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Report to Congressional Committees

February 2005

NATIONAL NUCLEAR SECURITY ADMINISTRATION

Contractors' Strategies to Recruit and Retain a Critically Skilled Workforce Are Generally Effective

GAO-05-164

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GAO Accountability·Integrity·Reliability

Highlights

Highlights of GAO-05-164, a report to congressional committees

Why GAO Did This Study

Responsibility for ensuring the safety and reliability of the nuclear weapons stockpile rests upon a cadre of workers at eight contractor-operated National Nuclear Security Administration (NNSA) weapons facilities. Many of these workers—including scientists, engineers, and technicians—have "critical" skills needed to maintain the stockpile. About 37 percent of these workers are at or near retirement age, raising concern about whether these specialists will have time to pass on their knowledge and expertise to new recruits. In this context, you asked us to (1) describe the approaches that NNSA, its contractors, and organizations with similar workforces are using to recruit and retain critically skilled workers; (2) assess the extent to which these approaches have been effective; and (3) describe any remaining challenges, strategies to mitigate these challenges, and the similarity of these challenges and strategies to those of organizations with comparable workforces.

We provided NNSA with a draft of this report for its review and comment. In oral comments, NNSA agreed with the report.

www.gao.gov/cgi-bin/getrpt?GAO-05-164.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Robin Nazzaro at 202-512-6246 or nazzaror@gao.gov.

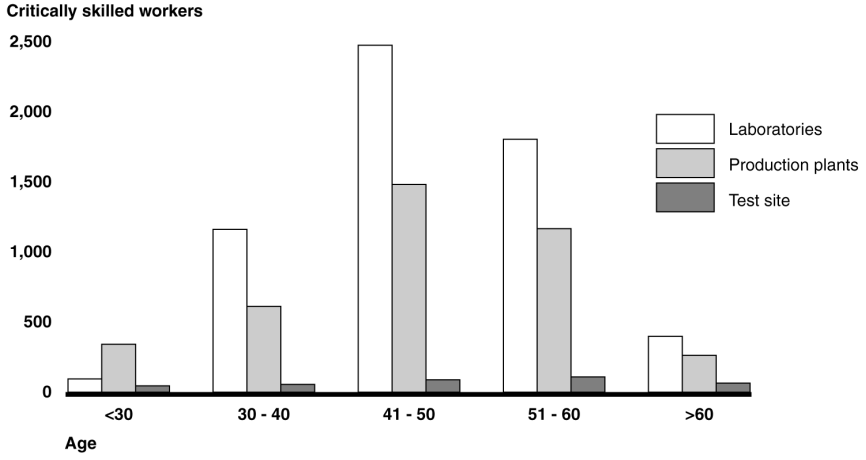
What GAO Found

NNSA contractors have each developed and implemented a multifaceted approach to recruit and retain critically skilled workers. These approaches are similar to those used by six organizations with comparable workforces with whom GAO spoke and consist of combinations of activities tailored to meet the specific needs of each facility. These activities include offering internships and providing knowledge transfer opportunities. NNSA has supported the contractors' efforts by, for example, providing additional funding to help them recruit workers to fill critically skilled positions.

The efforts of NNSA's contractors to recruit and retain a critically skilled workforce have been generally effective. The contractors' fiscal year 2000 through 2003 data show that all eight facilities have maintained the critically skilled workforce needed to fulfill its current mission. In addition, our review of the workforce planning processes of each facility shows that they have incorporated, to varying degrees, the five principles GAO has identified as essential to strategic workforce planning. Finally, most of the program managers GAO spoke with believe their facilities have, and are well poised to maintain, the critically skilled workforce needed to fulfill their mission.

NNSA contractors and the six organizations with comparable workforces face ongoing challenges in recruiting and retaining a critically skilled workforce, but are using a number of similar strategies to mitigate most of these challenges. These challenges include the amount of time it takes new staff to obtain security clearances and a shrinking pool of technically trained potential employees. Beyond such identifiable challenges, NNSA contractors also face future uncertainties, such as the possibility that a new contractor might be awarded the contract and shifts in their mission that could affect their ability to recruit and retain a critically skilled workforce in the future.

Age Distribution of Critically Skilled Workers at NNSA Nuclear Weapons Facilities, Fiscal Year 2003



Source: NNSA.

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United States Government Accountability Office
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Congressional Committees:

Responsibility for ensuring the continued safety and reliability of the several thousand nuclear weapons currently stored at strategic military locations or deployed on military aircraft, missiles, or submarines rests upon a cadre of scientists, engineers, and technicians—hereafter referred to as "critically skilled workers"—within the National Nuclear Security Administration (NNSA). As of fiscal year 2003, this critically skilled workforce numbered approximately 10,200, with about 37 percent of the workforce older than 51, placing many of these workers at or near the NNSA-wide average retirement age of 60 within the next 10 years. This raises concerns about whether the exodus of these specialists will outpace their replacement and whether the specialists will have time to pass on their knowledge and expertise to new recruits.

Within the Department of Energy (DOE), NNSA's Office of Defense Programs has primary responsibility for ensuring the safety and reliability of the nuclear weapons stockpile.[1] NNSA's nuclear weapons complex consists of eight contractor-operated facilities: three national laboratories (Lawrence Livermore, Los Alamos, and Sandia); four production plants (Kansas City, Pantex, Savannah River, and Y-12); and the Nevada Test Site.[2] NNSA oversees and supports these contractors, whose responsibilities include ensuring that the facility can attract and retain the workforce required to fulfill the facility's mission. Many of these workers possess certain critical skills not readily available in the job market, the loss of which could impair the facility's ability to maintain the safety and reliability of the nation's nuclear weapons. While these workers often have advanced degrees in scientific or engineering fields, it generally takes an additional 2 to 3 years of on-the-job training to achieve the skills necessary to fill a critical skills position.

With the end of the Cold War and the declaration of a moratorium on nuclear testing in 1992, the Office of Defense Programs' total contractor workforce fell from approximately 52,000 in fiscal year 1992 to

[1]The National Defense Authorization Act for Fiscal Year 2000 (Pub. L. No. 106-65, § 3211) created NNSA as a separately organized agency within DOE.

[2]In addition to its main facility in Albuquerque, New Mexico, Sandia National Laboratories has a satellite facility in Livermore, California.

approximately 26,000 in fiscal year 2003, through targeted downsizing and closing of production facilities. During this time, the Office of Defense Programs restructured the nuclear weapons complex to focus on a new mission—known as the Stockpile Stewardship Program—to maintain the safety and reliability of the nation's nuclear weapons stockpile indefinitely without nuclear testing. In this test-free environment, the ultimate success of the program depends on the expert judgment and capabilities of NNSA's critically skilled workforce to maintain and assess the condition of the stockpile.

To address concerns about the effect of the shrinking critically skilled workforce on NNSA's ability to fulfill its stockpile stewardship responsibilities, the National Defense Authorization Act for Fiscal Year 1997 established the Commission on Maintaining U.S. Nuclear Weapons Expertise (known as the "Chiles Commission") and directed it to assess and report to the Congress on, among other things, DOE's ongoing efforts to recruit and retain scientific, engineering, and technical personnel.[3] The Commission's report projected that large numbers of retirements over the next few years could further erode the experience and expertise of the critically skilled workforce.[4] The Chiles Commission warned that unless DOE acted quickly to recruit and retain its critically skilled employees—and sharpen the expertise already available—the department could have difficulty ensuring the safety, security, and reliability of the nation's nuclear weapons. Although the Chiles Commission noted that many DOE officials already understood the challenges, it found few initiatives to change in any basic way the manner in which these officials approached recruitment, career management, or retention.

In this context, you asked us to (1) describe the approaches that NNSA, its contractors, and organizations with comparable workforces are using to recruit and retain critically skilled workers; (2) assess the effectiveness of the NNSA contractors' approaches; and (3) describe any ongoing challenges NNSA's contractors face in recruiting and retaining this specialized workforce, any strategies they are using to mitigate these

[3]Pub. L. No. 104-201, § 3162, 110 Stat. 2843 (1996), as amended by Pub. L. No. 105-85, § 3163, 111 Stat. 2049 (1997).

[4]"Report of the Commission on Maintaining United States Nuclear Weapons Expertise: Report to the Congress and Secretary of Energy, Pursuant to the National Defense Authorization Acts of 1997 and 1998" (Washington, D.C.: March 1, 1999).

challenges, and the extent to which such challenges and strategies are similar to those of organizations with comparable workforces.

To describe the approaches NNSA contractors are using to recruit and retain a critically skilled workforce, we spoke with human resource and workforce planning managers at each of the eight NNSA nuclear weapons complex facilities. Furthermore, we spoke with human resource managers from six research and advanced technology organizations with comparable workforces to validate the extent to which the ongoing challenges identified by NNSA exist in other comparable organizations and to gather information on strategies these organizations are using to mitigate their challenges.[5] We selected organizations with similar workforces based on their selection by the Chiles Commission as a benchmarking organization; their geographic dispersal; and their representation of different high-technology, laboratory, or manufacturing industry segments. We also spoke with two industry associations representing manufacturing and nuclear materials industries to validate whether the challenges cited by these organizations were consistent with those noted by other groups in similar industries.[6]

To assess the effectiveness of the approaches used to recruit and retain critically skilled workers, we collected a variety of workforce data from each facility, including total numbers of Defense Program and critically skilled workers and average ages of these workers broken out by job classification, hiring and attrition trends, average retirement ages, and forecasted needs for critically skilled workers. To assess the reliability of these data, we reviewed relevant documentation, interviewed cognizant contractor officials, obtained data from key database officials, and reviewed responses to a series of data reliability questions covering issues such as data entry, access, quality control procedures, and the accuracy and completeness of the data. We added follow-up questions whenever necessary. We determined that the data were sufficiently reliable for the purposes of this report. In addition, we conducted structured interviews with 20 managers in the Stockpile Stewardship Program, including at least

[5]The six research and advanced technology organizations are the Charles Stark Draper Laboratory, the Jet Propulsion Laboratory, the Johns Hopkins University's Applied Physics Laboratory, the Naval Research Laboratory, the Exelon Corporation, and the Lockheed Martin Corporation.

[6]The two industry associations are the National Association of Manufacturing and the Institute of Nuclear Materials Management.

2 managers at each of the eight facilities, and evaluated each facility's workforce planning process using our five principles of strategic workforce planning.[7] These five principles are (1) involving management and employees in developing and implementing the strategic workforce plan, (2) determining critical skills needs through workforce gap analysis, (3) developing workforce strategies to fill gaps, (4) building needed capabilities to support workforce strategies, and (5) monitoring and evaluating progress in achieving goals.

To describe the ongoing challenges NNSA contractors face in recruiting and retaining a critically skilled workforce, we spoke with contractor human resource, workforce planning, and Stockpile Stewardship Program managers. We also interviewed human resource representatives at the eight organizations with comparable workforces to determine the extent to which they face similar challenges and are using similar approaches to address their challenges. We conducted our work from February 2004 through January 2005 in accordance with generally accepted government auditing standards. More details on the scope and methodology of our review are presented in appendix I.

Results in Brief

NNSA contractors, with support from NNSA, have each developed and implemented a multifaceted approach to recruit and retain critically skilled workers. The contractors' approaches are similar to each others and to those used by organizations we contacted with comparable workforces and consist of combinations of activities tailored to meet the specific needs of individual facilities. These activities are primarily aimed at hiring recent college graduates and to a lesser extent on hiring mid-career workers. NNSA contractors use a number of recruiting activities, including providing internships and other educational outreach programs to increase awareness about job opportunities at NNSA facilities, monitoring compensation programs to maintain competitiveness in the marketplace, and providing professional development and knowledge transfer programs to improve retention rates. For example, as part of its approach, Sandia National Laboratories targets its recruiting efforts by using teams of program managers, recruiters, and alumni of graduate programs at 22 strategically selected colleges and universities. In addition, Sandia makes over 1,200 internship positions available annually to both undergraduate

[7]GAO, *Human Capital: Key Principles for Effective Strategic Workforce Planning*, GAO-04-39 (Washington, D.C.: Dec. 11, 2003).

and graduate-level students. The laboratory also continually monitors its salary and benefits packages to ensure that they remain competitive with those of similar regional industries. Furthermore, Sandia offers a variety of in-house courses and a mentoring program aimed at enhancing the transfer of knowledge from more experienced workers to those just starting out at the laboratory. Organizations with comparable workforces have adopted similar multifaceted approaches to recruit and retain their needed workforces, according to officials of the six organizations we spoke with. For example, one organization used a combination of university recruiting, student co-op and internship programs, recruitment bonuses, and competitive compensation packages, among other strategies, to recruit and retain its target workforce. For its part, NNSA has supported the contractors' efforts to recruit and retain their critically skilled workforce by, for example, reviewing contractors' salary and benefits packages and providing additional funding for internship programs and recruitment bonuses to help the contractors recruit workers to fill critically skilled positions.

