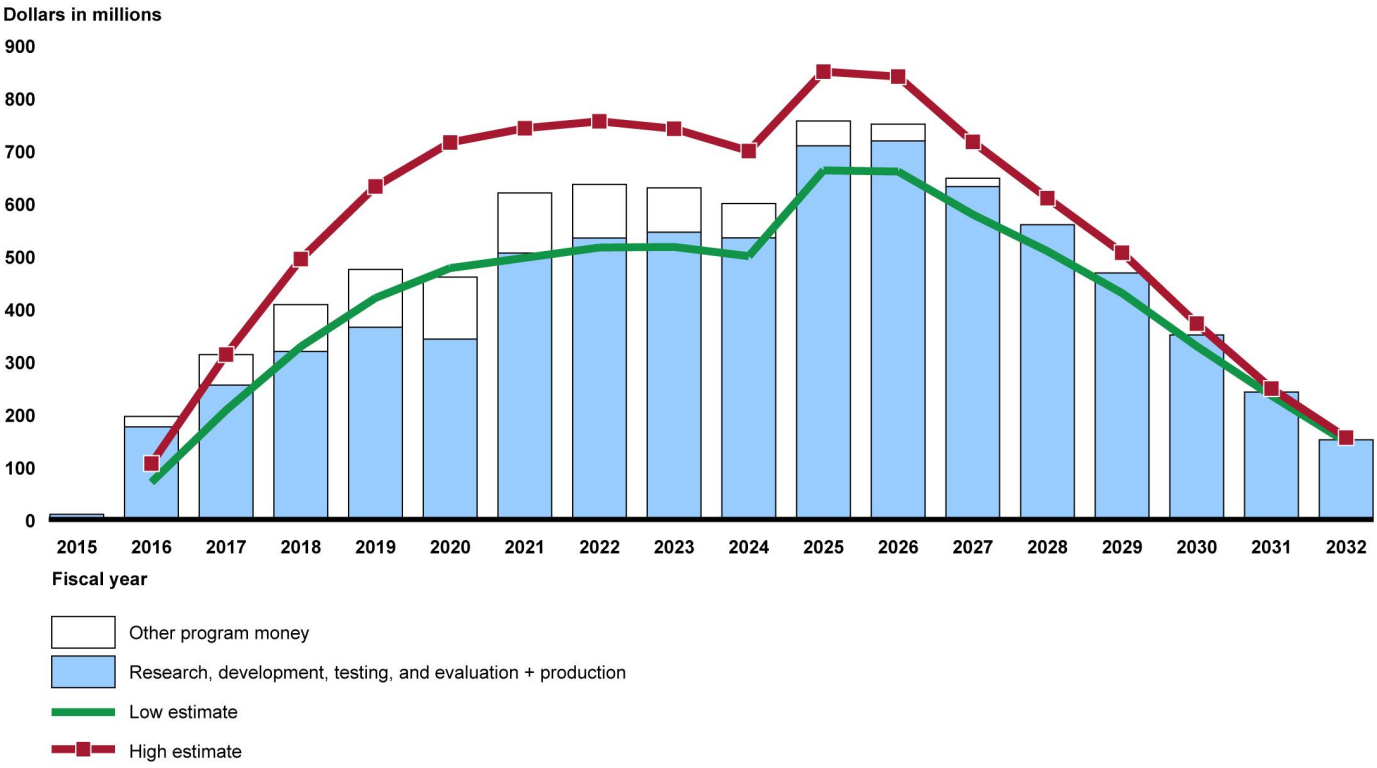


Source: GAO analysis of National Nuclear Security Administration data. | GAO-16-290

Note: According to the National Nuclear Security Administration (NNSA), because the W76-1 life extension program is the only weapon program that has been through the development phase and the majority of the production phase, the Department of Energy uses it as the primary basis for modeling cost range estimates for all future life extension programs. NNSA does not prepare high and low cost range estimates for it.

W80-4: The W80-4 LEP is intended to provide a warhead for a future long-range standoff missile that will replace the Air Force's current air-launched cruise missile. The first production unit is planned for 2025, and the program is scheduled to end in 2032. In the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, NNSA estimates that the W80-4 LEP will require approximately $8.2 billion from 2016 to 2032. See figure 3 for an illustration of budget estimates against projected cost ranges.

