



April 2019

MODERNIZING THE NUCLEAR SECURITY ENTERPRISE

NNSA Is Taking Action to Manage Increased Workload at Kansas City National Security Campus

Accessible Version

GAO Highlights

Highlights of [GAO-19-126](#), a report to congressional committees

Why GAO Did This Study

Modernization of the nation's nuclear stockpile depends on timely procurement and production of nonnuclear parts and components. Such parts and components make up over 80 percent of the items in a nuclear weapon. The Kansas City site procures or produces most of these parts, under NNSA oversight. In fiscal year 2012, the site completed construction of a modern production facility. The new facility was expected to accommodate rising future workload demands, based on the forecasts that were current in 2012, according to Kansas City site contractor representatives.

The Senate committee report accompanying a bill for the National Defense Authorization Act for Fiscal Year 2018 included a provision for GAO to review the Kansas City site's staffing plans and capabilities to meet national security requirements. This report examines (1) workload forecasts for the site since 2012, and (2) management challenges the site has identified for achieving the forecasted workload, and actions the site has taken to mitigate these challenges.

GAO reviewed NNSA and contractor documents from 2012 through 2018 relevant to workload changes, and associated workload capacity, including information on infrastructure, equipment, and business processes—as well as personnel data. GAO also interviewed NNSA program and field officials and contractor representatives.

View [GAO-19-126](#). For more information, contact Allison Bawden at (202) 512-3841 or bawdena@gao.gov.

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NNSA Is Taking Action to Manage Increased Workload at Kansas City National Security Campus

What GAO Found

Workload forecasts have significantly changed at the National Nuclear Security Administration's (NNSA) primary site for procuring or producing nonnuclear parts and components of nuclear weapons since the site's modern production facility was built in 2012. Specifically, workload projections made by the contractor operating the site, known as the Kansas City National Security Campus (Kansas City site), has increased significantly from forecasts used in planning the site's new production facility. More recent forecasts show that to meet workload requirements, production and administrative staff will need to almost double by 2020 compared to 2014 levels. For example, workload to modernize the B61-12 and W88 weapons systems will double during fiscal years 2020 through 2022.

Photos of Kansas City National Security Campus



Source: Photos courtesy of the U.S. Department of Energy, National Nuclear Security Administration. | GAO-19-126

According to NNSA officials and contractor staff, the site has identified and begun to mitigate management challenges to meeting future workload, including:

- **Ensuring sufficient production and office space.** Because the current space is not sufficient for the increase in projected workload, the site is leasing additional space until long-term solutions, currently in planning, can be implemented.
- **Updating production equipment.** To update aging production equipment, the site is developing a 10-year equipment strategy, among other things.
- **Retaining and recruiting a sufficient workforce.** The site has offered rewards and benefits to retain existing staff, about a third of whom are eligible to retire. It is also recruiting skilled new staff in tight labor markets and seeking to expedite security clearances for them.
- **Ensuring adequate external supplier capacity.** The site procures about 65 percent of its nonnuclear components from external suppliers. The site is assessing capacity and risk of existing suppliers and developing new ones.

Current mitigation efforts should help the site meet currently planned increased workload and capacity demands, according to contractor and NNSA analyses. However, the February 2018 Nuclear Posture Review—conducted by the Department of Defense under the direction of the President to determine the role of nuclear weapons in the nation's security strategy—may change requirements and add to the site's workload in ways not yet fully known because studies and plans in response to the review are not fully complete.

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Abbreviations

Alt	Alteration
DOD	Department of Defense
DOE	Department of Energy
FYNSP	Future-Years Nuclear Security Program
LEP	Life Extension Program
NNSA	National Nuclear Security Administration
OIG	Office of Inspector General
SSMP	Stockpile Stewardship and Management Plan

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April 12, 2019

Congressional Committees

Modernization of our nation’s nuclear stockpile depends on the timely procurement and production of nonnuclear parts and components, which make up over 80 percent of the parts and components that compose a typical nuclear weapon. Delays in or disruption to procurement or production of these parts and components could jeopardize the nation’s ability to accomplish nuclear weapons modernization goals in a timely manner. Most of these parts and components are procured or produced by the contractor operating the Kansas City National Security Campus (Kansas City site). This site operates under the direction and oversight of the National Nuclear Security Administration (NNSA)—a separately organized agency within the Department of Energy (DOE).¹ Honeywell Federal Management and Technologies, LLC, has managed and operated the site since 2000.² The most recent management and operating contract for this site began in July 2015.³ Nonnuclear parts and components that the site provides⁴—through procurement or production—for NNSA include fasteners, electrical interconnects, machined parts, electronic microcircuits, polymers, plastics, foams, and other engineered materials. The Kansas City site is also responsible for quality assurance for all the parts and components it provides.

In November 2012, the site completed construction of a more modern, leased production facility. The new facility was expected to accommodate

¹NNSA’s Kansas City Field Office provides local oversight of all activity at the Kansas City site.

²In 1999, Allied Signal acquired and merged with Honeywell, adopting the Honeywell name. In 2000, NNSA awarded Honeywell the contract to manage and operate the Kansas City site.

³NNSA carries out its work at government-owned, contractor-operated facilities. According to the Federal Acquisition Regulation, management and operating contracts are agreements under which the government contracts for the operation, maintenance, or support, on its behalf, of a government-owned or government-controlled research, development, special production, or testing establishment, wholly or principally devoted to one or more major programs of the contracting federal agency.

⁴For this report, when we refer to actions taken by the Kansas City site, we mean collaborative actions taken by NNSA and the contractor managing and operating the site.

increasing future workload demands, based on the forecasts that were current in 2012, according to Kansas City site contractor representatives and NNSA documents. According to these representatives, the workload of the Kansas City site has increased and is currently at the highest level since the end of the Cold War. According to NNSA reports and officials, NNSA will continue to modernize most of the nuclear weapons systems in the U.S. stockpile in the coming years, and some refurbishment efforts currently planned were not reflected in 2012 workload demand forecasts. In addition, the February 2018 Nuclear Posture Review contains policy direction that could further increase the Kansas City site's workload if eventually implemented.⁵

We and others have made recommendations to NNSA aimed at improving modernization planning in light of increasing workload. For example, in 2017 we found that the next decade is particularly challenging for NNSA's nuclear modernization efforts because the agency needs to ensure sufficient production capacity to execute life extension programs (LEP),⁶ along with major construction projects and programs to modernize its uranium and plutonium capabilities.⁷ We further found that NNSA's modernization budget estimates for fiscal years 2022 through 2026 may exceed the funding levels programmed for modernization in future budgets, raising affordability concerns, and we recommended that NNSA include an assessment of the affordability of its modernization programs in future versions of its annual plan on stockpile stewardship. Although NNSA did not explicitly agree or disagree with the recommendation, we continue to believe it is valid and are monitoring any

⁵Department of Defense, Office of the Secretary of Defense, *Nuclear Posture Review* (February 2018). In January 2017, the President directed the Department of Defense (DOD) to conduct a new Nuclear Posture Review to determine what role nuclear weapons should have in the nation's security strategy. The review notes that the United States will sustain and deliver on time the warheads needed to support both strategic and non-strategic nuclear capabilities by completing the W76-1, B61-12, and W80-4 life extension programs, and W88 Alterations (Alt) work, among other efforts.

⁶To maintain the readiness and extend the operational lives of weapons in the stockpile, DOE, NNSA, and DOD undertake LEPs that refurbish or replace weapon components. LEPs may also deploy advanced or emerging technologies to enhance safety and security characteristics of weapons, as well as consolidate the stockpile into fewer weapon types to minimize maintenance and testing costs. LEPs can extend the operational lives of weapons by 20 years or more. NNSA also conducts Alts of weapons at the system, sub-system, or component level to ensure the weapons are safe, secure, and effective.

⁷See, for example, GAO, *National Nuclear Security Administration: Action Needed to Address Affordability of Nuclear Modernization Programs*, [GAO-17-341](#) (Washington, D.C.: Apr. 26, 2017).

actions NNSA takes that may address the recommendation. In addition, a congressional advisory panel examining the governance of the nuclear security enterprise recommended that NNSA take action to stabilize long-term workload across NNSA's nuclear security enterprise sites, including its Kansas City site, to better support its weapons modernization efforts.⁸

The Senate committee report accompanying a bill for the National Defense Authorization Act for Fiscal Year 2018 included a provision for us to review the Kansas City site's staffing plans and capabilities to meet national security requirements.⁹ This report examines (1) workload forecasts for the Kansas City site since 2012, and (2) management challenges the Kansas City site has identified for achieving the forecasted workload and actions the site has taken to mitigate these challenges.

To address these objectives, we visited the site and obtained and reviewed workload planning documents, such as NNSA contractor planning charts and graphs showing workload forecast information for future years through 2036. We also interviewed officials from NNSA's headquarters offices and its Kansas City field office—co-located with the management and operating contractor—as well as contractor representatives at the site. To examine workload forecasts for the Kansas City site since 2012—the year construction was completed for the modern production facility—we obtained information on the Kansas City site workload as full production commences for upcoming modernization efforts, especially the B61-12 gravity bomb LEP and W88 submarine launched ballistic missile Alteration (Alt) 370 work.¹⁰ We also examined steps the Kansas City site has taken to forecast workload demand from 2012 through 2018.

To examine management challenges the Kansas City site had identified at the time of our review in 2018 for achieving the forecasted workload,

⁸Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, *A New Foundation for the Nuclear Enterprise: Report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise* (Washington, D.C.: November 2014).

⁹S. Rep. No. 115-125, at 356 (2017).

¹⁰An Alt is a limited scope change that affects assembly, tests, maintenance, and/or storage of weapons. An Alt may address identified defects and component obsolescence; however, it does not change a weapon's operational capabilities. A weapon Alt generally refurbishes fewer components than an LEP.

and any actions the site has taken to mitigate these challenges, we interviewed NNSA officials and contractor representatives. We then reviewed relevant documentation and data, available at the time of our review in 2018, on the nature of the challenges and any mitigation steps to determine if the Kansas City site is addressing previously identified challenges. Among other things, we reviewed Kansas City site capacity analyses; personnel data regarding worker attrition, aging, retention, and hiring; information on worker clearances; analyses of information on the capacity of external suppliers; and lessons learned from recently completed work on the LEP for the W76-1 submarine-launched ballistic missile warhead. We obtained information on actions the Kansas City site has taken over the past several years, particularly from 2012—when the new modern production facility was built—through 2018, regarding infrastructure, business processes, staffing, and other areas to manage current workload demands. To corroborate information provided by the Kansas City site on management challenges and associated mitigation action(s), we interviewed additional NNSA headquarters officials; reviewed alternative documentation or analyses; and obtained examples of the specific action(s) being taken, when available. See appendix I for more details regarding our objectives, scope, and methodology and for specific examples of steps we took to corroborate the information obtained from the Kansas City site.

We conducted this performance audit from November 2017 to April 2019 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.