The efforts of NNSA contractors to recruit and retain a critically skilled workforce have been generally effective, according to our analysis of contractors' data, our review of contractors' workforce planning processes, and information we gathered from stockpile stewardship program managers. First, the contractors' workforce data for fiscal years 2000 through 2003 show that all eight facilities have hired, on average, 69 percent more critically skilled staff in fiscal years 2000 through 2003 than retired or left during that period. This additional hiring should help ensure that each facility will have workers in place who have completed the needed 2 to 3 years of training, or are close to doing so, by the time the anticipated future retirements occur. Second, our review of the workforce planning processes of all eight nuclear weapons facilities shows that they have incorporated, to varying degrees, the five principles we have identified as essential to strategic workforce planning. Specifically, all of the 20 stockpile stewardship program managers said they are involved to at least a moderate extent with workforce planning and participate in recruiting or retention activities, such as identifying and interviewing prospective staff and mentoring newer staff. Each of the facilities also has, to some degree, analyzed its workforce, identified critical skills needed to achieve current and future goals, and determined if and where gaps exist. To fill these identified gaps, the facilities have designed and implemented a mix of strategies specific to each facility's needs. In addition, the facilities have increased their capabilities to support these workforce planning strategies by, for example, assigning human resource specialists to critical

skill areas to help ensure that new staff are being retained. To ensure that the facilities' critical skill workforce needs are being met, NNSA monitors and evaluates contractor progress by reviewing periodic reports and uses these reports, along with other measures, to determine the size of the bonus the contractor is eligible for. Third, almost all of the 20 stockpile stewardship managers we interviewed believe their facilities have, and are well poised to maintain, the critically skilled workforce needed to carry out their current mission. According to these managers, their facilities have been able to achieve this workforce, in part, because they have effective recruiting and training programs and a commitment to workforce planning that has allowed them to identify their needs.

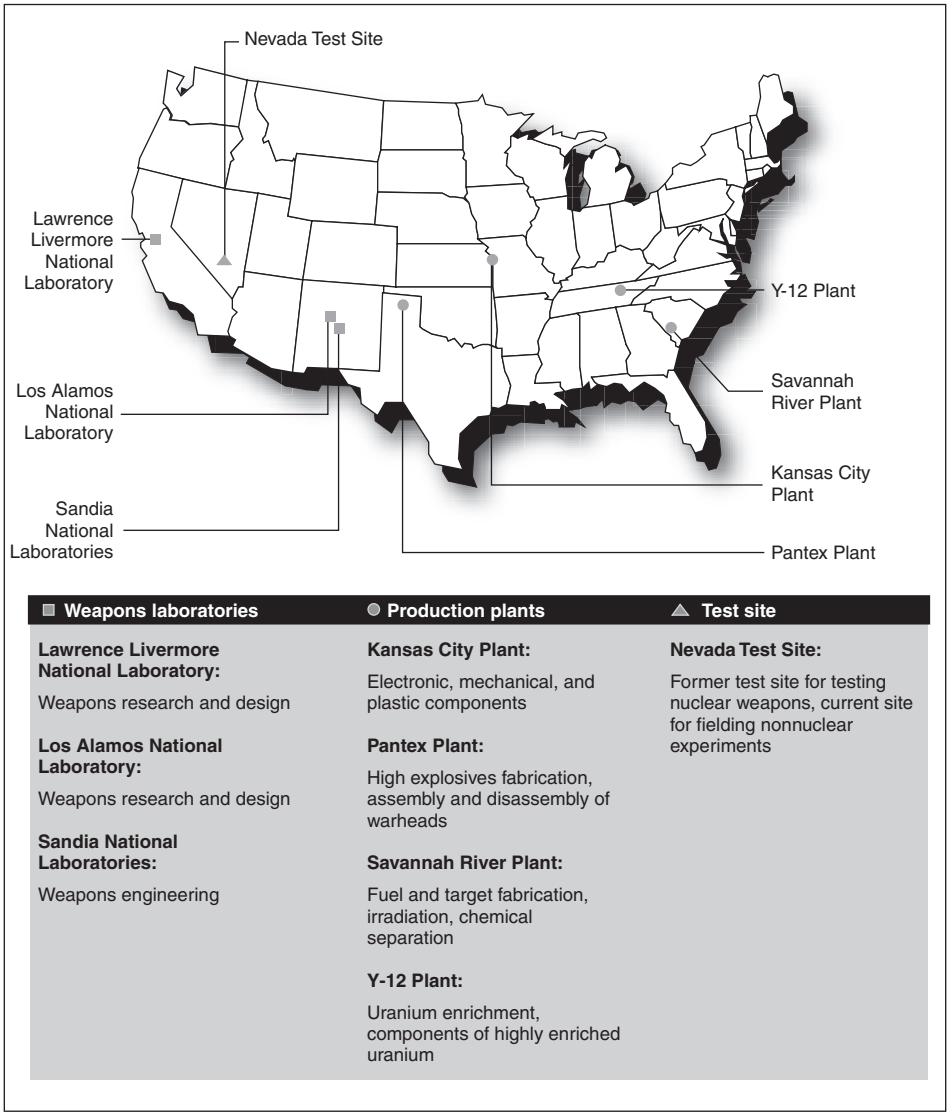
Both NNSA contractors and the six organizations with comparable workforces we contacted face ongoing challenges in recruiting and retaining a critically skilled workforce, but they are using a number of similar strategies to mitigate most of these challenges. The first immediate challenge cited by human resources and program managers is the amount of time it takes newly hired staff to obtain security clearances. NNSA contractors said that security clearances have been taking from 1 to 2 years and that these delays have prevented new employees waiting for a clearance from obtaining needed critical skills training and from doing the work for which they were hired. To mitigate this challenge, most facilities have been able to place the employees on other projects that allow them to gain exposure to unclassified, yet cutting edge, work. In addition, contractors pointed to a shrinking pool of employees with the needed critical skills caused by a decline in the number of students with U.S. citizenship seeking advanced degrees or technical training in these skill areas. The laboratories have mitigated this challenge by, for example, establishing institutes in local high schools that help encourage students to pursue college and advanced degrees in technical fields by providing pathways to jobs at the laboratories. Organizations with comparable workforces face similar challenges and are using similar strategies to mitigate them. For example, officials at some of these organizations mentioned the time it takes for new workers to obtain security clearances. One organization reported mitigating this challenge by hiring staff who already possess clearances. Officials of these organizations also cited the challenge of a dwindling pool of candidates pursuing education in critical skill areas. As NNSA facilities have done, these organizations have implemented programs designed to attract younger students and encourage them to pursue careers in technical fields.

Beyond such identifiable challenges, each of the eight NNSA facilities also face future uncertainties, such as the possibility that a new contractor might be awarded the contract to manage and operate the facility, budget constraints, and shifts in their mission, that could affect their ability to recruit and retain a critically skilled workforce in the years ahead. The facilities are cognizant of these future uncertainties and have taken some actions to proactively guard against them. For example, DOE is currently rebidding the contract at Los Alamos. The possibility that a new contractor may not be linked to the University of California system may potentially result in early retirements and affect the facility's ability to perform its mission. To lessen the potential impact, NNSA recently issued an acquisition plan requiring bidders on the contract to offer current workers at Los Alamos the same level of pension benefits as the current contractor. Until this process is completed, it will be difficult to determine how Los Alamos' critical skills capabilities would be affected.

Background

To ensure the safety, security, and reliability of the nation's nuclear weapons stockpile, NNSA relies on contractors who manage and operate government-owned laboratories, production plants, and a test site. The number of workers and facilities involved in the nuclear weapons program has changed since the program began in the early 1940s at various locations, such as the Los Alamos National Laboratory in New Mexico. Each facility performs a different function, all collectively working toward fulfilling NNSA's nuclear weapons related mission. Figure 1 shows the locations of the facilities and describes their functions.

Figure 1: Locations and Functions of NNSA Facilities



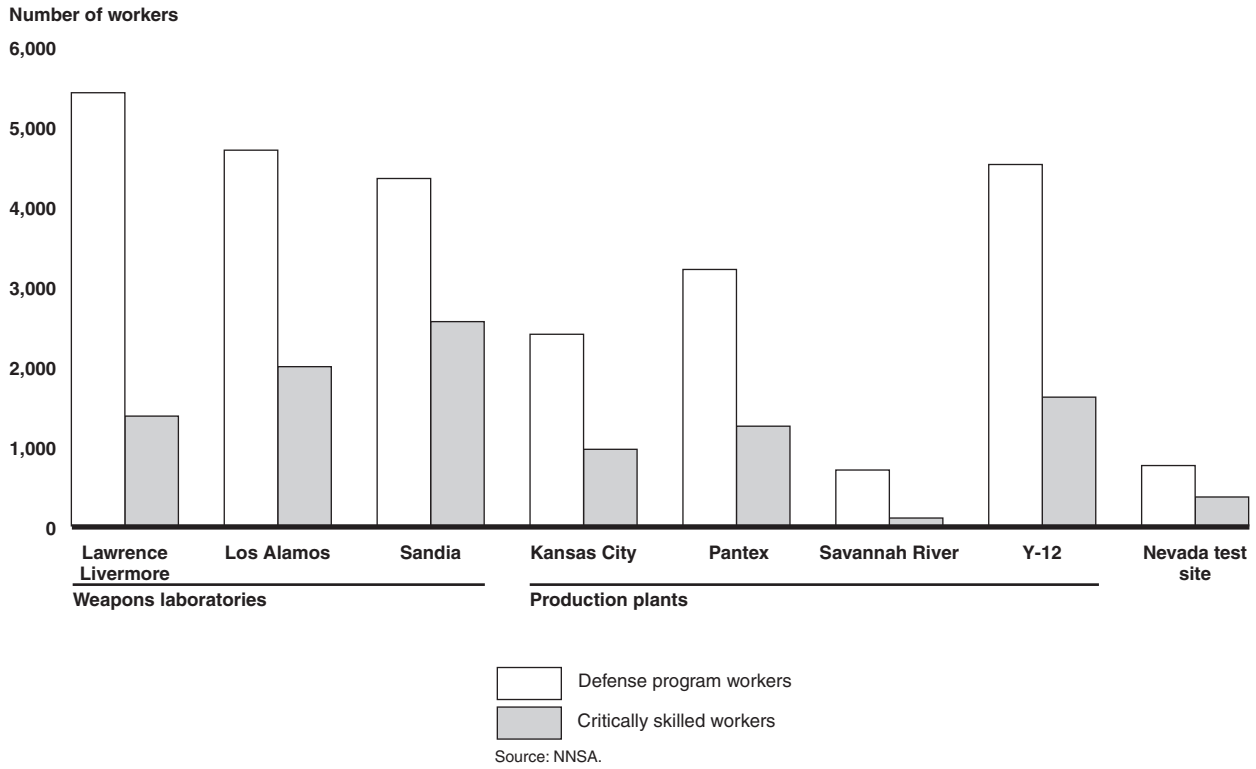
Source: NNSA.

Historically, confidence in the safety and reliability of the nuclear stockpile derived, in part, from underground live testing of nuclear weapons. In 1992, at the end of the Cold War, the United States scaled back its operations, ceased live testing of nuclear weapons, and adopted the Stockpile Stewardship Program as an alternative to testing. The Stockpile Stewardship Program focuses on obtaining a wide range of data through

nonnuclear tests, computer modeling, experimentation, and simulation to make expert judgments about the safety, security, and reliability of the nuclear weapons.