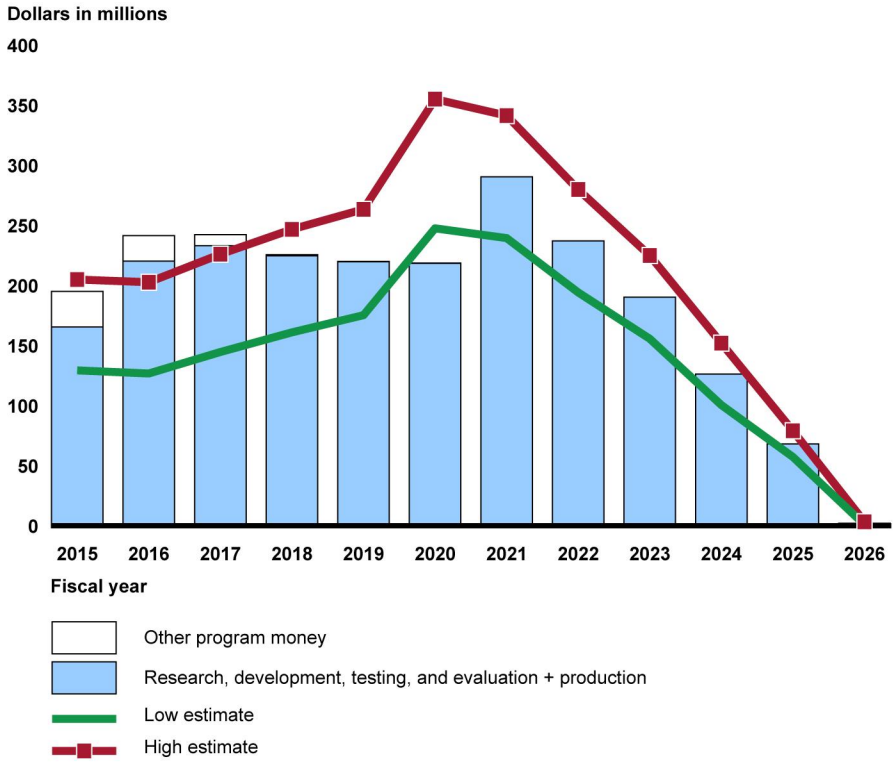
Figure 3: W80-4 Life Extension Program Budget Estimates from 2015 to Completion



Source: GAO analysis of National Nuclear Security Administration data. | GAO-16-290

W88 Alteration 370: Among other things, the W88 Alteration 370 will replace the arming, fuzing, and firing subsystem for the W88 warhead, which is deployed on the Navy's Trident II D5 submarine-launched ballistic missile system. In November 2014, the Nuclear Weapons Council decided to replace the conventional high explosive main charge, which led to an increase in costs for the alteration. The first production unit is planned for 2020, and the program is scheduled to end in 2026. In the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, NNSA estimates that the program will require a total of $2 billion from 2016 to 2026. See figure 4 for an illustration of budget estimates against projected cost ranges.