Background

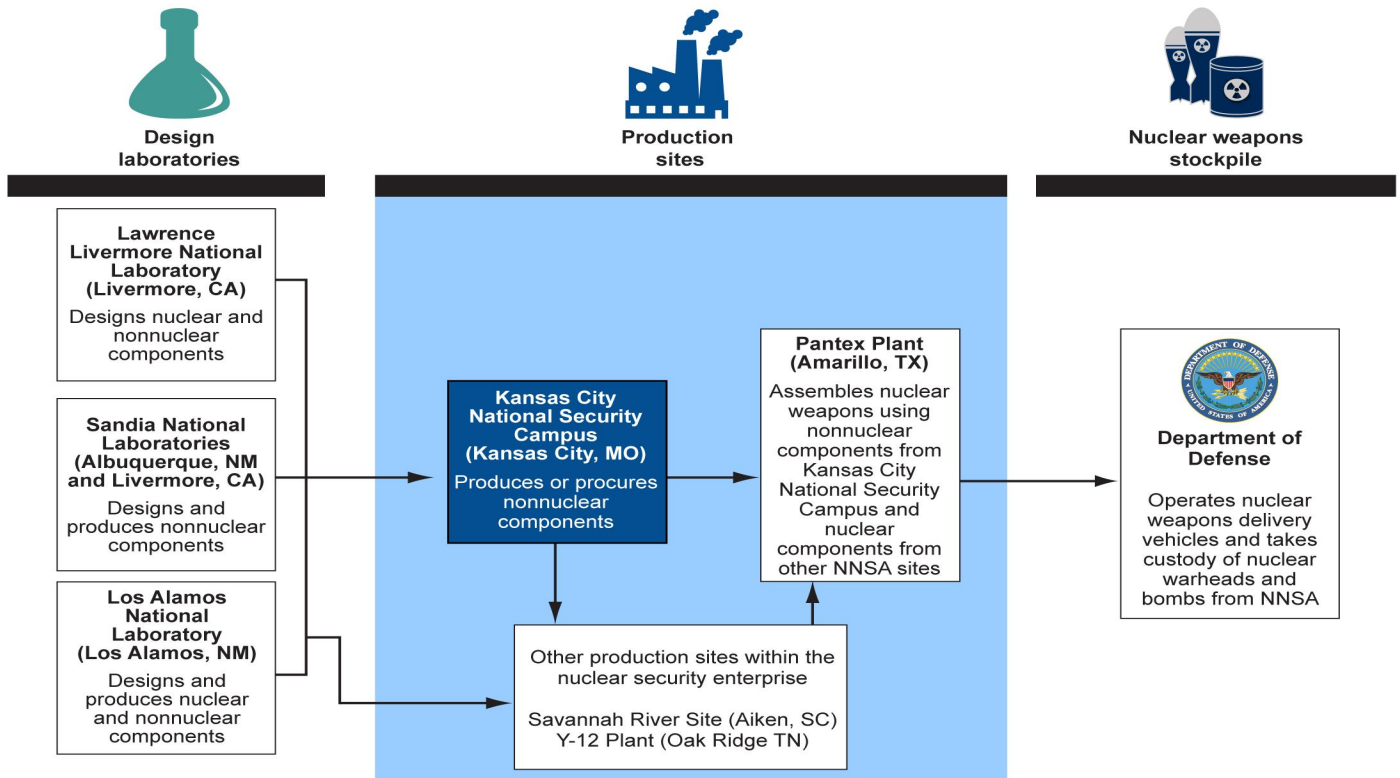
This section describes the (1) Kansas City site's role in providing nonnuclear parts and components, and (2) current and planned nuclear weapons stockpile life extension and alteration efforts that drive workload.

Kansas City Site's Role in Providing Nonnuclear Parts and Components

The Kansas City site is NNSA's primary site for procuring or producing nonnuclear parts and components, providing over 80 percent of the parts and components that compose a typical nuclear weapon. The Kansas City site interacts with a number of other NNSA sites that comprise the nuclear security enterprise to support the nuclear weapons stockpile. For example, NNSA's design laboratories develop precise parts or component specifications or requirements to which production sites, such as the Kansas City site, must conform in procuring or producing these items for use in the nation's nuclear weapon stockpile.¹¹ Figure 1 depicts how sites in the nuclear security enterprise interact with each other to design, produce, procure, and assemble nonnuclear components.

¹¹NNSA relies on management and operating contractors at its laboratories to support understanding of the physics associated with the safety, security, and reliability of nuclear weapons, as well as to maintain core competencies in nuclear weapons science, technology, and engineering. In addition, NNSA relies on contractors at its production sites to maintain, evaluate, repair, and dismantle both the nuclear and nonnuclear components of nuclear weapons; to manufacture weapons components; and to process tritium, a key isotope used to enhance the power of nuclear weapons. NNSA also relies on management and operating contractors at these sites to refurbish or replace aging components of nuclear weapons as part of LEP activities.

Figure 1: Design Laboratories and Production Sites of the Nuclear Security Enterprise



Source: GAO analysis of National Nuclear Security Administration (NNSA) and Kansas City National Security Campus data. | GAO-19-126

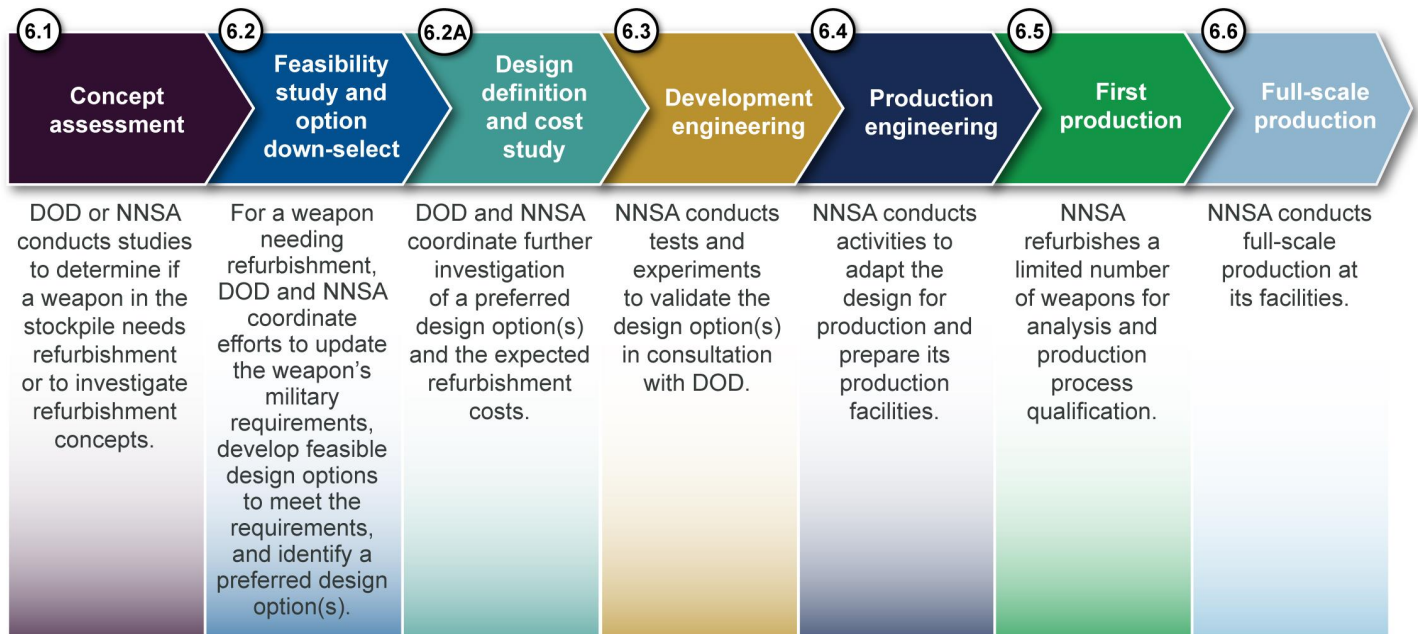
Note: In addition to the laboratories and sites discussed, NNSA also maintains a testing site in Nevada that supports its overall mission. Also, on behalf of NNSA and DOE, the Pantex Plant accepts the final product after weapons assembly and transfers custody of the weapons to DOD.

Components procured or produced by the Kansas City site range from simple items such as nuts and bolts to more complex components such as radars, arming and firing mechanisms, and critical nuclear safety devices meant to prevent accidental detonation. The site delivers approximately 100,000 parts annually, according to our previous report.¹² According to Kansas City site contractor documents, the primary mission of the site is keeping the nation’s nuclear stockpile safe, secure, and reliable by delivering mission-critical mechanical, electrical, and engineered material components and services.

¹²GAO, *Nuclear Weapons: National Nuclear Security Administration Needs to Better Manage Risks Associated with Modernization of Its Kansas City Plant*, [GAO-10-115](#) (Washington, D.C.: Oct. 23, 2009).

NNSA and the Department of Defense (DOD) jointly manage LEPs and Alts under a multi-step process known as the phase 6.X process (see fig. 2). Phase 6.4 of this process, or the production engineering phase, involves activities to adapt designs for production and prepare production facilities, including the Kansas City site. For example, according to a senior NNSA official, activities to adapt designs could include updating product specifications to make parts easier to produce, changing or refining tester limits, and substituting among commercial off-the-shelf parts. The B61-12 LEP and W88 Alt 370 are currently in phase 6.4 (production engineering) of this process and are approaching production. Other LEP efforts are in earlier phases.

Figure 2: Joint DOD and NNSA Phase 6.X Process for Managing Warhead Life Extension Activities for Nuclear Weapons



Abbreviations
 DOD Department of Defense
 NNSA National Nuclear Security Administration
 Source: Nuclear Weapons Council. | GAO-19-126

Current and Planned Nuclear Weapons Stockpile Life Extension and Alteration Efforts

NNSA describes its plans to meet nuclear weapons stockpile life extension and alteration goals in two key documents that also describe NNSA's operations and budget estimates for implementing these plans.

These documents, which NNSA updates annually, constitute NNSA’s nuclear security budget materials. First, the *Stockpile Stewardship and Management Plan* is NNSA’s formal means of communicating to Congress information on modernization and operations plans and budget estimates over the following 25 years. Second, NNSA’s annual justification of the President’s budget provides program information and budget estimates for the following 5 years. This 5-year plan is called the Future-Years Nuclear Security Program (FYNSP), and the budget estimates in this plan reflect amounts approved by the Office of Management and Budget.¹³ These estimates align with those presented for the first 5 years included in the *Stockpile Stewardship and Management Plan*.

According to the Fiscal Year 2018 *Stockpile Stewardship and Management Plan*, NNSA and its nuclear security enterprise are conducting a substantial level of activity to ensure the continued credibility of the nation’s nuclear weapons stockpile. Specifically, in fiscal year 2018 NNSA was executing three nuclear weapons LEPs and one major Alt, which are described in table 1.

Table 1: National Nuclear Security Administration (NNSA) and Department of Defense Life Extension Programs (LEP) and Alterations (Alt), as of Fiscal Year 2018

Program	Description
W76-1 LEP	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’s service life, among other things. In its Fiscal Year 2018 Stockpile Stewardship and Management Plan, NNSA estimated that it would incur a total cost of about \$3.6 billion for the program. ^a The first production unit was completed in September 2008, ^b and NNSA produced the last production unit in December 2018.
B61-12 LEP	The B61 bomb is the oldest nuclear weapon in the stockpile. It was first fielded in 1968, with current modifications fielded between 1979 and 1991. ^c The B61-12 LEP will consolidate and replace the B61-3, -4, -7, and -10 modifications of the bomb. NNSA estimates that it will incur a total cost of about \$7.6 billion for the program. The first production unit is scheduled for December 2020. Production is planned to be completed in fiscal year 2024.
W88 Alteration 370 ^d program	The W88 nuclear warhead entered the stockpile in late 1988 and is deployed on the Navy’s Trident II D5 submarine-launched ballistic missile system. The W88 Alt 370 program will replace the arming, fuzing, and firing subsystem for the W88 warhead. In November 2014, the Nuclear Weapons Council decided to also replace the conventional high-explosive main charge, which increased the estimated cost for the Alt. As of April 2017, the program was estimated to cost NNSA about \$2.6 billion and was scheduled to complete its first production unit in December 2020, according to NNSA officials, and end production in fiscal year 2024.