The scaling back of operations and the cessation of nuclear testing led DOE to reduce its workforce by downsizing existing staff and reducing its emphasis on recruiting. The number of defense program workers declined by about 50 percent, from a high of about 52,000 in fiscal year 1992 to about 26,000 in fiscal year 2003. The remaining workers needed to develop skills that were critical to ensure the safety, security, and reliability of the nuclear stockpile without conducting tests. Also, since the United States was no longer designing and producing nuclear weapons, the workers needed to develop new surveillance and maintenance skills to detect potential or actual defects in the aging weapons and replace components to extend the life of the warheads. Currently, the three laboratories report that it takes at least 3 years of specialized training and work experience—and sometimes more for unique jobs, such as safety engineers—for workers to obtain the skills needed to be considered critically skilled. According to the four production plants and the Nevada Test Site, it takes at least 2 years of specialized training and work experience for workers to gain the critical skills necessary to fulfill their mission. As of the end of fiscal year 2003, of the nearly 26,000 defense program workers, 10,186 were classified as critically skilled. Figure 2 shows the total number of defense program workers, as well as the number of workers classified as critically skilled, at each of the facilities as of the end of fiscal year 2003.

Figure 2: Number of Defense Program and Critically Skilled Workers at NNSA Facilities, Fiscal Year 2003



Source: NNSA.

NNSA and the contractors broadly categorize their workers by the type of work they do. Over 70 percent of all the critically skilled workers fall into the engineer, scientist, or technician categories. The remaining critically skilled workers perform a diverse set of critical job functions. For example, operators operate machines, systems, equipment, and plants for the purposes of producing, destroying, and storing materials and supplies. The tasks operators perform require a high degree of precision, and it often takes several years for operators to achieve proficiency. Professional administrative positions include health physicists, who develop programs to protect personnel from the effects of radiation, and security specialists, who develop, conduct, monitor, and maintain security-related programs. Crafts workers are involved in fabricating materials and equipment and constructing, altering, and maintaining buildings, bridges, pipelines, and other structures. It generally takes at least 2 years of training and education for crafts workers to obtain the hand or machine skills required. NNSA gathers information from the contractors and, twice each year, issues

reports on certain characteristics of critically skilled workers, such as age and vacancy rates. NNSA uses this information to monitor the progress of the laboratories in meeting critical skill needs. Table 1 shows the numbers of critically skilled workers by skill area at each facility for fiscal year 2003.

Table 1: NNSA Facilities' Critically Skilled Workers by Skill Area, Fiscal Year 2003

Facility	Engineers	Scientists	Technicians	Management	Operators	Professional administrators	Crafts	Other[a]	Total
Laboratories									
Lawrence Livermore	310	754	249	0	0	0	59	0	**1,372**
Los Alamos	441	549	441	326	60	128	41	4	**1,990**
Sandia	803	649	531	403	8	71	88	0	**2,553**
Production plants									
Kansas City	562	10	103	132	67	52	11	20	**957**
Pantex	315	66	236	215	288	93	33	0	**1,246**
Savannah River	56	14	12	15	0	1	0	0	**98**
Y-12	560	102	130	13	287	212	305	0	**1,609**
Test site									
Nevada	101	53	153	36	4	2	11	1	**361**
Total	**3,148**	**2,197**	**1,855**	**1,140**	**714**	**559**	**548**	**25**	**10,186**

Source: NNSA contractors.

[a]Includes positions classified as general administrative and labor.

By the late 1990s, concerns were raised about the ability of DOE's contractors to fulfill the goals of the Stockpile Stewardship Program because the workforce had aged, which could potentially leave gaps in knowledge as older workers retired. In response, the Congress created the Commission on Maintaining United States Nuclear Weapons Expertise, commonly known as the Chiles Commission, and mandated that it review ongoing DOE efforts to attract scientific, engineering, and technical personnel; recommend improvements and identify actions to implement these improvements where needed; and develop a plan for recruitment and retention within the DOE nuclear weapons complex.

In March 1999, the Chiles Commission reported that the downsizing resulting from the change from weapons production to stockpile stewardship left a considerably smaller and older contractor workforce. Recognizing that the contractors had already lost some of their critically

skilled workers, the Commission projected that large numbers of retirements over the next few years could further erode the experience and expertise at the facilities. The Commission warned that unless DOE acted quickly to retain and sharpen the expertise already available and "recruit, train, retain, and inspire an evolving nuclear workforce of great breadth, depth, and capability,"[8] DOE could have difficulty ensuring the safety and reliability of the nation's nuclear weapons.

In addition, the Chiles Commission found that many workers were anxious about job security and the nation's commitment to the nuclear weapons program in the wake of DOE's downsizing. This anxiety fostered an unfavorable environment for recruiting and retaining highly skilled workers. In addition, the Commission predicted that recruitment and retention of highly skilled workers would become more competitive because, in general, only U.S. citizens may obtain the security clearances required to work in the nuclear weapons program and contractors faced a shrinking pool of U.S. citizens graduating with degrees in science and engineering, especially compared with the growing pool of non-U.S. citizens graduating with those degrees. Furthermore, the Commission found that contractors needed to identify their requirements for critically skilled workers early because of the time it takes to complete security background checks and for workers to gain the experience necessary through specialized or on-the-job training. As a result of its review, the Chiles Commission made 12 recommendations based on its findings at DOE and its review of industries with similar workforces. Four of the Commission's recommendations focused on improving recruitment, training, and retention strategies. Specifically, the Commission recommended that DOE and its contractors should (1) establish and implement plans for replenishing essential critical skill workforce needs, (2) provide contractors with expanded latitude and flexibility in personnel matters, (3) expand training and career planning programs, and (4) expand the use of former nuclear weapons program employees. In response to the Chiles Commission report, Defense Programs developed a point-by-point action plan to address each of the 12 recommendations.

[8]Chiles Commission Report, 1999.

NNSA's Contractors Use Multidimensional Recruiting and Retention Approaches Similar to Those Used by Organizations with Comparable Workforces

Since the Chiles Commission report was issued, the contractors for NNSA's weapons laboratories, production plants, and the Nevada Test Site have developed a variety of recruitment and retention approaches, blending them to meet their specific critical skill needs. These approaches are similar to each others and to those used by organizations with comparable workforces. NNSA has supported its contractors by clarifying the roles and responsibilities of the contractors and providing additional funding to help them recruit workers to fill critically skilled positions.

Each Contractor Addresses the Facility's Specific Needs through a Combination of Activities

NNSA contractors developed multifaceted approaches to recruiting and retaining critically skilled workers that primarily focus on hiring recent graduates from universities and colleges. These approaches include targeted recruitment activities, educational outreach programs, competitive compensation and benefits packages, and professional development and knowledge transfer programs. Despite the array of initiatives used across facilities, the contractors for the laboratories and for the production plants have used generally similar approaches for recruiting and retaining critically skilled workers.

Focusing Recruitment Efforts for Better Results

All the contractors reported that, over the past few years, they have refocused their recruiting efforts at universities and other educational institutions to improve their chances of recruiting highly qualified job candidates in an increasingly competitive job market. Whether at a laboratory or production plant, NNSA contractors have done this by establishing recruiting teams to work with the faculty in scientific and engineering departments to attract highly qualified candidates. These recruiting teams generally involve both human resources officials and technical recruiters—scientists, engineers, technicians, or stockpile stewardship program managers with knowledge about the technical needs of the facility. The teams attend recruiting fairs, professional workshops, and other similar events. Some of the technical recruiters said that their involvement enables them to more reliably and quickly assess the job candidates, as well as answer questions the candidates have about specific technical programs.

At the laboratories, technical recruiters bring valuable contacts to the recruitment process, having already established working or professional

relationships with faculty and students at various colleges and universities. Some of the contractor officials stated that these contacts enable the technical recruiters to evaluate potential job candidates before they apply for jobs. The type and depth of the relationships vary, but many have been built from joint research efforts, adjunct teaching at local universities, or similar collaborations. According to human resource officials, these relationships have proven extremely valuable in identifying and recruiting high quality students for internships, fellowships, post-doctoral appointments, and full-time positions. For example, Lawrence Livermore National Laboratory, which the University of California operates under contract, collaborates with several of the University of California college campuses. The laboratory sponsors and partially funds joint research efforts involving both faculty and students. In addition, many laboratory scientists have access to faculty and students through teaching segments of science or math classes. According to Lawrence Livermore officials, these collaborations have resulted in productive recruitment opportunities.

All three laboratories also indicated that their relationships with colleges and universities have served as a key component of recruitment plans. Contractors use these relationships, as well as their reviews of past recruitment successes and comparisons of critical skill needs with course curricula, to target specific colleges and universities for recruitment. For example, on the basis of an initial analysis of its collaborative research efforts, Sandia narrowed its list of places to recruit to 22 universities. The laboratory further prioritized those universities according to four key variables: academic quality, research investment, past recruitment successes, and diversity of students. According to Sandia officials, this approach has allowed Sandia to effectively meet its critical skill needs.

Similar to the laboratories, the production plants also use technical recruiters in their efforts to recruit critically skilled workers, focusing on recent graduates from high schools, technical schools, community colleges, and universities. While these recruitment efforts have been fruitful, many of the contractors at NNSA's production plants and at the Nevada Test Site have also relied on recruiting mid-career workers to fill other critical skill positions because of the level of expertise that these positions need. For example, the Pantex plant has sought out mid-career workers to fill key critical skills positions, such as production technicians. Pantex has partnered with the Amarillo Community College and the Texas Workforce Center to develop a range of technical courses, from 6 weeks to 6 months long, that generates trained production technicians. Most of these trainees are currently employed elsewhere locally. While trainees cover all

course costs, Pantex offers each graduating technician an interview for employment, which allows the plant to fill vacancies with the most qualified graduates. As of July 2004, Pantex officials stated that the year-old program has graduated 70 participants and that they plan to hire 24 production technicians this spring.

In addition, a manager who works for the contractor operating the Nevada Test Site said that about 15 percent of his new hires must come on board with at least 10 years' work experience to perform the required work. He noted that, given the demands placed on the contractor to conduct experiments developed by the weapons laboratories and record the resulting data, he cannot always wait the 3 to 4 years required for inexperienced new hires to obtain their security clearances and gain the skills necessary to perform the work. Some production plants have addressed this issue by recruiting at professional or trade association meetings and seeking out experienced workers from other NNSA facilities that are being downsized or closed, such as the Rocky Flats production facility, located outside Denver.[9]

Providing Educational Outreach

The NNSA contractors, primarily the laboratories, provide a wide range of programs including postdoctoral positions, internships, fellowships, and summer employment to attract and develop critically skilled workers. According to the contractors, educational programs at the facilities further the education of participants, increase awareness of the facilities as places of employment, and develop pools of potential job candidates. The contractors reported that these programs are a significant source of new hires. Contractors may offer full-time positions to program participants who already have earned degrees by the time they complete their program participation; program participants without degrees may apply for full-time positions at the facilities after graduating.

The laboratories typically hire a greater proportion of graduates with Ph.D. and master's degrees than the production facilities and the test site do—about 62 percent of the critically skilled workers at the laboratories have postgraduate degrees, in contrast with about 18 percent of the critically skilled workers at the production plants and the test site.

[9]The Rocky Flats site began operations in 1952, manufacturing plutonium components for nuclear weapons until 1989, when operations were suspended because of environmental problems. The plant never resumed work and is scheduled for closure in 2006, once environmental cleanup and building dismantlement activities have been completed.

Laboratory officials said they offer a variety of graduate-level and post-doctoral programs in an effort to recruit and retain workers with the level of education needed. For example, Sandia offers about 1,200 internships each year, generally evenly split between undergraduate and graduate students. Many of the interns return to the facility for successive internships, allowing them to gain additional skills and creating a pipeline of future job candidates for the laboratory. Generally, the laboratory converts about 15 percent of its interns to full-time positions each year. In addition to internships, Sandia also offers fellowships, sometimes partnering with professional societies such as the National Physical Sciences Consortium, which awards fellowships to U.S. citizens pursuing graduate study in the physical sciences. Similarly, Lawrence Livermore instituted the Lawrence Livermore National Laboratory Postdoctoral Fellowship Program in 1998. The laboratory typically receives 300 to 400 applications a year for three to five fellowships. Since the program's inception, the laboratory has appointed 15 fellows, 6 of whom have been converted to full-time employees. The laboratory has also hired about 40 other workers who were identified from the fellowship applicant pool.