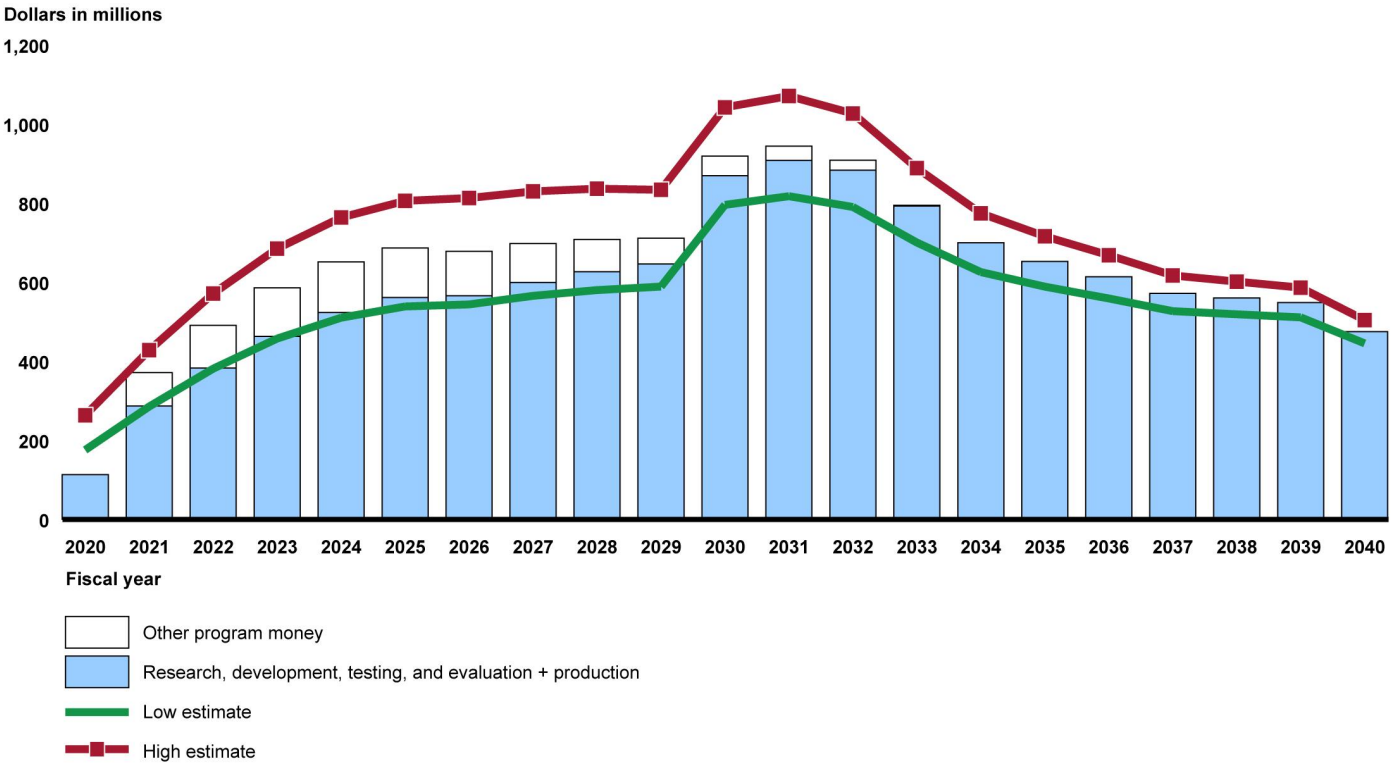
Figure 4: W88 Alteration 370 (with Conventional High Explosive Refresh) Budget Estimates from 2015 to Completion



Source: GAO analysis of National Nuclear Security Administration data. | GAO-16-290

IW-1: The IW-1, also known as the W78/88-1, is the first ballistic missile warhead LEP in NNSA's interoperable strategy to transition the stockpile to three interoperable ballistic missile warheads and two air-delivered warheads The first production unit is planned for 2030; the 2016 budget materials do not report an end date for the LEP. In the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, NNSA estimates that the program will require a total of $13.4 billion from 2020 to 2040. See figure 5 for an illustration of budget estimates against projected cost ranges.