¹³The budget estimates for years included in the FYNSP must align with the 5-year overall federal budget estimates in the President’s budget. The budget estimates for years beyond the FYNSP are not subject to this requirement.

Program	Description
W80-4 LEP	In 1982 the U.S. introduced the air-launched cruise missile that housed a W80-1 warhead. In close coordination with DOD, NNSA is extending the life of the W80-1 through the W80-4 LEP which is intended to provide a warhead for a future missile that will replace the Air Force's current air-launched cruise missile. In NNSA's Fiscal Year 2018 Stockpile Stewardship and Management Plan, the agency preliminarily estimated that the W80-4 LEP would cost NNSA between about \$8.0 billion and \$11.6 billion, that NNSA would complete the first production unit by fiscal year 2025, and that NNSA would complete production for the LEP by fiscal year 2031.

Source: GAO analysis of NNSA documents and information reported by NNSA officials. | GAO-19-126

Note: To maintain the readiness and extend the operational lives of weapons in the stockpile, NNSA and DOD undertake LEPs that refurbish or replace weapon components. LEPs may also deploy advanced or emerging technologies to enhance safety and security characteristics of weapons, as well as consolidate the stockpile into fewer weapon types to minimize maintenance and testing costs. An Alteration (Alt) is a limited scope change that affects assembly, tests, maintenance, and/or storage of weapons. An Alt may address identified defects and component obsolescence; however, it does not change a weapon's operational capabilities. A weapon Alt generally refurbishes fewer components than an LEP.

^aThe Stockpile Stewardship and Management Plan is NNSA's formal means of communicating to Congress information on modernization and operations plans and budget estimates over the following 25 years and is produced annually.

^bThe "first production unit" is the first complete warhead from a production line certified for deployment.

^cThroughout the history of nuclear weapons development, the United States has developed families of warheads based on a single warhead design. Thus, some weapons in the U.S. stockpile were developed as modifications to an already complete design. For example, the B61 bomb has had 12 variations over time, each designated as a different modification.

^dThe W88 Alt 370 program is technically an Alt, not an LEP, but the effort is being managed consistent with LEP execution guidance. An Alt is usually a replacement of an older component with a newer component that does not affect military operations, logistics, or maintenance.

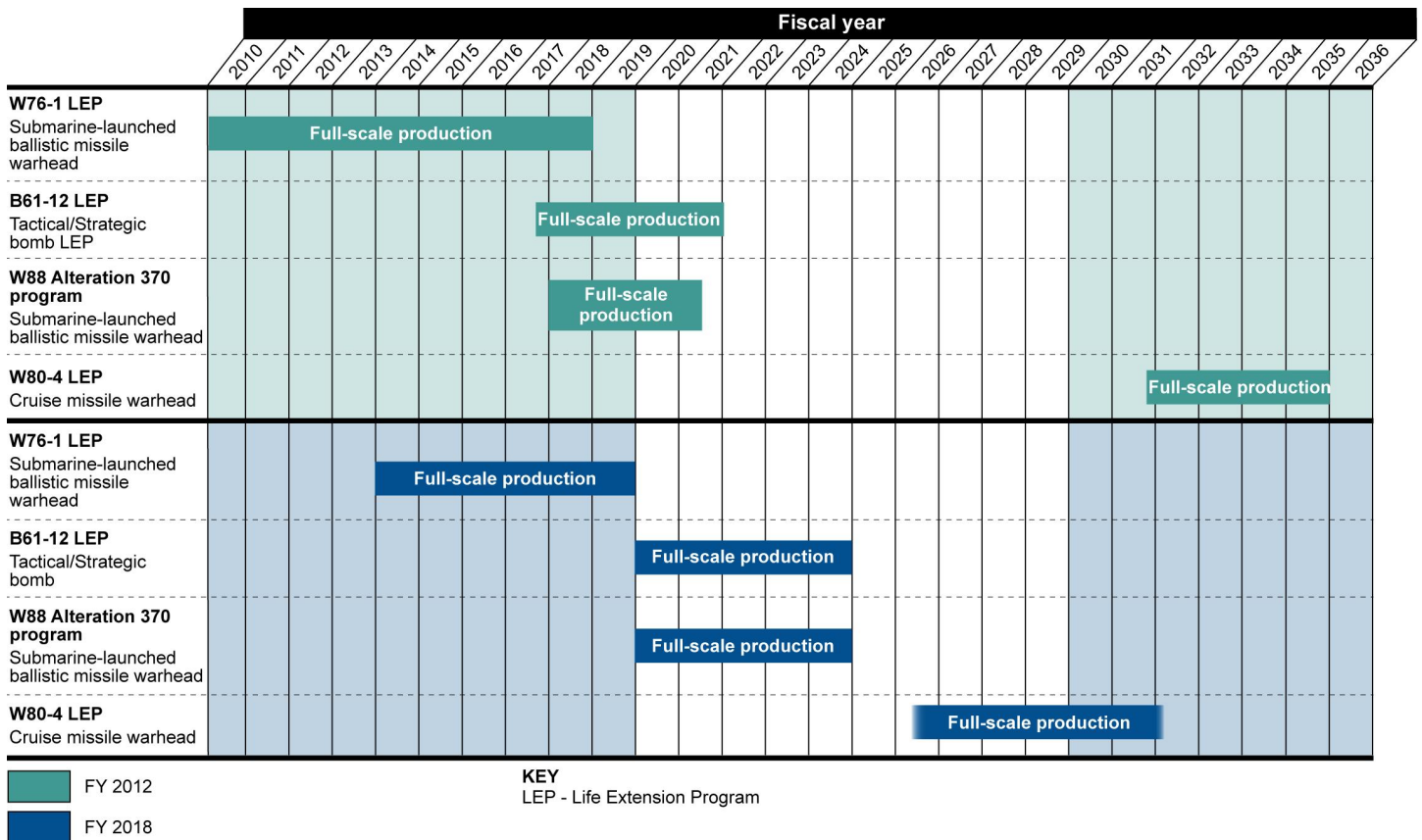
In addition, the 2018 Nuclear Posture Review calls for NNSA to resume a program to replace the W78 warhead in fiscal year 2019;¹⁴ produce a low-yield submarine launched ballistic missile warhead, known as the W76-2; and consider options for providing a nuclear warhead for a potential sea-launched cruise missile. According to NNSA officials and contractor representatives, NNSA developed an early production planning roadmap for implementing the Nuclear Posture Review in late 2018. The conference report accompanying DOE's fiscal year 2019 appropriations act directed the agency to spend a specified amount on the W78 warhead replacement and W76-2 efforts.

¹⁴GAO, *Nuclear Weapons: NNSA Has Taken Steps to Prepare to Restart a Program to Replace the W78 Warhead Capability*, [GAO-19-84](#) (Washington, D.C.: Nov. 30, 2018).

Projected Workload for the Kansas City Site Has Increased Significantly from 2012 Forecasts

Projected workload for the Kansas City site has increased significantly, based on NNSA's stockpile plan changes from 2012—when the new modern facility was built—to the 2018 stockpile plan update. A comparison between the 2012 and 2018 plans shows that the start of full production for the B61-12 LEP and the W88 Alt were delayed by approximately 2 years, and their completions were delayed by 3 years from initial schedule estimates in 2012. The 2018 plan also accelerates production of the W80-4 LEP by approximately 5 years. Figure 3 below shows the change in the full production timelines for key weapons systems.

Figure 3: Full Production Timeline Comparison—Stockpile Stewardship Management Plans for Fiscal Years 2012 and 2018



Source: GAO analysis of National Nuclear Security Administration data. | GAO-19-126

Note: To maintain the readiness and extend the operational lives of weapons in the stockpile, National Nuclear Security Administration and Department of Defense undertake LEPs that refurbish or replace weapon components. LEPs may also deploy advanced or emerging technologies to enhance safety and security characteristics of weapons, as well as consolidate the stockpile into fewer weapon types to minimize maintenance and testing costs. An Alteration (Alt) is a limited scope change that affects assembly, tests, maintenance, and/or storage of weapons. An Alt may address identified defects and component obsolescence; however, it does not change a weapon's operational capabilities. A weapon Alt generally refurbishes fewer components than an LEP. The W88 Alt 370 program was referred to as the W88 Alt in 2012, and the W80-4 LEP was referred to as the W80 in 2012.

Enterprise Risk Management at the Kansas City Site

Contractor representatives at the Kansas City site determined that overlapping weapons refurbishment efforts and schedule compression, which can increase workload demand, was (1) likely to occur, (2) of high impact, and (3) a site-wide challenge. Representatives made this determination in part by using an enterprise risk management approach. This management approach includes the identification, prioritization, and management or mitigation of the site's most significant risks to achieving objectives and mission success, according to site contractor representatives. Senior contractor representatives assess risks by project, program, division, and enterprise levels. Once a potential risk is identified, the site contractor representatives responsible for managing the risk use a Kansas City site scoring matrix to determine the potential likelihood and severity of that risk for the site. Kansas City site leaders then formulate plans to mitigate the risks and are responsible for elevating risks that impact the entire Kansas City site, in order to determine the resources and help that will be needed. For example, reviewing this matrix helps ensure Kansas City site contractor representatives meet regularly throughout the year with NNSA site officials to review all site-level risks, according to site contractor representatives.

Source: Kansas City National Security Campus data. | GAO-19-126

Using an enterprise risk management approach, the Kansas City site determined that this change in production schedule represented a significant challenge that needed to be better understood and regularly monitored. NNSA contractor representatives at the Kansas City site developed a strategy for analyzing workload to better understand the enterprise risk and ensure the site's ability to provide an adequate supply of nonnuclear components under variable requirements scenarios. Specifically, in 2015, the Kansas City site increased the frequency of using its "what-if" approach that models standard production work and allows for an in-depth review of labor, equipment, and material capacity information, according to contractor representatives at the Kansas City site.¹⁵ This analytic capability is intended to help ensure that the site contractor can accurately predict future workload demand across multiple scenarios representing different production requirements. Contractor representatives update the model every quarter to reflect the current hardware schedules; testing requirements; and nuclear weapon scope, production quantities, and schedules. These representatives use the model to develop hourly staffing, equipment, and other capacity-related forecasts and plans. For example, contractor representatives evaluate capital equipment capacity quarterly for multiple programs, with a primary focus on equipment that is at or above a two-shift capacity.¹⁶ However, according to these representatives, this approach has not been in place long enough to allow comparison of historical data with forecasts from the model to assess their accuracy.