In addition to the shorter term recruiting approach of offering internships and fellowships, the laboratories have also adopted a longer-term strategy for developing candidates to fill future critical skill needs. All of the laboratories offer educational outreach programs that seek to promote basic science, math, and engineering at local middle and high schools. The contractors cited their concern with statistics that show shrinking pools of U.S. students graduating with science and math degrees as a reason for these programs. The programs range from organizing informal school activities to offering specialized curricula, or academies, at local schools. In one program, Sandia partners with professional societies and industry to create a pool of potential technicians in photonics and optical engineering, which are considered critical skill areas at the laboratory and certain industries and include work with lasers, fiber optics, and various optical systems. Sandia's program begins at the middle school level by exposing students to science and math and encouraging them to pursue careers in those fields. At the high school level, the program recruits the most promising students to participate in the Photonics Academy, which offers a 4-year packaged curriculum and coursework in science and math and the opportunity for an internship at Sandia. Students can pursue their education in photonics and optical engineering at the Albuquerque Technical Vocational Institute or the University of New Mexico. According to Sandia officials, the program has become very successful, and other

entities, including the State of New Mexico, have begun to establish similar programs to promote careers in scientific and mathematical disciplines.

While the laboratories offer a more extensive variety of internship and fellowship programs, the production plants have also established educational programs that help the facilities recruit critically skilled workers. For example, Pantex has partnered with Texas Tech University and other universities to promote student work programs in an effort to encourage students to pursue educations in areas related to science and engineering, such as mathematics, physics, materials science, and nuclear engineering. Pantex officials said that 40 students participated in the student work programs in fiscal year 2003.

Maintaining Competitiveness

NNSA's contractors at the laboratories, production plants, and test site all cited the opportunity to do a variety of challenging and cutting-edge work as their most important assets in competing against industry to attract critically skilled workers. Many of the facilities, particularly the laboratories, perform work unrelated to the nuclear weapons program for customers other than NNSA. For example, the Los Alamos National Laboratory performs advanced research in such areas as medical technology, genetics, space sciences, and nanoscience, which involves using machines and their components to do research on a molecular level. NNSA laboratories participate in the Laboratory Directed Research and Development program, which allows them to use up to 6 percent of their budgets to fund basic research selected on their scientific and technical merits. Similarly, NNSA production plants can set aside up to 2 percent of their budgets through the Plant-Directed Research and Development program, for basic science research that is competitively awarded in areas to be determined by the facilities' directors. Contractor officials noted that these research funds have helped to attract and retain workers. For example, the Savannah River plant is using some of its research dollars to fund unclassified hydrogen research. Savannah River officials anticipate that the opportunity to contribute to a growing area of important work will attract new workers and help retain current workers.

The contractors also noted that the cutting-edge nature of the work done in the nuclear weapons program, particularly work relating to elements of the Stockpile Stewardship Program, offers many challenges in basic science research that are unique to NNSA facilities. Contractor recruiters said that they use the cutting-edge nature of this work as an incentive to attract workers to critical skill positions during recruitment events. For example, a manager who works for the contractor operating the Nevada Test Site

stated that the opportunity to perform sophisticated measurements and capture data during stockpile stewardship program experiments, some of which have never been done before, is a major factor in attracting engineers for critical skill positions.

In addition to the nature of the work, all the contractors noted the importance of being able to offer salaries and other forms of compensation and benefits to remain competitive with industry and other government entities for highly skilled workers. The contractors said they have adopted some changes to their compensation or benefits programs as a result of comparing their programs with those of industry. For example, laboratories, production facilities, and the test site have considered such options as bonuses for critically skilled new hires; bonuses to retain critically skilled workers; various forms of bonuses, such as lump-sum payments and stock options; increased base salaries in specialty areas; and awards and recognition programs. To be more competitive in attracting critically skilled workers, some contractors have also begun providing day care facilities, flexible work hours, and fitness centers to improve workers' quality of life.

Providing Professional Development and Knowledge Transfer Opportunities

All of the contractors reported having developed or enhanced their professional development programs and knowledge transfer opportunities in an effort to attract and train new workers, retrain current workers to fill certain critical skill positions, and help retain the current workforce. Most of the professional development programs provide benefits to workers to further their training or education. Some programs may provide an avenue for attending professional workshops or conferences; others may help workers earn a bachelor's, master's, or doctoral degree. For example, Sandia offers the One Year On Campus program as a hiring tool for prospective employees. This program allows the employee to pursue a nonthesis master's degree over an 18-month period. Sandia will pay the full tuition and fees for the degree, as well as paying the participant a partial salary and full benefits during the program's duration.

Similarly, the production plants offer professional development programs. For example, Pantex pays the educational expenses for workers to earn bachelor's or master's degrees in areas relevant to work performed at the plant. Workers pursue their degrees through community colleges or long-distance learning opportunities, such as correspondence courses or Internet-based education. Furthermore, Pantex and Amarillo Community College have partnered with Texas Tech University, situated about 2 hours away, to offer evening or weekend courses taught by Texas Tech

professors. Pantex also has a fellowship program that allows employees to take leave from work and return to school full-time, while still earning a salary, if they commit to working for Pantex for an agreed-upon time after completing the degree. According to Pantex officials, their professional development program is one key tool used to attract and retain workers. They also noted that many technicians take advantage of the opportunities offered to earn degrees in engineering.

In addition, all the facilities offer knowledge transfer programs, such as training programs led by senior workers and mentoring programs. For example, the Los Alamos National Laboratory offers the Theoretical Institute for Thermonuclear and Nuclear Studies program, which Los Alamos officials describe as a 3-year, highly intensive training program taught by senior scientists. According to Los Alamos officials, completing the program is comparable to earning a Ph.D. Although not required as a condition of employment, participating in the program is highly encouraged, and managers see it as an opportunity for workers to improve their technical knowledge. Through Sandia's Weapons Intern Program, individuals participate in a 1-year technically oriented work study program designed to accelerate the development of engineers and scientists in understanding stockpile stewardship tools, processes, and techniques. Most facilities also offer mentoring programs that pair new hires with senior workers to assist with on-the-job training and other aspects of working at the facility. For example, the Y-12 plant has a mentoring and job rotation program that pairs new hires with senior workers for the first 6 months of employment, during which time the new hires rotate among several job assignments. A second phase of the program identifies technical workers in the early to middle stages of their careers for rotation through assignments to further their professional development.

Organizations with Comparable Workforces Use Recruiting and Retention Approaches Similar to Those Used by NNSA Contractors

As with NNSA, officials we contacted at organizations with comparable workforces explained that they relied on a mixture of recruitment and retention approaches that best addresses their needs. The approaches they described paralleled those used by NNSA contractors and included focusing their recruitment efforts, providing educational outreach programs, assessing their compensation packages to ensure that they remain competitive, and providing professional development programs.

Officials from these organizations utilize strategies to target universities that result in hiring top workers. Many of the organizations described efforts to develop networks with faculty and students, some based on

collaborative research programs. For example, officials at the Jet Propulsion Laboratory noted that the laboratory recruits at 52 universities, but selects 20 to 30 each year as the top priorities for their recruitment efforts, on the basis of specific criteria. The criteria include comparing the laboratory's critical skill needs to course curricula, as well as targeting the universities with which the laboratory has a collaborative research effort.

Many of the officials at organizations with similar workforces also mentioned relying upon educational outreach programs, internships, and fellowships as a way of addressing their recruitment and retention needs. These programs can promote interest in basic science and math to younger students at local schools, increase the awareness about employment opportunities at the organization among universities and professional societies, and serve as a means to develop staff who may eventually be hired full time at the facility. For example, an official at the Charles Stark Draper Laboratory stated that the laboratory implements several programs intended to engage students at local schools in math and science activities. One such program allows high school students to shadow employees at the laboratory. The laboratory also offers fellowships and cooperative work programs for students at various universities. Some of the participating students are offered full-time positions at the laboratory once their education is complete.

Officials at each of the organizations noted the importance of being competitive in order to attract the workers with the required skills. Most of the officials cited challenging work as one of the key incentives to attract new workers. The officials also cited competitive salaries and benefits as being crucial to recruiting and retaining their workers, and several noted that they compared their compensation and benefits packages with those of competing organizations. The officials cited examples of other benefits that help in their recruiting and retention efforts, such as providing signing bonuses, paying for relocation expenses, and offering recognition and awards programs.

Finally, officials at most of the organizations said they use a variety of professional development programs and cited their importance in recruiting and retention efforts. Similar to NNSA facilities, the other organizations have programs that pay for educational expenses for obtaining a bachelor's or master's degree. For example, the Applied Physics Laboratory, a division of the Johns Hopkins University, offers on-site master's degrees through the university in six different subject areas. The information taught in these subject areas directly applies to the Applied

Physics Laboratory's research. Moreover, senior staff at the laboratory are given the opportunity to teach some of the courses.

NNSA Supports Contractors' Efforts by Clarifying Roles and Responsibilities and Providing Additional Funding

NNSA has supported the contractors' efforts to recruit and retain their critically skilled workforce in a couple of ways. NNSA has worked with the contractors to clarify the roles and responsibilities of its contractors and has provided additional funding to help the contractors obtain workers to fill critically skilled positions.

NNSA Has Clarified Contractors' Roles and Responsibilities

In response to Chiles Commission concerns regarding systemic problems with DOE management and policies that hindered recruitment and retention efforts, NNSA has reorganized to streamline contract oversight. In December 2002, NNSA reorganized to move its operational oversight from its regional-based operations offices to facility-based site offices. By eliminating its operations offices and setting up site offices, NNSA removed a layer of management and placed the contracting officers, a crucial element of the oversight process, closer to the contractors for which they have oversight responsibility. Also, NNSA consolidated business and technical support functions, including support for human resources and contracting issues, to a single service center in Albuquerque, New Mexico.[10]

In addition, NNSA has worked with the contractors to clarify and act on programs proposed by the contractors intended to improve their ability to recruit and retain critically skilled workers. Each contract references DOE Order 350.1 and contains Appendix A, which set forth certain contractor human resource management policies and which describe, among other things, the types of programs that the contractors can charge to the contract. These contract elements lay out the flexibility afforded the contractors in making changes to compensation and benefits programs to be more competitive. Certain types of changes, such as a variable pay program, require approval by NNSA. Many of the contractors

[10]Although the reorganization has resulted in improved communications and contract management, we reported in June 2004 that uncertainties with the reorganization still remain, particularly regarding NNSA's ability to exercise effective oversight in the wake of NNSA downsizing. See GAO, *National Nuclear Security Administration: Key Management Structure and Workforce Planning Issues Remain as NNSA Conducts Downsizing*, GAO-04-545 (Washington, D.C.: June 25, 2004).

acknowledged that NNSA responded quickly to clarify and act on proposed programs. For example, in July 2000, Los Alamos reported to NNSA that it had difficulty recruiting computer scientists and that the turnover rate for these workers was twice that of other workers. Los Alamos proposed to improve its recruitment and retention efforts by increasing the base salaries of the computer scientists and offering other benefits, such as hiring bonuses and relocation expenses. In August 2000, after a series of meetings and correspondences between NNSA and Los Alamos, NNSA approved Los Alamos' request to increase the base salaries of computer scientiests and to offer them hiring bonsues. However, NNSA denied Los Alamos' request to approve the relocation benefits.

In addition to describing the types of programs that the contractors can charge to the contracts for human resources management programs, DOE Order 350.1 also requires that DOE periodically review contractor studies of how their compensation and benefits programs compare with those of other organizations to ensure the programs are reasonable. In April 2004, we reported that contractor studies regarding benefits did not cover all sites and were inconsistent from one contractor location to another, calling into question the validity and comparability of the results.[11] NNSA officials told us they have contracted with a human resources consultant on a new benefits valuation study. This study compares the laboratories' benefits against those of market competitors, using such data as pension and health care programs, vacation, and disability. NNSA officials plan to use the results of the study to assess the contractors' benefits programs, including the reasonableness of benefits and the contractors' requests for increases in benefits. NNSA plans to commission a second benefits valuation study on two production plants and the test site. Also, NNSA officials indicate that they are working with the contractors to develop a common methodology to assess their compensation programs. NNSA plans to use the results of this analysis to assess the contractors' compensation programs, including the reasonableness of the programs and the contractors' requests for increases in compensation.