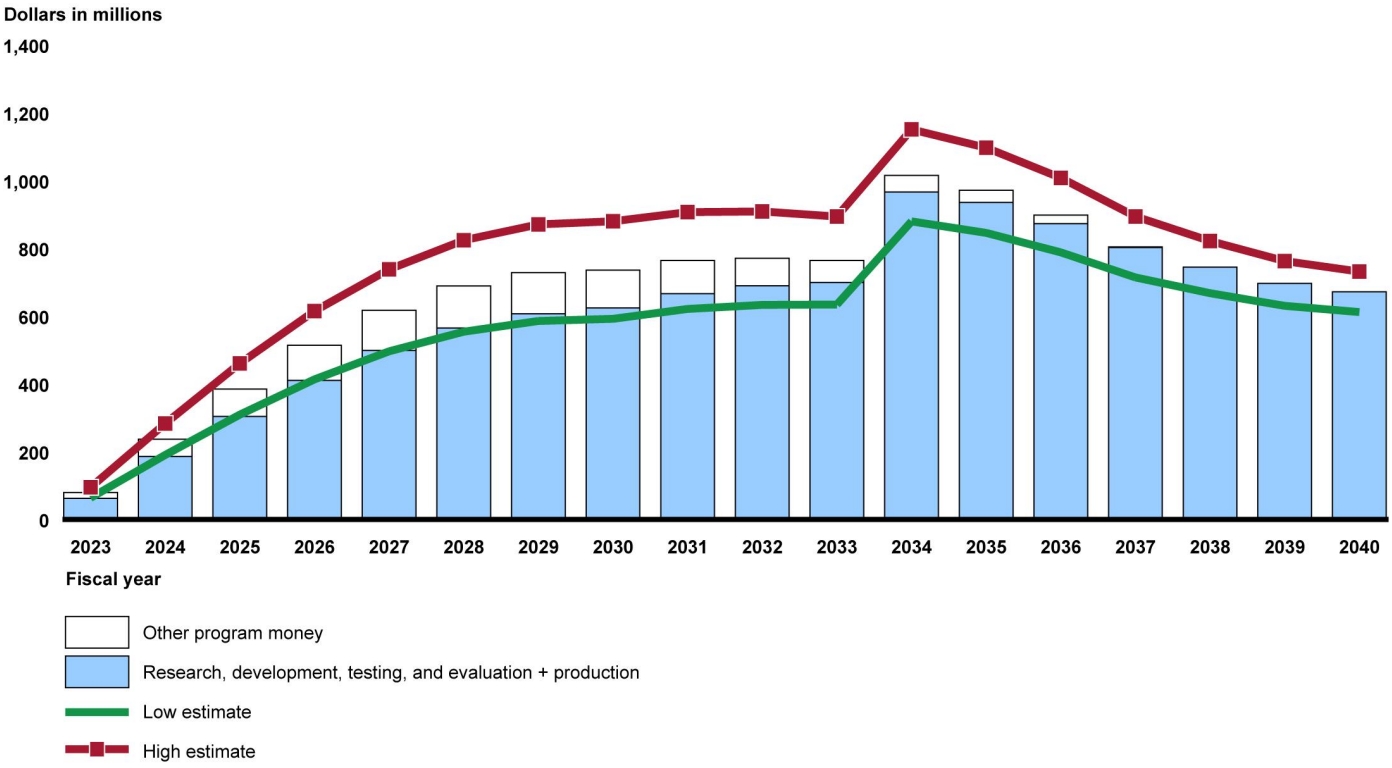
Figure 5: IW-1 Life Extension Program Budget Estimates from 2020 through 2040



Source: GAO analysis of National Nuclear Security Administration data. | GAO-16-290

IW-2: The IW-2 is an interoperable warhead intended to replace the W87/88 warhead. The Nuclear Weapons Council has not yet developed a more detailed implementation plan for this LEP. The first production unit is planned for 2034; the *Fiscal Year 2016 Stockpile Stewardship and Management Plan* does not contain a projected end date. In the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, NNSA estimates that the program will require a total of $12.1 billion from 2023 to 2040. See figure 6 for an illustration of budget estimates against projected cost ranges.