According to site contractor documents and representatives, forecasting data from the what-if models project that, under the 2018 plans, the full-time equivalent workload for production of nonnuclear parts and components will continue to increase annually through 2020.¹⁷

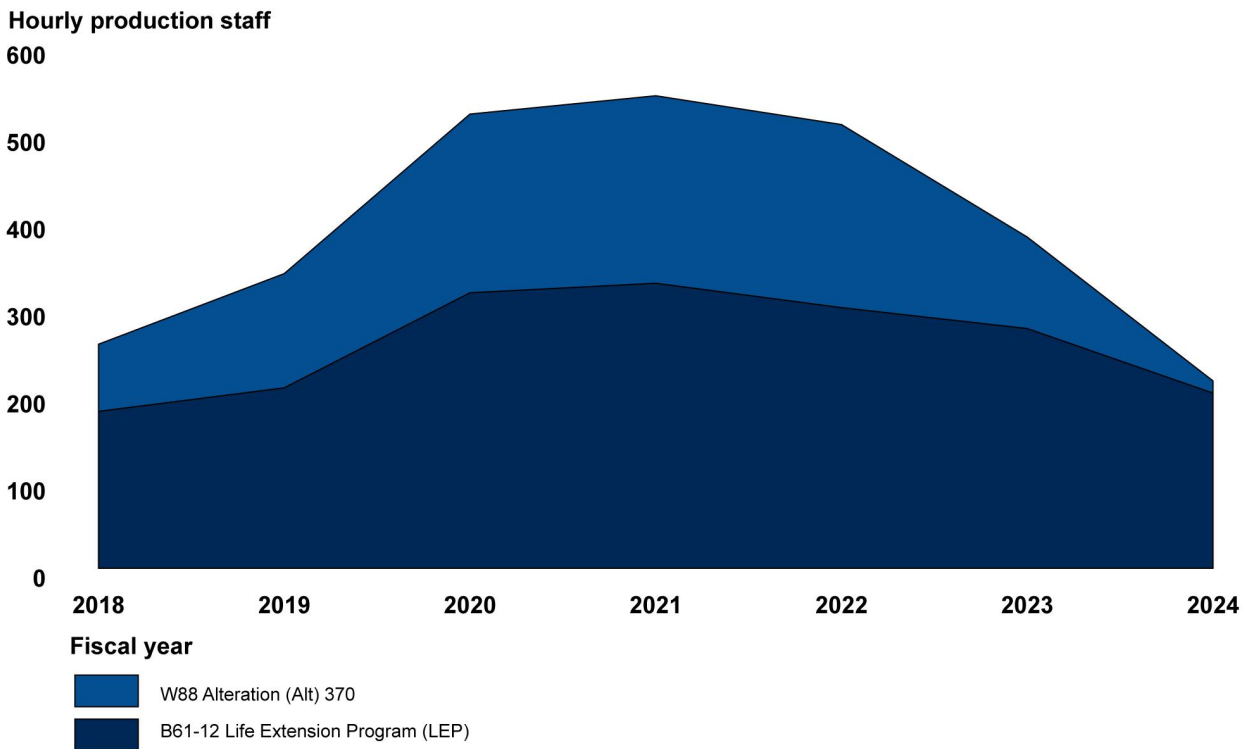
¹⁵NNSA officials stated that the Kansas City site had applied some form of a "what-if" analysis to production for many years prior to 2015. NNSA officials indicated that the "what-if" tool is less efficient when multiple programs share material, parts, or components that are experiencing issues, and added that the tool is not integrated or aligned with other program management tools required by NNSA.

¹⁶Most anticipated capacity issues can be mitigated with increased hiring and additional shifts and overtime, if necessary, according to Kansas City site officials. The officials noted that facility infrastructure and equipment can typically accommodate up to three 8-hour shifts to fill a 24-hour day.

¹⁷Full-time equivalent reflects the total number of regular straight-time hours (i.e., excluding overtime or holiday hours) worked by employees divided by the number of compensable hours applicable to each fiscal year. Annual leave, sick leave, and compensatory time off and other approved leave categories are considered to be "hours worked" for purposes of defining full-time equivalent employment.

Specifically, the number of production and administrative staff at the time of the relocation to the new facility in 2014 was almost 2,500, based on needs at that time. However, the fiscal year 2018 updates, based on “what-if” capacity analyses, now show that the headcount will need to almost double, growing to more than 4,900 administrative and production staff by 2020. For example, according to 2018 “what-if” capacity analyses prepared by site contractor representatives, personnel dedicated exclusively to two efforts—the B61-12 LEP and W88 Alt 370—will double from 251 full-time equivalents needed in fiscal year 2018 to over 500 during fiscal years 2020 through 2022, as shown in figure 4.¹⁸

Figure 4: Forecasted Full-Time Equivalent Workload for Production of Two Weapons Systems, as of Fiscal Year 2018



Source: GAO analysis of Kansas City National Security Campus data. | GAO-19-126

Notes: The B61-12 LEP seeks to consolidate four versions of a nuclear weapon—the B61 bomb—into a bomb called the B61-12. The W88 Alt 370 program 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.

¹⁸In this example, the full-time equivalents reflect workload forecasts for hourly production staff only for the B61-12 LEP and W88 Alt 370.

Full-time equivalent reflects the total number of regular straight-time hours (i.e., excluding overtime or holiday hours) worked by employees divided by the number of compensable hours applicable to each fiscal year. Annual leave, sick leave, and compensatory time off and other approved leave categories are considered to be “hours worked” for purposes of defining full-time equivalent employment. In this figure, the full-time equivalents reflect workload forecasts for hourly production staff only for the B61-12 LEP and W88 Alt 370.

Kansas City Site Has Identified and Begun to Mitigate Several Management Challenges Related to Forecasted Workload, Which May Further Increase

NNSA officials and contractor representatives at the Kansas City site have identified and begun to mitigate several management challenges to meeting the forecasted workload for known future production requirements, but they face uncertainties about future workload demands. Specifically, current mitigation efforts should help the site meet currently forecasted increased workload and capacity demands, according to NNSA analysis and consistent with the program plan included in the Fiscal Year 2018 *Stockpile Stewardship and Management Plan*. However, the February 2018 Nuclear Posture Review, the results of which were not fully reflected in the Fiscal Year 2018 *Stockpile Stewardship and Management Plan*, may change requirements and add to the site's workload because it calls for additional weapons efforts.

Current Efforts to Mitigate Identified Challenges Should Support Meeting Forecasted Future Workload Increases at the Kansas City Site

Kansas City site contractor representatives have identified management challenges that could affect the site's ability to meet forecasted future workload increases based on 2018 analyses and its Enterprise Risk Management process, and NNSA officials agreed with the challenges the contractor representatives identified. These management challenges include ensuring that the site has (1) sufficient production and administrative office space, (2) up-to-date production equipment, (3) a sufficient workforce with necessary security clearances, (4) capable and reliable external suppliers, and (5) complete weapons designs early enough in development to minimize production changes and delays. The Kansas City site has identified strategies to mitigate the effects of each of these management challenges and has begun taking steps to implement these strategies.

NNSA's Enterprise Modeling and Analysis Consortium

NNSA's Enterprise Modeling and Analysis Consortium is composed of NNSA site representatives and program representatives from NNSA's Defense Programs offices and is a principal source for NNSA model-informed analytics for decisions about stockpile stewardship program management, policy, and implementation. The consortium conducts modeling based on common data sets and assumptions of current and planned stockpile plans, design alternatives, commodity requirements, and nuclear security enterprise capacity. One of the consortium's projects includes analyzing the nuclear security enterprise's capacity to execute the nuclear weapon production program of record to identify any important issues or bottlenecks within or between sites.

Source: National Nuclear Security Administration data. | GAO-19-126

NNSA analysis concludes that current mitigation efforts initiated at the Kansas City site should support currently planned increased workload and an increased capacity to achieve the 2018 workload forecast. Specifically, according to analyses conducted by NNSA's Enterprise Modeling and Analysis Consortium, the Kansas City site's operations will be stressed above current capacity for multiple consecutive years in the future, and current mitigation efforts should reduce risk associated with the elevated workload. In addition, NNSA Kansas City Field Office and headquarters officials said that they have high confidence in the ability of the Kansas City site to forecast and manage infrastructure and staffing needs at the site to support currently planned nuclear weapon stockpile life extension needs over the coming decades. In particular, NNSA's recent annual performance evaluation reports—which document the contractor's overall performance for a fiscal year—show that the Kansas City site contractor has delivered the vast majority of hardware on time, within budget, and in a safe and secure environment.

Production and Administrative Office Space

Kansas City site officials indicated that ensuring adequate production and administrative office space at the site is a management challenge because the current facility is too small to accommodate future workload. Specifically, forecasted workload demand has grown significantly since the modern facility was built in 2012. The new facility, which accommodates both production and administrative staff, replaced a deteriorating World War II-era facility that was much larger and had significant maintenance and operations costs, according to site contractor representatives. For example, according to NNSA documents, the move reduced the footprint of the site's production activities from about 3 million square feet to 1 million square feet.¹⁹ According to site contractor representatives, the modern facility was designed to be more flexible in accommodating changes in the production line. For example, equipment can more easily be removed or installed at any location in the facility, to accommodate increased workload, because there is ready access to electrical, ventilation, or other necessary hookups and connections. Figure 5 shows a photo of the new facility.

¹⁹Since 2012, NNSA's Kansas City site is leasing this space over a 20-year period at an annual cost of about \$51 million, according to Kansas City site contractor staff. About 1 million square feet of this leased space initially included almost 63,000 square feet of unallocated space capable of accommodating unanticipated surge capacity needs, but this unallocated space has since been consumed, according to these staff.

Figure 5: Photo of Kansas City Site Production Facility Built in 2012



Source: Photo is courtesy of the U.S. Department of Energy, National Nuclear Security Administration. | GAO-19-126

The Kansas City site has identified that it needs an additional 250,000 square feet of production space in 2019 and ultimately a total of an additional 400,000 square feet to support the forecasted workload and associated staff increase. To mitigate the challenge of insufficient production and administrative space to support the forecasted increase in production staff, Kansas City site officials told us they are pursuing multiple short- and long-term strategies.

- With respect to production space, under the short-term plan the Kansas City site is pursuing a temporary lease of commercial space to allow for the offsite storage of unclassified materials that are currently at the production facility. According to site contractor representatives, this new lease would free up production space at the main site. Further, the site submitted a request to NNSA for leasing an additional 250,000 feet of production space—an increase of almost 30 percent over current production space in the modern facility. Kansas City site contractor representatives stated that the cost of this lease will be based on competitive offers, and they expect the lease to be awarded by summer 2019.

- With respect to administrative office space, the site has leased more than 150,000 square feet of space since 2014 for the short term at a cost of more than \$3.5 million per year.²⁰
- Under the long-term plan, expected to take a minimum of 5 years to implement, the site will complete an analysis of alternatives and submit a combined office and production space expansion project plan to NNSA, which will determine final costs and timelines. Currently, the mission need statement for the project indicates the need for over 400,000 square feet of additional production and administrative space to accommodate the planned increased workload for known production and supporting administrative requirements²¹—an increase of roughly 50 percent over current leased production space. According to Kansas City site contractor representatives, at this early stage, costs would be based on the current Kansas City site lease of \$43 per square foot, or roughly \$17 million per year. This long-term plan would include space for approximately 1,200 administrative personnel. Kansas City site contractor representatives told us in September 2018 that, depending on the selected long-term solution, the short-term leases for administrative space could either be terminated or modified into long-term arrangements.

In 2017, we reported in our high risk list update that federal agencies have not demonstrated that they have the capacity to reduce their reliance on costly leases,²² particularly high-value leases—defined as \$2.85 million and above per year in lease costs—where owning properties would be less costly in the long run. In particular, we reported that the General Services Administration had not implemented our 2013 recommendation to develop a strategy to increase ownership of investments for a prioritized list of high-value leases where ownership

²⁰The three leases have individual annual costs of approximately \$2 million, \$1.5 million, and \$150,000.