NNSA Has Provided Contractors with Additional Funding

In recognition of the need to ensure contractors can meet their critical skill requirements, NNSA has provided additional funding for the three laboratories through the Laboratory Critical Skills Development Program.

[11]See GAO, *Department of Energy: Certain Postretirement Benefits for Contractor Employees Are Unfunded and Program Oversight Could Be Improved*, GAO-04-539 (Washington, D.C.: Apr. 15, 2004).

This program is designed to encourage the laboratories to identify projected gaps in critical skills and develop programs that attract potential candidates at an early age to fill those gaps. The program is also designed to be flexible, allowing the laboratories to submit proposals to NNSA for the funds. The proposals vary considerably, some targeting middle school or high school, while others target college-age students. Some of the proposals include summer school opportunities, internships and fellowships, or more formal education programs in high school or college. NNSA provided $4.35 million for fiscal year 2004, a decrease from fiscal year 2003 funding of about $0.23 million. The program also requires that the contractor running each laboratory match NNSA's funding on a one-to-one basis and track success of the program.

An official at Sandia reported that, at first, line management did not support the Critical Skills Development Program, particularly because of the matching funds requirement. However, the program has become very successful and is seen as a means of recruiting critically skilled workers at a lower cost than in the past. In fiscal year 2003, Sandia converted 20 student participants to full-time staff from such programs as College Cyber Defenders Institute, Microsystems and Engineering Sciences Applications Institute, Materials Science Research Institute, and National Collegiate Pulsed Power Research Institute. According to Sandia officials, the Laboratory Critical Skills Development Program has become so popular that, collectively, line managers fund their share of the program at 2.5 times NNSA's one-to-one matching requirement.

Contractors' Approaches for Recruiting and Retaining a Critically Skilled Workforce Have Been Generally Effective

The efforts of NNSA's contractors to recruit and retain a critically skilled workforce have been generally effective, according to our analysis of the contractors' data, our review of the contractors' workforce planning processes, and information gathered from stockpile stewardship program managers.

Data Generally Demonstrate Hiring Levels Are Sufficient to Offset Current and Anticipated Attrition

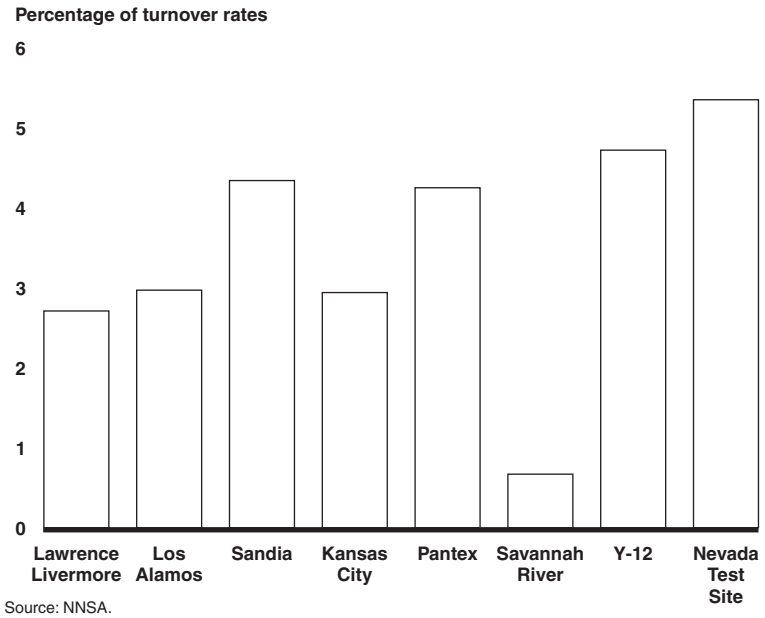
Contractors' data on critical skill positions indicate that the eight facilities have experienced low turnover rates and that the average age of critically skilled workers is expected to remain steady or decrease at almost all of the facilities. The data also demonstrate that most facilities have been hiring at a level sufficient to offset current and anticipated attrition. However, some facilities have limited or no data available on the number of new critically skilled workers hired because their method of organizing their critically skilled workforce, which is different from the ways the other facilities organize these employees, makes data on new hires difficult to collect.

Facilities Have Experienced Low Turnover and the Average Age of Critically Skilled Workers Is Generally Steady

Contractors' data show that turnover rates for critically skilled workers have been low. Of the 10,186 positions across the eight nuclear weapons facilities classified as critically skilled as of the end of fiscal year 2003, only 2 percent were vacant at any point during the year. From fiscal years 2000 through 2003, the turnover rate for critically skilled workers across facilities—including both retirement and non-retirement related job termination—was 3.92 percent.[12] The highest turnover for this time period was 5.35 percent at the Nevada Test Site, and the lowest turnover was .067 percent at Savannah River (see fig. 3).

[12]Critical skill workforce data and/or separation data were not available from Los Alamos for fiscal years 2000 and 2001 or from Lawrence Livermore for fiscal year 2000.

Figure 3: Turnover Rates for Critically Skilled Workers, Fiscal Years 2000-2003



Source: NNSA.

The average age of critically skilled workers across the complex has remained relatively steady since the end of 2001, at approximately 47 years of age. According to NNSA program managers, this is the result of a steady increase in the average age at the production plants, and a counterbalancing steady decrease at the laboratories and test site. For example, among the laboratories, NNSA has projected the trend in the average age of critically skilled workers to be decreasing for Sandia and Los Alamos, and remaining flat for Lawrence Livermore through 2005. Among the production plants, NNSA is projecting that the average age will decrease at Kansas City, increase at Savannah River, and hold steady at Pantex and Y-12 through 2005. NNSA also projects the average age at the Nevada Test Site to be decreasing through 2005. While the overall average age across the nuclear weapons complex has been holding steady, NNSA program managers believe that the average age will decrease starting in 2006, when staff at or beyond retirement age who had remained at the facilities to, among other things, train newer workers in critical skill areas, begin to leave the facility.

Most Facilities Have Hired a Sufficient Number of Staff with Critical Skills to Meet Current and Near Future Needs

Table 2 shows that for fiscal years 2000 through 2003, five NNSA facilities for which data were available hired, on average, 94 percent more critically skilled staff than they needed to replace because of retirements or other separations (i.e., for every one critically skilled worker who separated, the facilities hired 1.94 people). These facilities adopted this hiring pattern to maintain the critically skilled workforce needed to fulfill the current mission of the Stockpile Stewardship Program, to make up for past hiring shortages, and to proactively plan for the next 10 years, when as much as 39 percent of the current workforce is or will soon be eligible to retire.

Table 2: Critical Skill Replacement Rate at Five NNSA Facilities, Fiscal Years 2000 through 2003

Facility	Total critical skill separations	Total critical skills hires	Critical skills replacement rate
Nevada Test Site	72	195	2.71
Sandia	438	866	1.98
Y-12	278	543	1.95
Kansas City	108	192	1.78
Pantex	198	326	1.65
Total	**1,094**	**2,122**	**1.94**

Source: NNSA contractors.

Note: Because Lawrence Livermore, Los Alamos, and Savannah River do not hire, or hire limited numbers, directly into critical skill positions, data are not available on the number of new workers hired to fill these positions.

The human resource managers at many of the facilities stressed the importance of bringing in new staff early enough to take advantage of knowledge transfer opportunities before more experienced workers retire. While most of the critically skilled hires have advanced degrees, these workers often require additional, job-specific training because of the specialized and often classified nature of work in the nuclear weapons complex. Furthermore, the managers pointed out that it has been taking 1 to 2 years on average for new hires to obtain security clearances. In order for the new hire to be cleared and trained to take on critical work when the experienced staff member leaves, it is useful for the new staff member to be hired 2 to 3 years ahead of the retirees' anticipated departure.

To compensate for recent attrition, an aging workforce, and an increasing number of critical skill positions, the Nevada Test Site has been hiring at a greater rate than any of the other facilities in recent years—2.71 new staff

were hired for every 1 that left. With an average retirement age of approximately 62 and approximately 30 percent of its workforce over the age of 55, the facility has been planning ahead to replace staff who are expected to retire in the near future, according to site officials. They believe the rate at which the facility has been hiring will ensure that the workforce will maintain the skills necessary to complete its mission. Sandia has also been hiring aggressively over the past 4 years, bringing in almost twice the number of critical skill hires needed to replace critical skill workers who separated during that period. According to human resource officers, the laboratory had recently fallen behind in its efforts to replace critically skilled workers who retired or left the facility for other reasons. As a result, Sandia embarked on an aggressive hiring effort to replace these needed critical skill workers. Human resource managers stated that their efforts have been successful and that future hiring will more closely match the number of separating critical skill workers, assuming no significant programmatic changes.

Y-12 has also hired almost twice the workers needed to replace those who left. Human resource managers at Y-12 stated that they decided to take this course of action so that the facility would have the necessary critically skilled workers in place prior to the anticipated retirements of experienced workers. The average retirement age for critically skilled workers at Y-12 is approximately 59 years, and 364 of its critically skilled workers as of fiscal year 2003, or about 23 percent, are over the age of 55. Furthermore, human resource managers stated that the job market for many of the critical skill positions required at Y-12 is relatively good at the moment; therefore, the facility is trying to stay ahead of the perceived future market crunch by bringing these highly skilled workers into Y-12 now. Similarly, Kansas City has recently been hiring more critically skilled workers than needed to replace those leaving—1.78 workers for every 1 departing. According to human resource managers, this hiring was done so the facility would be better positioned to meet its future needs in the Stockpile Life Extension Program—a component of Defense Programs that is focused on maintaining and refurbishing existing nuclear weapons. Because of anticipated retirements in the next decade, the contractor has estimated that it has a 5-year window in which to ensure that essential knowledge gets transferred from experienced employees to newer staff so that the facility will be able to fulfill the program's mission. Pantex has also been hiring at elevated levels—bringing in 1.65 new hires for every employee who left—in order to replace departing critically skilled employees due to retirements or other separations and to accomplish its expanding work. For example, in fiscal year 2007, the facility will need to increase its cadre

of critically skilled technicians and operators by over 50 positions, which reflects a growth of about 4 percent, when it takes on new responsibilities in the Stockpile Life Extension Program.

While these facilities reported that they generally have the critically skilled workers needed, they pointed out that isolated gaps exist for specific positions at some facilities and efforts are ongoing to fill these openings. For example, Y-12 mentioned the high market demand for metallurgists and fire protection engineers as posing a challenge in hiring for these positions. The Nevada Test Site, whose turnover rates have exceeded 10 percent in 1 year, has had difficulty retaining the number of critically skilled crafts people needed, in part because it is competing with the building construction industry in Las Vegas. The site officials we interviewed said that they are continuing to overcome these workforce challenges and believe they will be able to fill these positions in the years to come; however, they acknowledge that this will require extra effort and emphasis.

Data on Critically Skilled New Hires Are Limited for Three Facilities because They Generally Do Not Hire Staff Directly into Critical Skills Positions

Lawrence Livermore, Los Alamos, and Savannah River generally bring in new staff to supply a pipeline of qualified workers to fill future critical skills openings, rather than assigning new hires to fill a specific current or future critical skills position. Because of this, these facilities have little or no information on the number of new critically skilled workers hired. For example, Lawrence Livermore is organized as a matrix system in which a worker's designation as "critically skilled" changes depending on the work he or she is doing and the amount of time spent doing that work. Lawrence Livermore defines a position as a critical skill position, in part, by the amount of time the worker spends doing Defense Program work, with the minimum requirement for this designation being 25 percent of the time. At any given point, there is a core set of Defense Program positions classified as "critical skills" positions and a set of workers filling those positions. However, there are also a number of other workers with skills that would qualify them for a critical skill position, but who are presently doing work for other missions of the laboratory. While not categorized as "critically skilled" at that moment, these workers are able to fill critical skill position openings when they arise and provide depth to the pipeline of qualified critical skill workers.