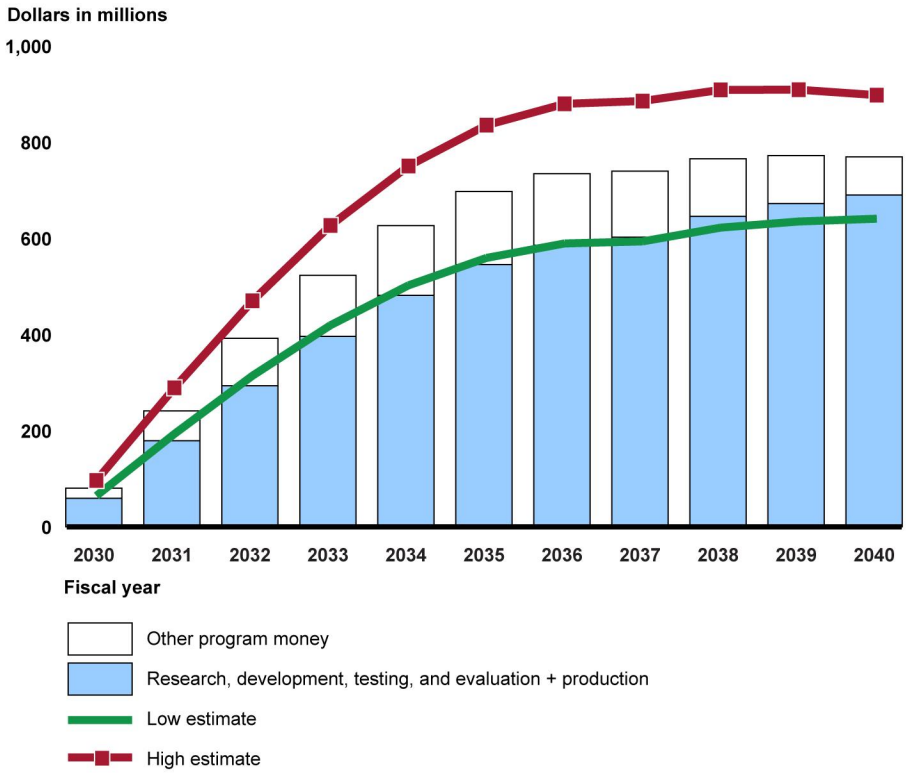
Figure 6: IW-2 Life Extension Program Budget Estimates from 2023 through 2040



Source: GAO analysis of National Nuclear Security Administration data. | GAO-16-290

IW-3: The IW-3 is intended to provide the third interoperable warhead for NNSA's future strategy for the stockpile. The first production unit is not yet specified, and there is not yet a budgeted end date. In the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, NNSA estimates that a total of $6.3 billion will be required for this program from 2030 to 2040. See figure 7 for an illustration of budget estimates against projected cost ranges.

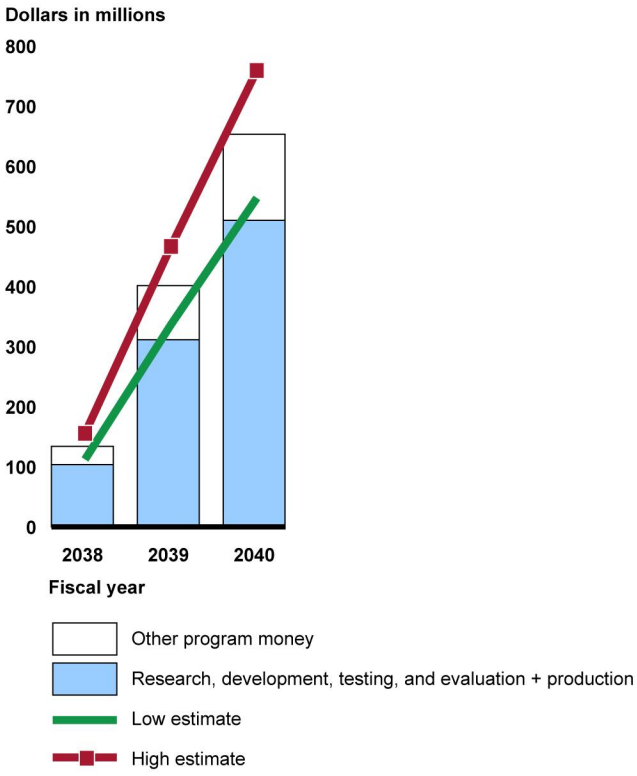
Figure 7: IW-3 Life Extension Program Budget Estimates from 2030 through 2040



Source: GAO analysis of National Nuclear Security Administration data. | GAO-16-290

B61-13: According to NNSA officials, the B61-13 LEP is intended to replace the B61-12 bomb. The first production unit is not yet specified, and there is not yet a budgeted end date. In the *Fiscal Year 2016 Stockpile Stewardship and Management Plan*, NNSA estimates that a total of $1.2 billion will be required for this program from 2038 to 2040. See figure 8 for an illustration of budget estimates against projected cost ranges.