²¹National Nuclear Security Administration, *Mission Need Statement: Office and Manufacturing Space Expansion Project, Kansas City National Security Campus* (Kansas City, Missouri: initial document Sept. 19, 2018). Developing a mission need statement is a key activity during the early stages of a project, and it identifies the capability gap between the current state of a program's mission and the mission plan.

²²GAO, *High-Risk Series: Progress on Many High-Risk Areas, While Substantial Efforts Needed on Others*, [GAO-17-317](#) (Washington, D.C.: Feb. 15, 2017).

would be less expensive in the long run.²³ The Kansas City site's plans for significantly expanding its production and office space underscores the challenges that exist in meeting these space needs while at the same time limiting overall reliance on costly leases.

Production Equipment

NNSA and its contractor at the Kansas City site have identified challenges in ensuring that the plant has up-to-date production equipment. Recapitalizing equipment was not a significant part of the move to the new modern production facility, according to site contractor representatives.²⁴ Information from NNSA's Master Asset Plan 2017,²⁵ for example, states that most of the equipment used for producing nonnuclear parts and components at the Kansas City site is nearing or past the end of its useable life—defined as 15 years.²⁶ Specifically, as shown in figure 6 below, 39 percent of the equipment at the Kansas City site is from 6 to 15 years old, and 27 percent is 16 years old or more, according to the plan. Much of the oldest equipment is located in functional areas used for machining, refurbishment, and dismantlement operations, or for production functions using rubber and plastics. The oldest piece of equipment still maintained is more than 60 years old.

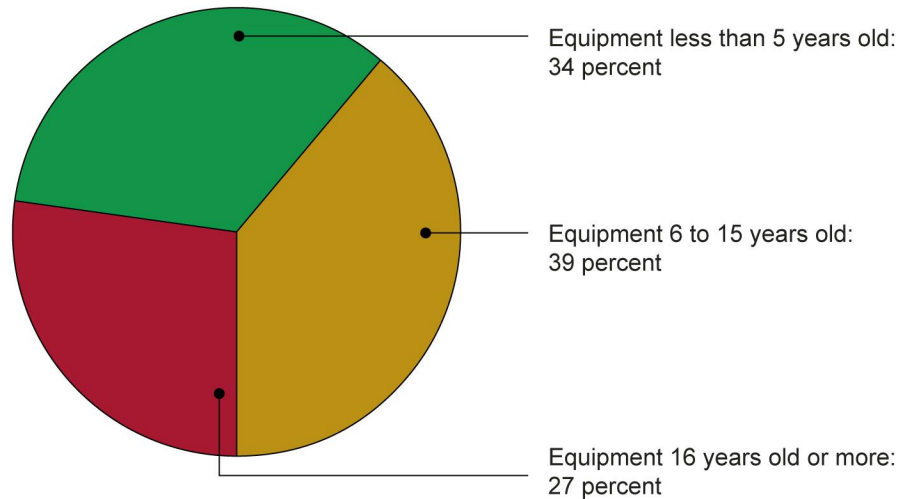
²³GAO, *Federal Real Property: Greater Transparency and Strategic Focus Needed for High-Value GSA Leases*, [GAO-13-744](#) (Washington, D.C.: Sept. 19, 2013). The General Services Administration provides real-estate management and other administrative support services for the federal government.

²⁴Production equipment no longer needed or no longer operational for mission purposes was not moved from the old facility to the new facility, but older equipment that was still needed and operational was moved, according to site contractor representatives.

²⁵National Nuclear Security Administration, Office of Safety, Infrastructure, and Operations, *Master Asset Plan 2017* (Washington, D.C.: 2017).

²⁶NNSA's Master Asset Plan represents NNSA's first step toward an integrated, strategic infrastructure plan. It covers the condition of NNSA's infrastructure, identifying current and potential infrastructure risks to mission requirements.

Figure 6: Age of Production Equipment at NNSA’s Kansas City National Security Complex, as of 2017



Source: GAO analysis based on National Nuclear Security Administration (NNSA) Office of Safety, Infrastructure, and Operations data. | GAO-19-126

Note: NNSA defines “useable life” as up to 15 years in its analysis; after that, equipment still needed is due for replacement or recapitalization.

In addition to age-related challenges, officials at the Kansas City site identified equipment challenges regarding capacity, based on an equipment workload forecast analysis performed in 2015. For example, according to this forecast, starting late in calendar year 2019, demand for vibration- and shaker-test equipment will become consistently greater than existing capacity, requiring additional equipment.²⁷

To address these challenges, Kansas City site contractor representatives stated that they evaluate equipment needs across the facility at least annually, based on production and maintenance schedules. The representatives then develop a master list of equipment requests—weighted for risk, age and condition of existing equipment, and whether an external supplier can provide the functional need, among other factors—and ranked according to current and future business needs, according to these officials and contractor representatives. NNSA officials at the Kansas City site and senior contractor representatives then review the master list to determine priorities for equipment purchases. Site

²⁷Vibration- and shaker-test equipment is used to test conformance of parts and components to design laboratory requirements for structural integrity, durability, and other performance requirements, according to site contractor representatives.

contractor representatives are developing a 10-year equipment strategy, expected to be completed in December 2019, to sharpen focus on the future needs of the production facility to support capacity and capability, according to NNSA officials at the Kansas City site.

Budgets for equipment procurements at the Kansas City site vary from year to year and are subject to change. According to Kansas City site contractor representatives, the site is regularly adjusting and communicating its equipment needs to reflect the results of equipment evaluations to ensure that the funding NNSA will request for equipment procurement is adequate. For example, according to Kansas City site contractor representatives, the site originally received \$4.5 million in fiscal year 2018 to fund planned equipment procurements and received an additional \$13.4 million from NNSA in April 2018 to move fiscal year 2019 work scope into fiscal year 2018.²⁸ The remaining funding available is \$11.6 million, which covers the remaining fiscal year 2019 work scope. Site plans for fiscal year 2018 specifically included capital equipment replacement and upgrades needed for parts assembly, electronics and fabrication, and non-destructive testing of nonnuclear parts and components.

For fiscal year 2019, planned procurements include equipment for testing of parts and components, rubber- and plastics-related production, precision milling, machining and welding, paint and heat treatment, fabrication, and chemical processing. NNSA officials at the Kansas City site stated that planned budgets for fiscal years 2019 through 2023—which currently include \$8 million in equipment procurements and \$2 million for area modifications for each of the 5 years—are subject to adjustment based on ongoing evaluation of site equipment needs. These estimates could change, depending on the outcome of the 10-year equipment strategy, according to NNSA Kansas City site officials and contractor representatives.

In addition to new equipment procurements, the Kansas City site has developed other mitigation plans also focused on equipment capacity risks. For example, these plans include options such as better allocating

²⁸According to Kansas City site contractor staff, the majority of equipment procured for the site is funded through NNSA's Weapons Activities appropriation, which is available for acquisition of plant and capital equipment and other purposes. These funds are administered by NA-50, NNSA's Office of Safety, Infrastructure, and Operations through its recapitalization program.

equal workload amongst similar equipment, and additional batching of material, according to Kansas City site officials.²⁹ The batching of material processed by a certain set of equipment increases efficiencies because it consolidates material into larger portions, which minimizes inefficiencies associated with starting and stopping the equipment multiple times, according to NNSA contractor representatives.

Workforce

Kansas City site officials and contractor representatives have identified three management challenges in ensuring the site can achieve a sufficient contractor workforce to meet forecasted future workload: (1) retention of existing staff, (2) recruiting skilled staff in a competitive job market, and (3) obtaining security clearances for new staff in a timely manner. To address these challenges, the site has been taking actions to retain existing staff, hiring and recruiting hundreds of new staff, and working to speed the security clearance process, according to site contractor representatives.

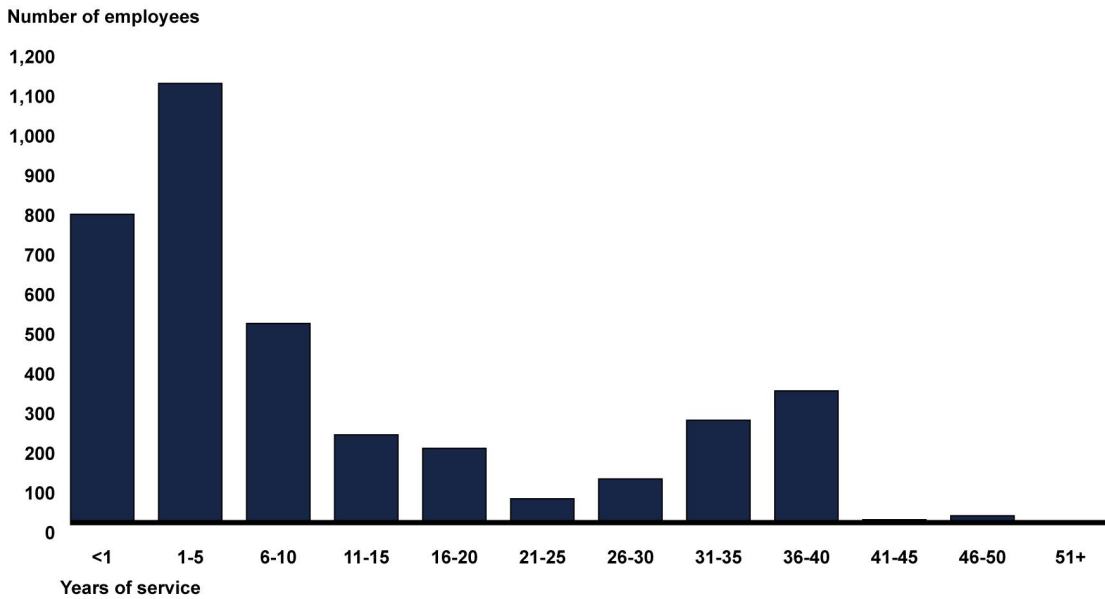
Retaining Existing Staff

Kansas City site contractor representatives said that retaining existing staff is challenging because the majority of the workforce falls into either of two categories: (1) recent, younger hires who have a high attrition rate,³⁰ or (2) staff eligible to retire. More than half (53 percent) of all staff have 5 years or less of service working at the site (see fig. 7).

²⁹Batching of material, as commonly defined, involves determining the amount of material prepared or needed for, or produced in, one operation. Batching is typically used as a method for purposes of gaining efficiency in operations, according to site contractor representatives.

³⁰According to Kansas City staff, within the first year of service, benefits and compensation are large factors for turnover.