The arrangement is somewhat similar at Savannah River, where workers are hired into the facility's pipeline of employees who can fill critical skill positions when needed. In fiscal year 2003, there were 698 Defense Program workers at the facility, 98 of whom were categorized as critically skilled. When any of these workers leave, Savannah River fills the opening

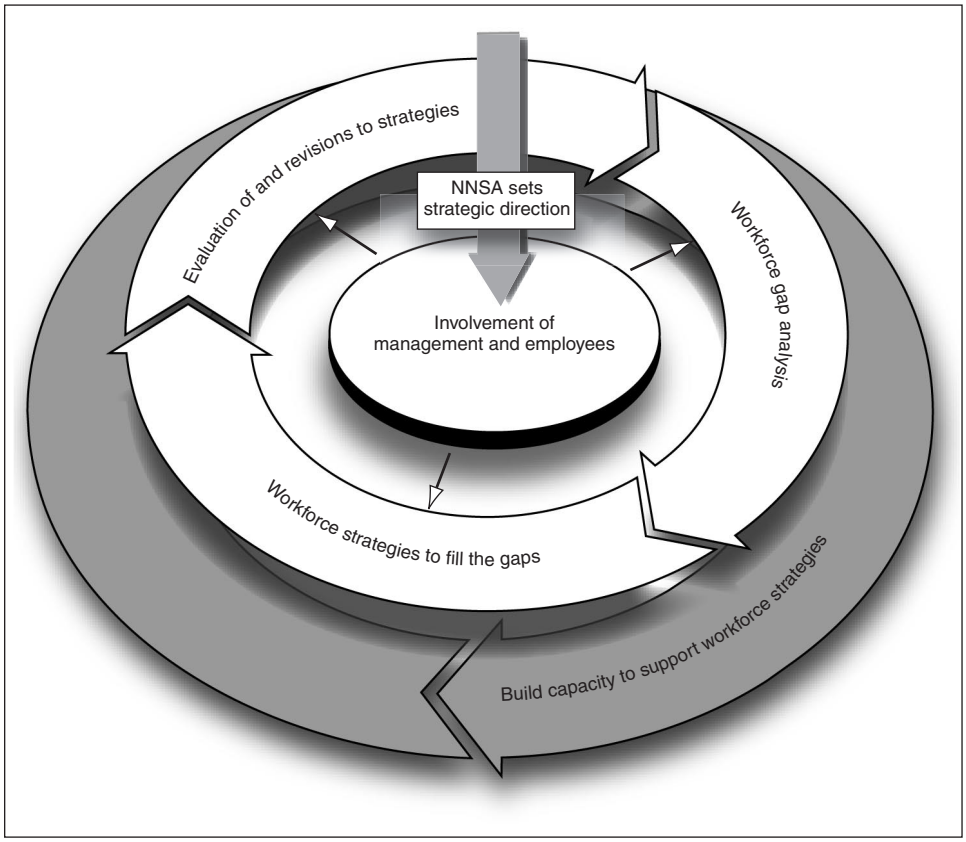
with a worker possessing the needed critical skills, but who has been working in another area of the facility. Los Alamos also depends upon its internal pipeline to a great extent to fill critical skill needs, as well as conducting limited hiring of new staff from outside the facility. In fiscal year 2003, Los Alamos filled 631 critical skill positions. Of these, 550 were filled via development of internal candidates, with the remaining 81 being hired from outside this internal pipeline. This distribution is partly reflected in the data showing that Los Alamos had hired fewer new staff to fill critical skill positions than had separated from the facility (i.e., 0.79 new workers hired for every 1 separating).

Facilities Have Incorporated Key Strategic Workforce Planning Principles to Varying Degrees

While NNSA defines the mission of each facility, the contractor is responsible for determining what resources are needed to meet that mission, including the type and number of critically skilled workers needed. To ensure that they will be in a position to meet their future critical skill needs, all eight nuclear weapons facilities have incorporated to some degree into their planning processes the five key principles we have identified as essential to strategic workforce planning: (1) involving management and employees in developing and implementing the strategic workforce plan, (2) determining critical skill needs through workforce gap analysis, (3) developing workforce strategies to fill gaps, (4) building needed capabilities to support workforce strategies, and (5) monitoring and evaluating progress in achieving goals.[13] (See fig. 4.)

[13]See GAO-04-39.

Figure 4: Strategic Workforce Planning Process



Source: GAO.

Managers and Employees Are Involved in the Planning Process

All of the 20 stockpile stewardship program managers said that they are involved with workforce planning to at least a moderate extent at their facilities. Their involvement encompasses a variety of activities, including identifying current and future critical skill needs, identifying and recruiting candidates for employment, and helping to retain current employees through training and mentoring.

All of the eight NNSA contractors undertake annual reviews of their critical skill needs, with managers playing a key role in this assessment. For example, managers at Sandia, as part of the facility's annual Strategic Capabilities Assessment, are responsible for identifying workforce skills required and developing projections of the number and type of staff needed to meet their mission. These managers are also asked to identify any

increases or decreases in future staffing levels that may result from programmatic changes and any staff who may require specific training to ensure they will be prepared to handle upcoming segments of work. The information gathered from the managers during the Strategic Capabilities Assessment process is used to develop a facilitywide hiring plan that ultimately guides Sandia's recruiting efforts. At Los Alamos, managers prepare annual workforce reviews that identify present and future capabilities of the workforce, including critical skills. These reviews provide an opportunity for managers to identify both strengths and gaps in the capabilities needed to achieve programmatic missions. Each review considers, among other items, projections of upcoming retirements, succession planning, recruitment goals and approaches, plans for replacing the lost skills, and mentoring and training needs. While these workforce reviews are comprehensive and help map out workforce needs, they have not yet been used to develop an overall hiring plan for Los Alamos; however, human resource managers said that they plan to begin to do this by the end of fiscal year 2006.

In addition, almost all of the 20 stockpile stewardship managers said that they participate in recruiting efforts to at least a moderate extent. Program managers identify the critical skill positions needing to be filled; recruit on campus; and interview prospective candidates when they visit the laboratory, production plant, or test site. For example, division managers at the Kansas City plant identify critical skill needs and process the necessary request forms to fill those needs. These requests are aggregated by the human resource department and used to inform the plant's college recruiting efforts where applicable. Managers are also involved in campus recruiting. For example, Y-12 sends line managers, not human resource personnel, out to campuses to recruit. This helps Y-12 develop a better relationship with the schools and faculty and provides students with an opportunity to interact with the managers with whom they may one day be working, according to the human resource officials. Managers also play a primary role in interviewing candidates who visit their facility, and many make the final selections. For example, as part of Los Alamos' just-in-time recruiting efforts, prospective candidates visit the laboratory and undergo a day of interviews with different program managers for multiple positions. At the end of the visit, the managers decide which of the candidates are best suited to fill the needs identified and make them offers.

Management involvement with workforce planning also continues after the candidate is hired, through involvement with training and mentoring programs that help ensure the facility will be able to retain the critically

skilled employees needed. For example, Pantex offers in-house educational and other programs to promote continuous professional development and improvement of the plant's knowledge base. New personnel at Pantex receive training to qualify as production technicians from seasoned employees at the facility, after which these newly trained technicians are assigned to work under the direction of other experienced personnel who continue with on-the-job training. In addition, some the facilities place a premium on the value of mentoring as a means to ensure that needed knowledge transfer takes place. For example, at Savannah River, once scientists and engineers reach a certain level of management, they are required to mentor newer staff in order to be considered for any future advancement. At Lawrence Livermore, formal and informal mentoring by experienced personnel, including retirees, is a key part of the learning process. These mentoring activities include reanalysis of past nuclear events and comparisons of the effectiveness of different experiments. According to contractor management, in some cases, these exercises have been able to produce fresh insights for the entire program. Lawrence Livermore, as well as some other facilities, relies upon a corps of retired workers to pass along knowledge to newer staff and to archive their knowledge through documentation and videotaped interviews to preserve it for future generations of workers.

Facilities Have Determined Critical Skills Needed to Achieve Current and Future Goals through Workforce Gap Analysis

All NNSA facilities have analyzed their workforce, including assessing the skills of the current employees, identifying the current and future critical skills needed, and determining if and where any gaps exist. For example, associate directors at Lawrence Livermore, with the assistance of human resource staff, annually evaluate employee capabilities, look at what resources are needed to support existing and anticipated future programs, perform a gap analysis, and develop projections. In doing this analysis, the associate directors consider the approximate attrition based on recent trends, the number of employees the laboratory would like to have as backup to meet anticipated critical skill needs for the next 3 years, anticipated future needs based on likely program changes and budget projections, and the training and mentoring needed for staff to be prepared to fill anticipated critical skill needs.

Program and human resource managers at Pantex conduct detailed workforce planning annually to ensure that the needed skills are available at the right time as workload and demographic changes occur. As part of this planning process, the managers analyze positions to ensure that they are properly designated as critical or noncritical. The workforce planning team at Pantex then works with managers across the organization to

determine the number of critically skilled workers needed in each area to meet the projected workload over several years. In doing so, the planning team considers new work and skills that may be required in the future. The workforce planners obtain data on the skills of the current employee workforce, review production estimates to determine what workforce skills will be needed to meet production goals, and assess the degree to which the skills required by the future workload line up with the current baseline of critically skilled employees. This analysis is rolled up and reported in Pantex's annual "Critical Skills Program Status Report." According to human resource managers, this report serves as the basis for planning for, filling, and maintaining critical skills in the future.

At Y-12, workforce planning can be broken down into two categories based on the planning horizon—long range or near term. Long-range workforce planning includes developing a 10-year comprehensive site plan, which is revised annually and contains a brief discussion of the workforce needs. Long-range planning also involves developing a 10-year baseline plan, which breaks down in more detail the information contained in the comprehensive site plan, including the specific number of workers needed for each position for the next 10 years. Finally, each suborganization within Y-12 prepares workforce planning reports that ultimately get rolled up to form the facilitywide workforce plan. Near term planning involves creating a workforce plan that includes the production schedule for the next 3 years, including the staff levels needed to meet production goals. These workforce plans are reviewed three to four times annually to ensure that adequate resources are available and that workforce capacity is appropriate to meet near-term workforce needs. Management conducts a gap analysis on these short-term estimates and determines what skills are needed. In addition, the Y-12 plant conducted a reorganization process over the past year that has compared the skills of the current workforce with the future needs of the facility and moved people around accordingly. Once the reorganization is complete, the plant will again reassess the workforce and skills needed to identify any remaining gaps or shortages in workforce skills.

Facilities Have Developed and Implemented Strategies to Fill Gaps

As gaps between the skills of the current workforce and the skills needed to fulfill the mission are identified, each facility has developed strategies to address these specific gaps. Because each facility is unique in mission, geographic location, and required skill sets, there is no standard approach that the facilities can use to address their gaps. Rather, each has developed strategies that help them identify, recruit, and retain the critically skilled employees needed at each facility. For example, all three laboratories, as

part of the Laboratory Critical Skills Development Program, have initiated a series of projects or institutes that provide training and research experience to precollege, undergraduate, and graduate students in critical skill fields relevant to the laboratory. One such institute in use by all three laboratories—the College Cyber Defenders Institute—is focused on addressing the national shortage of trained people and lack of formal university programs that prepare students for a career in cyber security. Other programs are focused more specifically on the needs of a particular laboratory. For example, the Computer System Administrator Development Initiative at Los Alamos is designed to recruit students who are enrolled in area colleges and universities and who want to develop their skills as a computer systems administrator, a critical resource need at the laboratory.

The production plants have also implemented strategies that directly address some critical skill needs identified by their workforce gap analyses. For example, to help meet its need for production technicians and to ensure that candidates under consideration for this position have the basic technical skills that will be transferable to various weapons programs once they are hired, Pantex requires that each candidate successfully complete a Pantex Job Skills Development Program available through the local community college. A similar strategy is under way at Y-12. To help address its need for nuclear engineers, Y-12 has been working closely with South Carolina State University to develop a nuclear engineering program that will enable the university to supply Y-12 with needed graduates in this critical area. Y-12 managers currently serve on the university's advisory board and visit the campus several times each year to work closely with faculty in developing the program.