Figure 8: B61-13 Life Extension Program Budget Estimates from 2038 through 2040



Source: GAO analysis of National Nuclear Security Administration data. | GAO-16-290

Appendix III: Comments from the National Nuclear Security Administration

Department of Energy
Under Secretary for Nuclear Security
Administrator, National Nuclear Security Administration
Washington, DC 20585

February 24, 2016

Mr. David C. Trimble
Director, Natural Resources
and Environment
U.S. Government Accountability Office
Washington, DC 20548

Dear Mr. Trimble:

Thank you for the opportunity to review the Government Accountability Office's (GAO) draft report titled "Modernizing the Nuclear Security Enterprise: NNSA's Budget Estimates Increased but May Not Align with All Anticipated Costs" (GAO-16-290). As stated in response to GAO's report on our Fiscal Year (FY) 2015 estimates, we will continue to enhance information on the potential effects of funding levels in budget supporting materials, while adhering to Office of Management and Budget Form and Content requirements. Additional enhancements were implemented concurrent with our FY 2017 budget request as appropriate.

Technical comments for your consideration in improving the clarity and accuracy of the report have been provided under separate cover. If you have any questions regarding this response, please contact Dean Childs, Director, Audit Coordination and Internal Affairs, at (301) 903-1341.

Sincerely,

Frank G. Klotz

Appendix IV: GAO Contact and Staff Acknowledgment

GAO contacts

David C. Trimble, (202) 512-3841 or trimbled@gao.gov

Staff Acknowledgment

In addition to the contact named above, William Hoehn (Assistant Director), Antoinette Capaccio, Pamela Davidson, Philip Farah, Bridget Grimes, Carol Henn, Aaron Karty, and Cynthia Norris made key contributions to this report.

Appendix V: Accessible Data

Agency Comment Letter

Text of Appendix III: Comments from the National Nuclear Security Administration

Page 1

Department of Energy

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Sincerely,

Frank G. Klotz

Data Tables

Data Table for Figure 1: B61-12 Life Extension Program Budget Estimates from 2015 to Completion

	Research, development, testing, and evaluation + production	Other program money	Low estimate	High estimate
2015	643	103.4	497.052	723.053
2016	643.3	89.9	486.712	706.678
2017	623.402	55.3	504.027	715.042
2018	734.905	14.2	521.448	722.533
2019	733.546	0	529.385	715.984
2020	760.82	0	667.869	854.815
2021	693.7	0	658.612	837.135
2022	582.9	0	540.123	680.943
2023	480.9	0	417.542	517.276
2024	426.9	0	320.196	393.825
2025	64	0	195.408	239.508
2026	0	0	0	0

Data Table for Figure 2: W76-1 Life Extension Program Budget Estimates from 2015 to Completion

	Research, development, testing, and evaluation + production	Life extension program model
2015	259.2	266.028
2016	244.019	264.942
2017	227.288	237.368
2018	228.148	211.491
2019	119.824	175.801
2020	27.8	107.526

Data Table for Figure 3: W80-4 Life Extension Program Budget Estimates from 2015 to Completion

	Research, development, testing, and evaluation + production	Other program money	High estimate	Low estimate
2015	9.4	n/a	n/a	n/a
2016	175.197	19.8405	105.776	70.0736
2017	254.43	57.8096	312.224	206.973
2018	318.258	89.0122	493.453	327.529
2019	364.32	109.44	631.156	419.715
2020	341.88	117.466	714.598	476.35
2021	504.872	113.931	741.74	495.867
2022	533.553	101.57	754.846	515.401
2023	544.595	84.0383	740.743	516.524
2024	533.826	64.9214	698.537	498.958
2025	708.35	47.015	849.055	661.674
2026	717.589	32.0063	839.629	659.562
2027	630.823	16.1156	715.823	578.054
2028	558.741	0	609.021	508.46
2029	467.25	0	505.659	428.84
2030	349.605	0	371.154	328.056
2031	241.26	0	247.993	234.526
2032	150.743	0	154.95	146.536

Data Table for Figure 4: W88 Alteration 370 (with Conventional High Explosive Refresh) Budget Estimates from 2015 to Completion