Figure 7: Number of Kansas City Site Contractor Staff, by Years of Service, as of Fiscal Year 2017

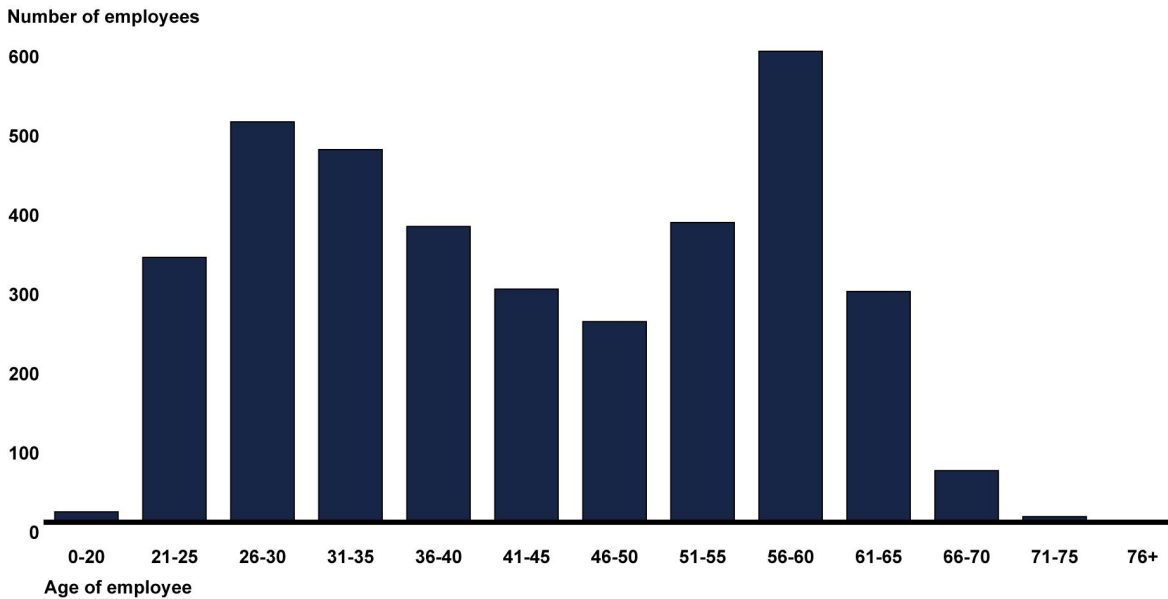


Source: GAO analysis of Kansas City National Security Campus data. | GAO-19-126

In addition, approximately 32 percent of the Kansas City site’s contractor staff are eligible to retire.³¹ Figure 8 shows the distribution of staff by age at the Kansas City site, with the highest number in their late 50s and the next highest number in their late 20s.

³¹According to site contractor representatives, Kansas City site staff are designated as eligible to retire based on a combination of their age and years of service. For salaried staff, retirement eligibility equates to their age and years of service adding to 80, or being 55 years of age with 5 years of service. For hourly staff, retirement eligibility equates to their age and year of service adding to 80, or being 55 years of age with 10 years of service.

Figure 8: Distribution of Kansas City Site Contractor Staff, by Age, as of Fiscal Year 2017



Source: GAO analysis of Kansas City National Security Campus data. | GAO-19-126

According to Kansas City contractor representatives and NNSA documents, site strategies for retaining newly hired and retirement-eligible staff include improvements in rewards and recognition programs, along with an emphasis on pay for performance. Contractor representatives also noted that the site offers telecommuting from a home office for those approved, flexible work hours—such as working 9-hour days to allow for a day off every 2 weeks—and flexible work options, including part-time employment.

To better retain retirement-eligible staff the site has also created talking points to better prepare managers to discuss retirement and delayed retirement, covering topics such as the potential for reduced hours or returning to work after retirement, consistent with certain restrictions and policies. Because of these steps, according to Kansas City contractor representatives, many retirement-eligible staff are electing to continue to work; projected retirements are less than 20 percent of those eligible for retirement, based on actual retirement data for years 2013 to 2017. For example, although an employee may be eligible to retire at age 55 with at least 25 years of service, contractor representatives we interviewed noted that most retirements on average are at age 62 with 30 years of service.

Recruiting Skilled Staff

Kansas City site contractor representatives we interviewed have identified a management challenge in recruitment because of a gap between the critical technical skills needed at the site and those available in the local labor market. In particular, they cited high demand for skilled labor in the Kansas City area and low unemployment in the labor market at 4 percent, which can make it difficult to fill positions. Contractors at the site said that filling skilled positions can take an average of 58 days and that certain positions, such as electrical engineers and toolmakers, are particularly difficult to fill.

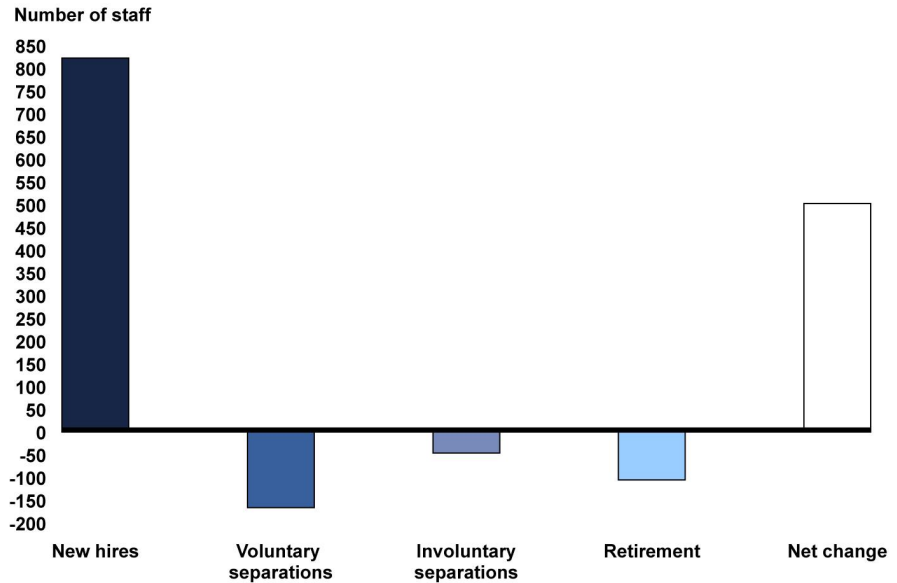
Kansas City site contractors noted that they have taken actions to mitigate this challenge. These actions, which contractor site representatives have characterized as largely successful, include participation in and development of university relations programs, involvement in research and development partnerships and consortiums, recruitment from area trade schools and technical schools, and expanding the market area in which the site searches for recruits. For example, contractors noted the site's participation in a service academy career conference in San Diego, California, in August 2018.³² They also said they are considering ways to recruit skilled positions that are in high demand, such as toolmakers, by offering to cover relocation expenses for newly hired workers. They further noted that the site maintains an internship program and has plans to double the number of interns, from 35 in 2018 to 71 in 2019, as a strategy to increase talent in critical areas.

According to Kansas City site contractor representatives, the site increased the total number of contractor staff by about 65 percent in a 4-year period, from 2,492 in August 2014 to 4,134 in August 2018, and is expected to continue to increase to nearly 5,000 staff by August 2019. Figure 9 shows the change in number of Kansas City site staff during the last fiscal year for which data are complete, and the reasons for the changes, as reported to us by site contractor representatives. To meet forecasted workload increases, the site plans to continue to increase staff in each year through 2020, with the numbers of planned annual hires

³²The service academy career conference is a job fair exclusively for service academy alumni, administered and supported by the alumni associations and association of graduates of the U.S. Military Academy, the U.S. Naval Academy, the U.S. Air Force Academy, the U.S. Coast Guard Academy and the U.S. Merchant Marine Academy.

ranging from 800 to more than 1,000 staff, according to site contractor representatives.

Figure 9: Change in Number of Kansas City Site Contractor Staff from End of Fiscal Year 2016 through End of Fiscal Year 2017



Source: GAO analysis of Kansas City National Security Campus data. | GAO-19-126

Obtaining Timely Security Clearances for New Staff

Kansas City site officials identified a challenge in obtaining appropriate, high-level security clearances for new staff on a timely basis. Contractor representatives we interviewed noted that 100 percent of staff who directly contribute to the design, disposition, fabrication, inspection, scheduling, and protection of products and services related to nuclear weapons require a Q clearance.³³ They further noted that the large majority of support functions also require a Q clearance. As we reported in March 2018,³⁴ the National Background Investigation Bureau had a

³³DOE and U.S. Nuclear Regulatory Commission “Q” clearances are equivalent to top-secret clearances granted by DOD.

³⁴GAO, *Personnel Security Clearances: Additional Actions Needed to Implement Key Reforms and Improve Timely Processing of Investigations*, [GAO-18-431T](#) (Washington, D.C.: Mar. 7, 2018).

backlog of more than 700,000 investigations as of February 2018.³⁵ As we reported, this backlog was caused in part by two 2015 breaches of Office of Personnel Management personnel records.³⁶ We designated the government-wide personnel security clearance process as a high-risk area in January 2018.³⁷

Of this national backlog, 3,609 were investigations of Q applicants. As of April 2018, over 790 Kansas City site personnel were awaiting Q clearances, according to Kansas City site contractor representatives. According to these representatives, historically, the Bureau took 80 days, on average, to investigate most Q applicants prior to the 2015 breaches; however, as of February 2018, the Bureau took 316 days, on average, to do so. According to Kansas City site contractor representatives, the Bureau is not projecting normal operations until late 2019 or early 2020. From fiscal year 2017 through March 2018, 778 Q clearances were granted for the Kansas City site, with an average of 335 days at the Bureau and another 27 days at NNSA to make a final determination.³⁸ According to site contractor representatives, these long wait times may contribute to less than full employee utilization at the site. For example, they noted that fully cleared staff are able to perform roughly 38 percent more productive work than uncleared staff, and that difference amounts to approximately 695 direct labor hours of productive work per person in a year.

³⁵The National Background Investigations Bureau is the entity within the Office of Personnel Management with responsibility for conducting personnel background investigations. It absorbed the Federal Investigative Services—the prior entity within the Office of Personnel Management that conducted background investigations—when it became operational on October 1, 2016.

³⁶In June 2015, the Office of Personnel Management reported that an intrusion into its systems had affected the personnel records of about 4.2 million current and former federal employees. Then, in July 2015, the agency reported that a separate, but related, incident had compromised its systems and the files related to background investigations for 21.5 million individuals. In total, OPM estimated 22.1 million individuals had some form of personally identifiable information stolen, with 3.6 million being victims of both breaches.

³⁷GAO's High-Risk List includes federal areas in need of either broad-based transformation or specific reforms to prevent waste, fraud, abuse, and mismanagement. See [GAO-18-431T](#) for additional detail.

³⁸According to NNSA officials, Kansas City site contractor representatives indicated progress in increasing the number of clearances granted in a December 2018 update to NNSA, due in part to the site requesting priority background investigations from the Bureau.

The Kansas City site is taking steps to mitigate the challenges associated with the Bureau's backlog. For example, the site is hiring hourly production factory staff well in advance of the full production schedule for the B61-12 and W88 Alt 370 weapons systems in fiscal year 2019, in part to ensure these staff will be cleared in time to meet workload demands, according to site contractor representatives.³⁹ Site contractor representatives told us that they have also worked to expedite the issuance of clearances by working with local Office of Personnel Management officials on interviews for clearance cases. In addition, the site has worked to ensure that new staff can be trained and productive while awaiting clearances. Specifically, according to contractor representatives, the site has

- established segregated training space for uncleared workers;
- created security plans and escorting practices that allow uncleared staff supervised access into secure areas to perform unclassified work, where possible;⁴⁰ and
- temporarily converted some production space into areas where uncleared staff can perform unclassified hand assembly work.

In addition, the Kansas City site has requested 339 interim Q clearances, 267 of which had been approved, as of January 2018. DOE's order that establishes requirements for processing and granting security clearances allows for interim security clearances to be issued under exceptional circumstances and when such action is clearly consistent with agency and national interests. DOE considers interim clearances to be temporary measures pending completion of the investigation, which must be in process when the interim clearance is granted.⁴¹ As of September 2018,

³⁹These hourly staff may work in areas such as assembly and electrical fabrication, rubber and plastics, or secure electronics.

⁴⁰Contractor staff noted that sufficiently cleared staff supervise uncleared staff while the latter conduct unclassified work only in areas of the plant where the need for those uncleared staff outweighs the potential burden placed upon the department to utilize escorts. Contractor staff further noted that they temporarily converted production space into areas where such employees can perform unclassified hand assembly work.