The Nevada Test Site finds itself in a unique position regarding its workforce planning activities. The site's primary mission was to be able to conduct underground nuclear tests to ensure the reliability of the nuclear stockpile. However, with the 1992 moratorium on testing and a Presidential directive that the United States must be able to resume nuclear testing with as little as 18 months' notice, the Nevada Test Site is faced with the unique challenge of maintaining testing skills without being able to conduct actual nuclear tests. To help maintain the critical skills required for testing, the site has a workforce of engineers to support the three weapons laboratories in research and development engineering on advanced diagnostic tests and in their subcritical tests (tests that do not produce a nuclear reaction) associated with the Stockpile Stewardship Program and other special projects. This allows the Nevada Test Site to maintain critical diagnostic skills related to testing and evaluate the strengths and

weaknesses in testing methods they will need to apply in the event that the facility begins testing again. In addition to on-the-job training to maintain diagnostic skills among engineers, the Nevada Test Site is developing a set of training classes geared toward junior employees. These classes will be led by the engineers who used to develop diagnostics at the site for underground testing and will help preserve critical knowledge about testing from being lost.

Facilities Have Built the Capabilities to Support Workforce Planning Strategies

Each of the nuclear weapons facilities increased their capabilities to support the critical skill workforce planning strategies by augmenting administrative support to implement these strategies, utilizing technological planning tools, and increasing the use of educational and financial incentives that help recruit and retain critically skilled staff. For example, Sandia has established a Nuclear Weapons Strategic Management Unit to manage the work, products, processes, and people needed to accomplish the laboratory's mission. Similarly, the Planning, Scheduling, and Integration division at Pantex oversees all workforce planning tasks and has created a detailed flowchart defining how workforce planning takes place at the facility and at what stages different stakeholders, such as division managers or human resource officials, become involved to ensure that the critical skill needs are being met. Alternatively, Los Alamos is piloting a program in one of its divisions that is designed to enhance the retention of critically skilled staff. As part of this program, a human resource manager is deployed full time to a division at the laboratory to help ensure that the students participating in the internship or co-operative program are given a high quality experience, increasing the likelihood that they will want to stay on at the laboratory full time after graduating. This specialized human resource manager also helps ensure that the student will be a good fit for the laboratory in the long run and worthy of continued investment and training in critical skill areas.

Some facilities have also used technology to better link critical skill planning to hiring activity. For example, Sandia developed a Web-based application called the HR Graphalyzer that enables the human resource personnel to analyze human resource data graphically. One component of this application, the Enhanced Staff Planning Tool, helps the divisions design a hiring program that more accurately represents facility needs, factoring in the specific organization's current headcount, current age and years of service distribution, and history of internal employee movement. The application is able to project separations (both retirement and nonretirement) on the basis of historical trends using the organization's age and years of service distributions. It also equalizes hiring over 2 years in

order to avoid swings in recruiting and hiring efforts from year to year. One of the main benefits of this system is that it helps the human resource department to more accurately identify the number of workers with specific skills who are needed. In addition, some facilities use human resource information databases to help them better manage the flow of the critical skills workforce. For example, Pantex uses a database that maintains information on individual skills of the current staff and whether the individual currently fills a critical skill position. This database is updated annually and critical skill positions are reviewed in light of the current mission and workload, helping the facility ensure that it is meeting those workforce and mission needs. Contractors have also used technology to assist with their recruiting efforts. For example, Kansas City implemented a Web-based resume-sourcing tool that allows the facility to post detailed job descriptions of open positions on the Internet, increasing exposure to prospective candidates.

Some facilities have offered incentives to help recruit and retain critically skilled staff, including offering educational programs and providing workplace flexibilities. For example, Kansas City's Technical Fellowship Program is an internal program designed to train and develop associates for future critical skill positions. The facility has also identified a number of workplace flexibilities that have helped it remain competitive in attracting new staff, including signing bonuses, retention bonuses, and employee referral fees. Furthermore, the Kansas City plant has provided housing stipends to student interns who were relocating to the Kansas City area. The Y-12 facility has adopted similar strategies, focusing on employee development through companywide training, education, and job rotation programs that help the new hire get wider exposure and training to different aspects of the facility. Y-12 also recently modified its relocation policy and now provides new hires with an up-front sum of money to help with moving expenses. The intent of this change was to help the facility stay competitive with other industries in the area. Similarly, Lawrence Livermore has tried to stay abreast of market trends and has offered incentives to successfully compete for employees including hiring bonuses, employee referral bonuses, relocation packages, and benefits and compensation packages. Furthermore, it has instituted work-life programs such as flexible schedules, expanded day care facilities, and other on-site services, including dry cleaning and a fitness center, to keep Lawrence Livermore an appealing place to work.

NNSA Has Monitored and Evaluated Contractor Progress in Meeting Critical Skills Workforce Needs

NNSA has continually monitored and evaluated contractor progress through annual, semi-annual, and monthly reviews. As part of their annual Performance Evaluation Plans in fiscal year 2004, each NNSA facility was responsible for meeting one or more performance measures related to critical skills management. Before the start of each new fiscal year, NNSA and the contractor negotiate these plans, which establish the expectations for the coming fiscal year and serve as the basis for evaluating how well the contractor has met the goals of the contract. At the end of the fiscal year, NNSA prepares a Performance Evaluation Review, evaluating the contractor's performance on the objectives set out in the Performance Evaluation Plan. This final overall assessment of how well the performance evaluation measures were met, including those dealing with the critical skill needs at the facility, provides the basis for any financial awards given to the contractor. (See app. II for a summary of the performance measures related to critical skills for each facility.)

Semiannually, each facility reports to NNSA headquarters on a set of predefined metrics related to recruiting and retention. Among the metrics used to assess performance are the number of job offers and acceptances for critical skills positions, age statistics for the current critical skills population, and percentage of critical skill positions vacant. Retention indicators include attrition rates of critical skill employees as compared with other Defense Program employees and total number of departures of critical skills employees. According to NNSA Office of Defense Program officials, two of these performance metrics—average age of the critical skills workforce and the percentage of critical skill vacancies—are good indicators of the overall success of the contractors in recruiting, developing, and retaining critical skills employees.

On a monthly or quarterly basis, the contractors report to NNSA representatives metrics related to meeting critical skill needs. NNSA site managers conduct monthly reviews with the contractor managers to check progress on meeting the performance objectives that have been laid out for the contractors and briefly discuss the status of critical skill positions. During these meetings, the contractors are also free to discuss any other issues adversely affecting their ability to reach their critical skills goals, such as concerns about clearance delays or salary competitiveness. While many of these metrics tracked each month may be based on the actual performance measures established under the contract, others may be tracked because of their close connection to maintaining a critically skilled workforce. For example, at Y-12, reports are issued monthly on an established set of performance metrics for hiring, retention, and turnover,

but also for college recruiting plans, career fair activities, and information regarding involuntary reductions-in-force at other facilities and how these reductions affect hiring at Y-12.

In addition to monitoring contractors' overall progress in meeting critical skill performance measures, some facilities also track progress on specific programs designed to help recruit and retain critically skilled workers. For example, all the proposals for projects initiated through the Laboratory Critical Skills Development Program include milestones, goals, objectives, success measures, and evaluation criteria. Follow-on funding for these projects is dependent on how well these criteria are being met. In addition, NNSA monitors how well money spent as part of the Plant Directed Research and Development program is helping retain critically skilled staff at production plants.

Most Managers Believe Their Current Workforce Is Sufficient to Fulfill Their Facility's Mission

Of the 20 stockpile stewardship program managers we interviewed at the eight NNSA facilities, 15 believe that their critically skilled workforce is currently sufficient to fulfill their facility's mission. Although this belief was widely held, the factors these managers cited as helping their facility achieve a sufficient critical skills workforce varied. Among the factors most commonly cited were the strength of the recruiting programs, the quality of work performed at the facility, and their facility's commitment to training and development. For example, of the managers who believe their critically skilled workforce is currently sufficient, some commented that the recruiting programs are effective in attracting highly qualified new and experienced workers to their facilities. They also mentioned that their facility performs work that is technically challenging, interesting, and of national importance, making it an appealing place to work. These managers also said that their facilities have made a commitment to training and development, ensuring the transfer of knowledge from experienced employees to new workers and allowing many staff to be trained in areas of critical importance to the mission. Some of the five managers who felt the current critical skills workforce was insufficient to meet their facilities' missions expressed concern that the current pool of qualified, technically trained candidates is inadequate to meet the facility's specific needs. At some sites, the candidates with specific skills and training are simply not readily available in the market and managers commented that there are few students entering professions applicable to certain critical skill needs.

Stockpile stewardship managers we interviewed were less confident overall in their facility's ability to fulfill its future critical skills needs;

however, the majority still felt the critical skills workforce would be sufficient over the next 10 years to fulfill the facility's mission. Twelve of the 20 program managers we spoke with believe their critical skills workforce would be sufficient in the future, 3 believe it will be insufficient, while 5 were unsure. The 12 managers who felt their critical skills workforce would be sufficient over the next 10 years cited a number of contributing factors, including the exciting mission of the facility, the strength of the recruiting programs, and a focus on training and developing employees. In addition, a number of these managers also mentioned the facility's workforce planning efforts as essential. For example, one manager said her facility's efforts enabled the managers to identify, understand, and plan for future critical skill needs.

Of the three managers who felt that the critical skills workforce will be insufficient to fulfill the mission over the next 10 years, two mentioned concerns about the budget and the likelihood that a substantial number of critically skilled workers would retire in the next 10 years. These managers said that budget shortfalls would make workforce planning difficult. Budget limitations can affect the number of staff who can be employed at any one time, limiting the amount of knowledge transfer that can occur between experienced staff and those new to the facility, both of whom might be holding the same position while this training and development takes place. In addition, because it can take as long as 5 years for new staff members to receive clearances and be fully trained on the critical elements of their jobs, the impending retirements could influence the transfer of critical knowledge if these experienced workers retire before new staff are brought in and trained in these skills. The five remaining managers expressed uncertainty about whether their facility would be able to maintain the critical skills workforce needed in the future. Most expressed guarded optimism that their facility would be able to find the needed skilled workers; however, they mentioned a number of factors that could still hamper their ability to do so. In addition to the budget uncertainty and impending retirements mentioned by other managers with concerns about future workforce preparedness, some of these managers cited uncertainty about their facility's future mission and a shrinking pool of qualified candidates to fill future openings. One manager commented that shifts in the mission, such as a reduction of laboratory-directed research and development being done, could limit the amount of exciting work being performed at the facilities, making employment there less appealing to potential candidates and, consequently, planning for future skill needs more difficult. The five managers also expressed concern about the availability of technically trained workers to fill future critical skills

positions. According to one manager, competition remains high for certain graduates with particular training and educational background and whether this competition will continue in the future is uncertain.

NNSA Contractors and Organizations with Comparable Workforces Face Ongoing Challenges but Have Developed Strategies to Mitigate Most of Them

NNSA contractors face ongoing challenges in recruiting and retaining a critically skilled workforce and are using a number of strategies to mitigate them. Additionally, organizations with comparable workforces are facing similar challenges and are using similar strategies to mitigate those challenges. Beyond their challenges, NNSA contractors face future uncertainties that could affect their ability to recruit and retain a critically skilled workforce in the years ahead.

NNSA Contractors Have Developed, and Actively Share, Strategies to Mitigate Ongoing Challenges

NNSA contractors most commonly cited four challenges to recruiting and retaining a critically skilled workforce: the amount of time it takes to obtain security clearances, a declining pool of potential employees, the undesirability of certain facilities because of the area's high cost of living, and the undesirability of certain facilities because they are in locations that many potential new hires consider unattractive. Table 3 shows the facilities that cited each of the four challenges and provides sample strategies that some NNSA contractors are using to mitigate them.

Table 3: Challenges Facing NNSA Contractors and Sample Strategies to Mitigate Them

	Laboratories			Production facilities				Test site	
Challenge	Lawrence Livermore	Los Alamos	Sandia	Kansas City	Pantex	Savannah River	Y-12	Nevada	Sample strategies
Time to obtain security clearances	✔	✔	✔	✔	✔	✔	✔	✔	• Provide employees with meaningful work in other areas of the facility • Hire skilled employees from downsized DOE facilities
Declining pool of potential employees	✔	✔	✔	✔	✔	✔	✔	✔	• Develop programs to encourage U.S. students to pursue technical careers • Develop university relations • Utilize skilled staff from other NNSA programs • Develop training programs to meet specific facility needs
High cost of living	✔	✔	✔					✔	• Offer incentives such as signing and relocation bonuses • Offer relocation support
Unattractive location		✔	✔	✔	✔			✔	• Offer incentives such as signing and relocation bonuses • Focus on recruiting individuals local to the area

Source: NNSA.