	Research, development, testing, and evaluation + production	Other program money	Low estimate	High estimate
2015	165.4	29.6	129.2	204.8
2016	220.176	21.2	126.616	202.586
2017	232.898	9.3	144.495	225.871
2018	224.546	0.9	160.851	246.609
2019	219.679	0.2	175.143	263.26
2020	218.322	0.2	247.418	354.904
2021	290.241	0	239.283	341.198
2022	236.896	0	194.062	279.729

	Research, development, testing, and evaluation + production	Other program money	Low estimate	High estimate
2023	190.13	0	155.512	224.747
2024	126.162	0	100.394	151.931
2025	68.0762	0	57.1765	78.9759
2026	1.97407	0	0.764157	3.18399

Data Table for Figure 5: IW-1 Life Extension Program Budget Estimates from 2020 through 2040

	Research, development, testing, and evaluation + production	Other program money	High estimate	Low estimate
2020	112.808	0	262.806	175.23
2021	286.301	84.4933	427.484	285.104
2022	382.564	107.802	570.862	380.87
2023	462.613	122.582	684.49	456.901
2024	522.677	128.268	763.174	509.718
2025	560.689	125.528	805.255	538.178
2026	565.36	112.488	812.371	543.325
2027	598.783	98.3237	829.192	565.021
2028	625.946	81.819	835.971	579.559
2029	645.815	64.999	833.232	588.396
2030	869.068	49.3967	1041.79	795.145
2031	907.727	35.9658	1070.36	817.025
2032	882.792	25.1181	1026.07	789.75
2033	792.173	1.76769	888.057	699.824
2034	699.391	0	773.691	625.09
2035	651.94	0	715.609	588.271
2036	613.071	0	667.749	558.393
2037	571.444	0	616.561	526.326
2038	559.718	0	601.068	518.369
2039	548.139	0	585.717	510.563
2040	474.282	0	503.76	444.804

Data Table for Figure 6: IW-2 Life Extension Program Budget Estimates from 2023 through 2040

	Research, development, testing, and evaluation + production	Other program money	High estimate	Low estimate
2020	112.808	0	262.806	175.23
2021	286.301	84.4933	427.484	285.104
2022	382.564	107.802	570.862	380.87
2023	462.613	122.582	684.49	456.901
2024	522.677	128.268	763.174	509.718
2025	560.689	125.528	805.255	538.178
2026	565.36	112.488	812.371	543.325
2027	598.783	98.3237	829.192	565.021
2028	625.946	81.819	835.971	579.559
2029	645.815	64.999	833.232	588.396
2030	869.068	49.3967	1041.79	795.145
2031	907.727	35.9658	1070.36	817.025
2032	882.792	25.1181	1026.07	789.75
2033	792.173	1.76769	888.057	699.824
2034	699.391	0	773.691	625.09
2035	651.94	0	715.609	588.271
2036	613.071	0	667.749	558.393
2037	571.444	0	616.561	526.326
2038	559.718	0	601.068	518.369
2039	548.139	0	585.717	510.563
2040	474.282	0	503.76	444.804

Data Table for Figure 7: IW-3 Life Extension Program Budget Estimates from 2030 through 2040

	Research, development, testing, and evaluation + production	Other program money	Low estimate	High estimate
2030	59.5278	20.9899	64.5204	96.5149
2031	179.043	62.1518	193.287	289.103
2032	293.369	98.7009	314.233	469.906
2033	395.95	127.105	419.293	626.818

	Research, development, testing, and evaluation + production	Other program money	Low estimate	High estimate
2034	481.253	145.117	502.233	750.507
2035	545.259	152.046	559.273	835.338
2036	585.765	148.707	589.278	879.665
2037	602.465	137.081	593.565	885.527
2038	645.627	119.82	622.208	908.685
2039	672.261	99.7071	634.923	909.014
2040	690.041	79.2098	640.731	897.77

Data Table for Figure 8: B61-13 Life Extension Program Budget Estimates from 2038 through 2040

	Research, development, testing, and evaluation + production	Other program money	Low estimate	High estimate
2038	103.446	30.4688	112.211	155.619
2039	311.138	90.2191	336.271	466.444
2040	509.812	143.274	547.058	759.112