⁴¹DOE Order 472.2, *Personnel Security* outlines DOE's guidance for processing and granting of security clearances. According to Kansas City site contractor representatives, DOE also issued additional guidance directing personnel that grant security clearances for DOE federal and contractor staff/applicants to make risk-based interim clearance decisions on a case-by-case basis only until the clearance investigation backlog has abated, at which point interim security clearances will be processed in accordance with usual practices.

less than 1 percent of interim clearances approved for the Kansas City site had been cancelled once full investigations were completed, according to site contractor representatives.

External Suppliers

Kansas City site contractor representatives identified challenges regarding the site's monitoring and management of external suppliers' capacity and skills, and other challenges—such as ensuring that suppliers are willing to establish long-term partnerships with the Kansas City site—that could affect supply chain risk. Since the site procures about 65 percent of its nonnuclear components from external suppliers, these management challenges are highly important, according to site contractor representatives. For example, disruption to the established supply chain due to insufficient capacity, skills, or a supplier's decision not to do business with the Kansas City site can result in production delays. According to Kansas City site contractor representatives, delays in such instances are possible because site contractor representatives would need to take additional time to either replace the lost supplier or develop its own production line to produce the parts in-house at the Kansas City site.

To help mitigate challenges regarding the site's overall monitoring and management of suppliers' capacity, skills, and other risks, the Kansas City contractor representatives said that they developed two key analytic tools. These tools are a Supplier Capacity Analysis Tool, developed in 2018, and a Supplier Overall Risk Tool, which has been evolving since 2015, according to these representatives. According to Kansas City site officials, contractor representatives use these analytical tools to evaluate over 230 suppliers on a quarterly basis and to evaluate the top 39 suppliers monthly. The evaluations assess factors such as operational performance and financial health, whether a supplier is the sole commodity supplier, and a supplier's willingness to partner with the site.

To help mitigate supplier capacity risks, the site develops plans, using information from the supplier evaluations, to ensure sufficient external supplier capacity, according to Kansas City site contractor representatives. For example, Kansas City site contractor representatives used the supplier capacity analysis tool to identify capacity gaps for at-risk commodities, including machine parts, and to develop gap-closure plans, according to these contractor representatives. As a result of these plans, contractor representatives certified two new suppliers and entered into agreements with several other suppliers to provide reserve capacity.

In addition, NNSA's Enterprise Modeling and Analysis Consortium conducted alternate analysis on the Kansas City site's workload capacity that corroborated the Kansas City site's conclusion that mitigation steps being taken at the Kansas City site, including ensuring adequate external supplier capacity, should address increased workload concerns.

To help mitigate risks regarding suppliers' skills in working with the Kansas City site, site contractor representatives also said that the site has taken steps to help train new suppliers. For example, site contractor representatives perform multiple on-site training exercises within the first 6 months of new supplier relationships. These exercises educate the suppliers on purchase order requirements, terms, drawing definitions, and quality expectations using a documented, comprehensive, nine-step process, according to site contractor representatives.

To help mitigate risks regarding suppliers' willingness to establish long-term partnerships with the Kansas City site, site contractor representatives told us that they have begun taking steps to encourage and foster long-term partnerships with suppliers. According to these representatives and a study NNSA conducted of lessons learned from an essentially complete warhead life extension program,⁴² facilitating effective supply chains for the nuclear enterprise requires enduring business relationships with suppliers of commercial off-the-shelf components. Because specifications for weapons components and materials are exacting and quantities required are frequently low, many potential suppliers are reluctant to expose themselves to the risk of production for a niche market, according to Kansas City site officials and contractor representatives. To mitigate reluctance to partner with the Kansas City site, contractor representatives stated that the site has developed points of contact with each supplier. These points of contact work toward establishing and maintaining a collaborative partnership in which production forecasts are routinely shared and performance metrics are discussed to foster continuous improvement when needed.

In addition, Kansas City site contractor representatives stated that the site is taking steps to develop relationships with other sites to address site-wide challenges regarding supplier evaluations, which can contribute to risks such as lower efficiency and effectiveness and higher costs. The site

⁴²National Nuclear Security Administration, *Defense Programs W76-1 Life Extension Program Lessons Learned Study* (Washington, D.C.: August 3, 2017) (Official Use Only).

is taking this action in response to a July 2018 DOE Office of Inspector General (OIG) report that identified the potential duplication of supplier evaluations among NNSA sites, including the Kansas City site,⁴³ resulting in lower efficiency and effectiveness, and higher costs. The OIG report noted that the need to minimize duplication of efforts will become even more important when considering the additional demands on production related to upcoming weapon refurbishment efforts, which are expected to increase the number of supplier quality auditors needed by the Kansas City site. The OIG recommended that to maximize efficiencies and effectiveness, NNSA should work with contractors, including the Kansas City site, to assess ways to improve the efficiency of supply chain management activities, among other things.

Steps the Kansas City site has taken in response to this OIG report include establishing a point of contact with Sandia National Laboratories, which is leading an overarching effort across the nuclear security enterprise to address duplication concerns, according to site contractor representatives. In addition, a December 2018 report to the President by DOD, in consultation with other agencies, identified supply chain risks in the government's manufacturing and defense industrial base, including at DOE and NNSA sites, and recommended that DOE establish an Industrial Base Analysis and Sustainment program to address risks within the energy and nuclear sectors.⁴⁴ According to NNSA officials at the Kansas City site, they are still determining how it will respond to this recommendation.

Weapons Design Changes

With increasing concurrency of production forecasted, Kansas City contractor representatives have identified challenges regarding their need to minimize weapons design changes during production, which in the past contributed to cost increases and schedule delays for the W76-1 life extension. According to Kansas City contractor representatives and NNSA officials, at least two general weapons design issues can contribute to overall schedule pressure at the Kansas City site. For

⁴³Office of Inspector General, U.S. Department of Energy, *Supplier Quality Management at National Nuclear Security Administration Sites*, DOE-OIG-18-41 (Washington, D.C.: July 18, 2018).

⁴⁴Department of Defense, *Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States* (Washington, D.C.: September 2018).

example, delays due to design changes intended to make parts easier to produce can exacerbate schedule delays by compressing the overall weapons refurbishment schedule. In addition, design changes are undertaken for other reasons, such as in response to weapons testing results.

First, according to NNSA's B61-12 program manager, even though both design laboratories and production site team members advocate for the design changes that make parts easier to produce,⁴⁵ the enterprise-wide impact of these changes late in the design process may, as site contractor representatives noted, impact the LEP's schedule and may require more resources and plant/vendor capacity to meet the schedule. According to this official, given the resource demands of simultaneously occurring major weapons refurbishments, such as the B61-12 and W88 Alt 370, schedule impacts can be magnified and have caused justifiable concern with leadership at NNSA, the design laboratories, and the Kansas City site.

Second, Kansas City site officials expressed concern that some component design requirements continue to change late in the production development phase, sometimes because of test results, which creates tension between improving the design and stabilizing production requirements and processes in preparation for full-scale production. Kansas City site officials stated that such design changes pose an ongoing management challenge. Specifically, time lost because of design delays in the earlier stages of weapons' design and development often needs to be recovered later, during time allotted for production, to meet established delivery schedules, according to Kansas City site officials. Such delays have triggered the need for schedule recovery plans at the Kansas City site in the past.

In response to the concerns, NNSA has led several mitigation steps to address schedule risk as both the B61-12 and W88 Alt 370 enter the final stages before full production begins, according to NNSA's B61-12 program manager. For example, NNSA revised its baseline change process for the B61-12 and W88 Alt 370 to require all changes, including production-related changes, to be reviewed, according to NNSA's B61-12

⁴⁵Design changes for helping to make parts easier to produce could include changes such as updating product specifications, changing or refining tester limits, and substituting among commercial -off-the-shelf parts—such as resistors, caps, and diodes—to fine-tune circuit performance, according to NNSA's B61-12 program manager.

program manager. Specifically, NNSA implemented a change management board with several tiers for review and approval of proposed design changes based on the type of change, and potential impact to program milestones, cost, and risk. Varying levels of required review and approval, depending on the change, can include NNSA production and design agency officials, senior site managers, B61-12 or W88 Alt 370 project officers, or other senior managers at DOD and NNSA. The intent, according to this official, is to screen all the changes and determine if they are really needed and when, and if site-wide resources and schedules can support the changes.

In addition, Kansas City site contractor representatives said that they have developed management strategies to help mitigate production-related impacts of design changes, such as adding work shifts to increase production output. For example, an August 2017 analysis by Kansas City site contractor representatives shows the use of three shifts—both partial and full shifts—to meet workload demand in multiple functional areas, including production of cables, high voltage assembly, encapsulation and welding, arming and firing mechanisms, machining, and environmental and pressure laboratories.⁴⁶ Using additional shifts can help the Kansas City site recover from schedule delays that might result from late design changes, according to site contractor representatives. Moreover, lessons learned from the W76-1 LEP—which will complete production in 2019—are helping to improve coordination between production sites and design agencies, specifically through increased coordination earlier in the weapon development process, according to Kansas City site contractor representatives.

Further Changes to Stockpile Requirements Are Anticipated, Which May Affect Existing Workload Plans at the Kansas City Site

While current efforts to mitigate the challenges Kansas City site contractor representatives have identified are expected to help address the site's anticipated future workload, as discussed previously, this workload could further increase if certain 2018 Nuclear Posture Review

⁴⁶The analysis also showed that workload demand for other functional areas was being met by using single shifts, including the production of radars, certain electronics, telemetry, foam fabrication, plastics machining and molding, painting and heat treatment, and polymer production.

policy statements, based on nuclear weapons stockpile studies now underway in response to the review, result in changes to production requirements.⁴⁷ For example, the Nuclear Posture Review called for modifying existing sea-launched ballistic missile warheads to provide a low-yield option; advancing a program to replace the W78 Intercontinental Ballistic Missile warhead by 1 year;⁴⁸ the study of a sea-launched, nuclear-armed cruise missile; and sustaining the B83 strategic nuclear bomb past its currently planned retirement date. NNSA and DOD are developing studies and implementation plans for the 2018 Nuclear Posture Review, but it is too soon to know to what extent these studies and plans may affect the Kansas City site. One early indication of how implementing the 2018 Nuclear Posture Review may affect the Kansas City site is that, according to the Fiscal Year 2019 *Stockpile Stewardship and Management Plan*,⁴⁹ concurrent production of the W80-4 LEP and the W78 replacement LEP is now expected to extend into the 2030s. In addition, the 2019 plan anticipates that alts may be needed to sustain the B83, if the weapon system remains in the stockpile for long enough.

We concluded in an April 2017 report that the new Nuclear Posture Review comes during a particularly challenging decade for NNSA's nuclear modernization efforts, as the agency plans to simultaneously execute at least four nuclear LEPs along with major construction projects, such as efforts to modernize NNSA's uranium and plutonium capabilities.⁵⁰ We further concluded that NNSA's modernization budget estimates for fiscal years 2022 through 2026, which reflected past program plans, may exceed the funding levels programmed for modernization in future budgets, raising affordability concerns. Moreover, we concluded that NNSA had not addressed a projected "bow wave" of future funding needs—that is, an impending and significant increase in requirements for additional funds—or the mismatch between potential

⁴⁷The Nuclear Posture Review was prepared by the DOD under the direction of the President to determine the role of nuclear weapons in the nation's security strategy.

⁴⁸The W78 replacement is based on work NNSA and its sites previously did on an inter-operable warhead.

⁴⁹National Nuclear Security Administration, *Fiscal Year 2019 Stockpile Stewardship and Management Plan—Biennial Plan Summary Report to Congress* (Washington, D.C.: October 2018). According to the *Fiscal Year 2019 Stockpile and Stewardship Management Plan*, the plan begins to, but doesn't fully incorporate the 2018 Nuclear Posture Review—NNSA will continue to analyze the portfolio's long-term needs and the next plan will include further changes to align it with the 2018 Nuclear Posture Review.

⁵⁰[GAO-17-341](#).

funding needs and potential funding available even before the Nuclear Posture Review was completed. We recommended that NNSA include an assessment of affordability of NNSA's portfolio of modernization programs in future versions of the *Stockpile Stewardship and Management Plan*—for example, by presenting options NNSA could consider to bring its estimates of modernization funding needs into alignment with potential future budgets. NNSA did not explicitly agree or disagree with our recommendation, but we will continue to monitor any action NNSA takes in response to the recommendation.

In addition to addressing affordability concerns, NNSA has been advised to stabilize long-term workload at operating sites. A congressional advisory panel examining the governance of the nuclear security enterprise issued a report in November 2014 recommending, among other things, actions intended to stabilize long-term workload at operating sites.⁵¹ In particular, it recommended that NNSA, working with DOD, create a long-term operating plan to support the nation's warhead modernization strategy; it further specified that this plan should be designed to create a relatively stable, long-term workload. The panel's report stated that a stable baseline of design, engineering, and production is needed to make effective use of the available capabilities in the weapons complex, provide the basis for sizing and modernization of the weapons complex, and identify potentially conflicting demands on available capabilities. While NNSA has taken some actions in response to this recommendation, an expert panel concluded in March 2018 that NNSA's overall response had been inadequate and called for NNSA to develop, among other things, an integrated strategic plan for the entire nuclear security enterprise.⁵² The panel concluded that, given NNSA's

⁵¹Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, *A New Foundation for the Nuclear Enterprise*. Section 3166 of the National Defense Authorization Act for Fiscal Year 2013 established the panel to examine options and make recommendations for revising the governance structure, mission, and management of the nuclear security enterprise.

⁵²Panel to Track and Assess Governance and Management Reform in the Nuclear Security Enterprise (National Academies of Sciences, Engineering, and Medicine and National Academy of Public Administration), *Report 2 on Tracking and Assessing Governance and Management Reform in the Nuclear Security Enterprise* (Washington, D.C.: March 13, 2018). Section 3137 of the National Defense Authorization Act for Fiscal Year 2016 requires DOE and NNSA to develop an implementation plan to reform the governance and management of the nuclear security enterprise. The act also required NNSA to contract with the National Academy of Science and the National Academy of Public Administration to establish a panel of experts to assess the plan and its implementation.

expected increase in workload across the nuclear weapons complex, and the new 2018 Nuclear Posture Review uncertainties, NNSA's ongoing implementation of this and other recommendations made by the Panel over the next several years will take on additional importance.

Agency Comments

We provided a draft of this report to NNSA for its review and comment. NNSA provided technical comments, which we incorporated into this report, as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Administrator of the National Nuclear Security Administration, 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 have any questions about this report, please contact me at (202) 512-3841 or bawdena@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 key contributions to this report are listed in appendix II.



Allison B. Bawden
Director, Natural Resources and Environment

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Appendix I: Objectives, Scope, and Methodology

The Senate committee report accompanying a bill for the National Defense Authorization Act for Fiscal Year 2018 included a provision for us to review the Kansas City site's staffing plans and capabilities to meet national security requirements.¹ Our report examines (1) workload forecasts for the Kansas City site since 2012, and (2) management challenges the Kansas City site has identified for achieving the forecasted workload and actions the site has taken to mitigate these challenges.

To examine workload forecasts for the Kansas City site since 2012, we visited the site, obtained and reviewed workload documents, and interviewed officials from the National Nuclear Security Administration's (NNSA) Kansas City site office and headquarters offices, and NNSA contractor representatives at the site. In particular, we obtained information on the Kansas City site forecasted workload based on fiscal years 2012 and 2018 *Stockpile Stewardship and Management Plans* (SSMP), comparing full production schedules, including upcoming B61-12 Life Extension Program (LEP) and W88 Alteration (Alt) 370 work. Because the design and capacity of the modern production facility, completed in 2012, was based largely on the 2012 SSMP and previous plans, we used this as the baseline plan. We then compared nuclear weapons systems LEP and Alt schedules in the 2012 SSMP with the 2018 SSMP because Kansas City contractor representatives told us that plans and associated workload had changed significantly by 2018. In addition, we reviewed Kansas City contractor information provided by the "what-if" capacity analyses tool, including graphs and charts depicting workload for each weapons system undergoing LEPs or Alts.² Whenever possible, we validated or corroborated contractor-forecasted data on workload and facility capacity by reviewing other sources such as NNSA's Enterprise Modeling and Analysis Consortium analysis and conclusions and SSMP information.

¹S. Rep. No. 115-125, at 356 (2017).

²We reviewed the results of these contractor analyses but did not take steps to assess the specific forecasts for validity and accuracy.

To examine management challenges the Kansas City site has identified for achieving the forecasted workload, and any actions the site has taken to mitigate these challenges, we visited the Kansas City site, obtained and reviewed documentation, and interviewed NNSA and contractor officials who identified management challenges in five areas: ensuring that the site has (1) sufficient production and administrative office space, (2) up-to-date production equipment, (3) a sufficient workforce, (4) capable and reliable external suppliers, and (5) complete weapons designs early enough in development to minimize production changes and delays. We selected these five areas for review based on NNSA officials' and contractor representatives' identification of such challenges as being the most significant at the Kansas City site.

To corroborate information on management challenges and associated mitigation action(s) provided by the Kansas City site, we conducted interviews with additional sources, reviewed alternative documentation or analyses, and obtained examples of the specific action(s) being taken, when available. For example, regarding the first management challenge of ensuring adequate production and administrative office space, we reviewed Kansas City site information, including information on space in the modern facility, the mission needs statement for expanding the site's space, and NNSA budget justifications for fiscal years 2018 and 2019. We also obtained information on short- and long-term plans for meeting forecasted workload demands.

Regarding the second management challenge—ensuring it has up-to-date production equipment—we reviewed Kansas City site information and information from an alternative source. Specifically, we reviewed NNSA's 2017 Master Asset Plan, which provided additional information and alternate analyses concerning the age of the Kansas City site's production equipment. Regarding the third management challenge—ensuring a sufficient, capable, and security-cleared workforce—we reviewed both site-level information and information from other sources, including from NNSA and the Department of Energy (DOE). For example, we reviewed NNSA's *Fiscal Year 2018 Stockpile Stewardship and Management Plan*, which also includes workforce information and analyses. In addition, we asked the Kansas City site contractor representatives and NNSA officials for additional clarification and detail concerning the management challenges and mitigation actions, as well as specific examples to support their statements. For issues related to the clearance process, we contacted DOE officials to obtain information on DOE supplemental guidance for interim clearance mitigation steps. To confirm the accuracy of staffing-related information provided by Kansas

City site contractor representatives, we obtained information from these representatives on how the site performed certain calculations, such as determining the change in number of Kansas City site staff; number of Kansas City site staff, by years of service; and distribution of Kansas City staff, by age. We reviewed the various formulas Kansas City contractor representatives used in preparing its analyses in order to understand the logic used in making these determinations. Furthermore, we validated that these calculations were accurate by independently performing the calculations to see if our results matched the site's results.

For information concerning the fourth management challenge—ensuring capable and reliable external suppliers—we interviewed a senior NNSA headquarters official overseeing NNSA's Enterprise Modeling and Analysis Consortium, which conducted alternate analyses on the Kansas City site's workload capacity, equipment, and workforce. The Consortium corroborated the Kansas City site's conclusion—that mitigation steps being taken at the Kansas City site should address increased workload concerns. Regarding the fifth and last management challenge—ensuring complete weapons designs early in development to ensure that production changes and delays are kept to a minimum—we reviewed the W76 lessons learned report, which also describes design completion issues affecting the Kansas City site. In addition, we interviewed NNSA's B61 program manager to obtain additional perspective on design-related challenges facing upcoming B61-12 refurbishments.

We conducted this performance audit from November 2017 to April 2019 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: GAO Contact and Staff Acknowledgments

GAO Contact

Allison B. Bawden, (202) 512-3841 or bawdena@gao.gov.

Staff Acknowledgments

In addition to the individual named above, Jonathan Gill (Assistant Director), Christopher Pacheco (Analyst in Charge), and Sophia Payind made significant contributions to this report. Also contributing to this report were Elizabeth Dretsch, R. Scott Fletcher, Thomas Gilbert, Richard Johnson, Cynthia Norris, Jeanette Soares, and Sara Sullivan.

Appendix III: Accessible Data

Data Tables

Accessible Data for Figure 2: Joint DOD and NNSA Phase 6.X Process for Managing Warhead Life Extension Activities for Nuclear Weapons

6.1 Concept assessment

DOD or NNSA conducts studies to determine if a weapon in the stockpile needs refurbishment or to investigate refurbishment concepts.

6.2 Feasibility study and option down-select

For a weapon needing refurbishment, DOD and NNSA coordinate efforts to update the weapon's military requirements, develop feasible design options to meet the requirements, and identify a preferred design option(s).

6.2A Design definition and cost study

DOD and NNSA coordinate further investigation of a preferred design option(s) and the expected refurbishment costs.

6.3 Development engineering

NNSA conducts tests and experiments to validate the design option(s) in consultation with DOD.

6.4 Production engineering

NNSA conducts activities to adapt the design for production and prepare its production facilities.

6.5 First production

NNSA refurbishes a limited number of weapons for analysis and production process qualification.

6.6 Full-scale production

NNSA conducts full-scale production at its facilities.

Accessible Data for Figure 4: Forecasted Full-Time Equivalent Workload for Production of Two Weapons Systems, as of Fiscal Year 2018

Fiscal year	B61 LEP	W88 ALT
<u>2018</u>	180	77
<u>2019</u>	207	131
<u>2020</u>	316	205
<u>2021</u>	327	215
<u>2022</u>	299	210
<u>2023</u>	275	105
<u>2024</u>	201	14

Accessible Data for Figure 6: Age of Production Equipment at NNSA’s Kansas City National Security Complex, as of 2017

Equipment less than 5 years old:

34 percent

Equipment 6 to 15 years old:

39 percent

Equipment 16 years old or more:

27 percent

Accessible Data for Figure 7: Number of Kansas City Site Contractor Staff, by Years of Service, as of Fiscal Year 2017

Years of Service	Number of employees
<1	777
1-5	1107
6-10	502
11-15	221
16-20	187
21-25	60
26-30	110
31-35	258

Years of Service	Number of employees
36-40	332
41-45	7
46-50	17
51+	1

Accessible Data for Figure 8: Distribution of Kansas City Site Contractor Staff, by Age, as of Fiscal Year 2017

Age of employee	Number of employees
0-20	13
21-25	334
26-30	505
31-35	470
36-40	373
41-45	294
46-50	253
51-55	378
56-60	594
61-65	291
66-70	65
71-75	7
76+	2

Accessible Data for Figure 9: Change in Number of Kansas City Site Contractor Staff from End of Fiscal Year 2016 through End of Fiscal Year 2017

Category	Number of staff
New Hires	822
Voluntary separation	167 (minus)
Involuntary separation	47 (minus)
Retirement	106 (minus)
Net Change	320

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