Regarding the time it takes to obtain security clearances, most of NNSA's contractors said Q-level security clearances—the level needed for most critical skills positions—have been taking from 1 to 2 years to process, delaying new employees' ability to obtain on-the-job training for the classified work for which they were hired. To obtain new employee clearances, contractors submit background paperwork to the Albuquerque

Service Center for processing.[14] The Service Center uses the Office of Personnel Management (OPM) to conduct background investigations. The Service Center reviews the investigation files provided by OPM, conducts follow-up interviews when necessary, and makes the final decisions on clearances. The manager of NNSA's Personnel Security Division at the Albuquerque Service Center, who has responsibility for security clearance issues, said that Q-level clearances have been taking, on average, just under 1 year; however, he also acknowledged that in some cases these clearances are taking as long as 2 years to complete. Because an employee without a clearance cannot take part in classified work, the extended clearance reviews have delayed the beginning of the employees' on-the-job classified critical skills training needed to be designated as fully critically skilled. Without this training, employees cannot begin doing the work for which they were hired. According to contractor human resource officials and stockpile stewardship managers, employees can become frustrated and discouraged in the face of these delays.

While NNSA contractors are not able to directly address the time it takes to process security clearances because responsibility for the investigation and final determination lies elsewhere, they have developed strategies to mitigate the effects of these delays. Several contractors stated that they try to reduce the negative effects of waiting for clearances by providing new employees with meaningful, unclassified work. For example, Y-12 offers a program in which new employees waiting for a clearance can rotate through areas of the plant that do not require a clearance, learning about different departments that relate to the job they were hired to perform. The Savannah River plant plans to place new employees waiting for a security clearance in its soon-to-be-completed hydrogen technology laboratory being developed at a nearby site. Although the laboratory was not built specifically to address clearance delays, working there will benefit staff waiting for clearances by (1) providing an avenue for them to gain experience in areas relevant to the work they will perform once the clearance is obtained and (2) allowing them to work on cutting-edge projects in an unclassified setting. This opportunity should help reduce some of the frustration newly hired employees and the facility management associate with clearance delays. Some facilities have also taken advantage of downsizing at such DOE facilities as Rocky Flats. By hiring critically skilled employees who have Q-level clearances, the facilities can both

[14]The Albuquerque Service Center does not process security clearances for the Savannah River plant.

avoid the delays associated with the security clearance process and retain critical skills already within the nuclear weapons complex. While hiring these experienced NNSA contractor employees has been useful, their numbers will decrease when Rocky Flats is closed and the downsizing of other NNSA facilities is completed.

In addition to the amount of time it takes to obtain security clearances, most of NNSA's contractors also face the ongoing challenge of recruiting from a declining pool of technically skilled potential employees. First, contractors said this pool has shrunk because fewer students with U.S. citizenship are seeking advanced degrees or technical training in areas such as science and engineering. Because most critical skill positions require a Q-level clearance and U.S. citizenship is a primary consideration for such a clearance, NNSA contractors must locate U.S. citizens with the needed critical skills. Second, some contractors said they face a lack of qualified technicians in specific skill areas. For example, Pantex mentioned having difficulty finding enough qualified production technicians, and Los Alamos cited difficulties in finding skilled technicians who have nuclear weapons manufacturing experience or who are trained in using radiological gloveboxes—sealed containers that feature built-in gloves for handling radiological material.

To address the declining pool of technically skilled workers, most of the facilities have developed programs to attract U.S. citizen students earlier in their high school and undergraduate years and encourage them to pursue careers in technical fields. For example, under the Laboratory Critical Skills Development Program, the three weapons laboratories have established programs involving local high schools and universities that encourage students to pursue college and advanced degrees in technical fields and provide a pipeline of workers for future job opportunities at the laboratory. Additionally, some contractors have focused on improving their relationships with universities as a way to address the challenge of a declining pool. Sandia, for example, established its Campus Executive Program to develop a more coordinated and comprehensive recruiting effort at targeted universities. The program's recruiting teams, composed of researchers, recruiters, program alumni, and affiliated faculty, use existing relationships at colleges and universities to attract technically trained U.S. citizens. Contractors have also found a source of critically skilled employees in other NNSA programs operating at the same site. For example, the Defense Program division of Savannah River has been able to pick up critically skilled employees from the facility's Environmental Management segment as it is being shut down. The advantage of hiring

these staff is that they are already trained in critical skill areas relevant to Defense Program work and have their security clearances, which allows them to hit the ground running. Finally, some contractors have developed their own training programs to meet their facilities' specific skills needs as a way of mitigating the shortage of qualified technicians in needed skill areas. For example, Pantex established its Job Skills Development Program in partnership with Amarillo Community College and the Texas Workforce Center to help meet the facility's need for production technicians. The program trains and qualifies a local workforce of production technicians from which Pantex can recruit potential employees. Like Pantex, Los Alamos has developed a program to address one of its specific needs. The Glovebox Technician Pipeline Program develops college-educated technicians with basic skills in radiological glovebox technology. Los Alamos began the program in 2003 and expects it to produce a small pool of technically skilled graduates available for full-time employment.

The third ongoing challenge cited by some NNSA contractors is that their location is geographically undesirable because of the high cost of living. Some contractors stated that the high cost of living in the area where their facility is located makes recruitment and retention of critically skilled employees more difficult. This was the case with Lawrence Livermore, which is located in the San Francisco Bay area. To address cost of living issues, contractors have used such employee incentives as offering signing and relocation bonuses to assist with relocation expenses. Some contractors have also offered potential employees support by helping them find housing or learn about the community.

The fourth ongoing challenge cited by NNSA contractors is that their location hinders recruiting efforts because it is perceived as being an unattractive area to live in or as being remote. For example, contractor officials at the Pantex plant in Amarillo, Texas, report that they have trouble recruiting and retaining critically skilled workers. Pantex officials indicated that some workers are attracted to larger urban environments. To address concerns about locations that may be perceived as being unattractive, some facilities have also offered signing and relocation bonuses. Other facilities focus on recruiting individuals who are from the local area. For example, Y-12 targets universities in the surrounding geographic area because candidates are more likely to accept positions near where they live or attend school. Similarly, Pantex focuses on universities in west Texas, Oklahoma, and New Mexico to recruit engineering candidates.

As NNSA contractors have developed strategies to mitigate recruiting and retention challenges, they have used a variety of methods to share those strategies among themselves. One method for sharing information is to use the human resource specialists at the Albuquerque Service Center as a conduit. NNSA recently consolidated most of its contractor human resource staff, who were previously located at each of the NNSA facilities, in a central location at the Albuquerque Service Center. Six of the eight nuclear weapons complex facilities currently have human resource specialists located at the service center.[15] Because the specialists are now centrally located, they are able to obtain a broader perspective by taking advantage of each others' knowledge about the activities of different contractors. For example, Los Alamos adopted a tool from Lawrence Livermore—a "deliverables matrix"— that is used to help track the reports it submits periodically to NNSA on a number of subjects, including critical skill management. The Los Alamos contractor learned of this tool from its human resource specialist, who learned of it from his Lawrence Livermore counterpart at the service center.

In addition to using the service center as a conduit for sharing strategies, NNSA contractors are using a variety of other avenues. For example, contractors exchange ideas at periodic meetings such as the annual compensation managers meeting and DOE's annual human resource conference, which features sessions dedicated to discussing critical skill recruitment and retention and sharing best practices. Moreover, NNSA's plants participate in quarterly meetings, which allow them to discuss lessons learned in recruiting and retaining critically skilled employees. Partnerships among the facilities also promote strategy sharing. For example, Los Alamos and Lawrence Livermore coordinate their recruiting efforts under the Recruitment Coordination Cost Efficiency Initiative. In addition, the four production plants have developed a Senior Scientist Network for sharing information on nuclear weapons complex recruitment and retention problems and strategies. Additionally, Savannah River and Los Alamos engage in an employee exchange program that allows them to temporarily exchange staff with specific knowledge about tritium, a radioactive isotope of hydrogen that both facilities work with.

[15]Two facilities, Savannah River and Y-12, have human resource specialists located on site.

Organizations with Comparable Workforces Face Similar Challenges and Have Implemented Similar Strategies

Human resource officials from organizations with comparable workforces identified challenges similar to those faced by NNSA contractors in recruiting and retaining a critically skilled workforce. For example, most human resource officials from these organizations cited the amount of time it takes newly hired staff to obtain security clearances as being a challenge. These officials said that security clearances for new employees have been taking from 11 to 18 months, but they believe they have been able to lessen the impact of these delays by, for example, providing new employees with meaningful, nonclassified work to do while awaiting clearances. Additionally, one of these organizations—the Applied Physics Laboratory—addresses the problems associated with clearance delays by seeking staff who already have clearances. Much as NNSA seeks already cleared and trained individuals from nuclear weapons complex facilities that are closing or downsizing, the Applied Physics Laboratory targets Web sites and job fairs that specialize in attracting individuals who already have security clearances.

Most human resource officials from organizations with comparable workforces also cited the declining pool of technically skilled workers as a challenge. Like NNSA, these organizations said they have a smaller group of candidates from which to recruit because there are fewer technically trained U.S. citizens available in the marketplace and fewer U.S. citizens working toward graduate degrees in engineering and science. To mitigate this challenge, most of these organizations have developed programs, such as internships, to encourage students to pursue careers in science and engineering. Some of these programs are designed to expose high school students to the opportunities that exist in these technical fields, while others are intended to encourage college students to pursue graduate degrees in these areas. In one such program, offered by the Naval Research Laboratory, students spend 8 weeks working full-time with scientists and engineers actively engaging in research and planning, participating in special program seminars, and writing and presenting a final research paper. Similarly, the Charles Stark Draper Laboratory offers a program that allows high school students to shadow its employees.

Finally, human resource managers at two organizations with comparable workforces cited the challenge of recruiting staff to work in an area that has a high cost of living, similar to the difficulty expressed by NNSA contractors with staffing facilities in the San Francisco Bay area. Some organizations with comparable workforces have implemented strategies similar to those used by NNSA contractors to mitigate this challenge as well. For example, Exelon offers signing bonuses to help offset the cost of

relocation, and the Charles Stark Draper Laboratory offers its new employees support in finding a neighborhood in which to live and helps employees' spouses find work.

Future Uncertainties Could Affect NNSA's Ability to Maintain a Critically Skilled Workforce

In addition to facing ongoing challenges, NNSA contractors face a number of uncertainties the outcomes of which could affect their ability to maintain a critically skilled workforce into the future. These outcomes hinge on events and decisions over which NNSA contractors generally have little control. The contractors are therefore less able to develop strategies for addressing these uncertainties. For example, some NNSA contractors believe that they will face increased competition for science and engineering candidates, as well as other critically skilled employees, if the job market improves, since these workers will have more employment choices. Such increased competition would hinder the contractors' ability to recruit and retain the critically skilled workforce needed to fulfill the facility's mission, according to some contractors. Some of the programs designed to provide early exposure of college students to NNSA facilities through, for example, the Laboratory Critical Skills Development Program, will help to increase the chance that future candidates will be aware of and consider employment opportunities within the nuclear weapons complex.

Some NNSA contractors also stated that their ability to maintain their critically skilled workforce into the future could be affected by budget and funding limitations, which could hinder workforce planning. These contractors said that the budget process, specifically the timing of the budget cycle and the uncertainty of budget reauthorizations, makes it difficult to bring in new job candidates when they are needed. The Nevada Test Site, for example, said budget shortfalls in its Experimentation Support division resulted in the termination of seven or eight employees in 2003, making it difficult for the division to maintain the workforce needed. The contractors stated that budget uncertainty also hinders their ability to bring on new staff in time to be trained by, and gather essential knowledge from, experienced staff who are near retirement. Some facilities have implemented knowledge retention initiatives designed to archive weapons data by, among other means, interviewing experienced weapons subject matter experts, to mitigate the effects of retirement timing.

In addition, some NNSA contractors expressed concern about the number of their employees who are, or will be soon eligible, for retirement. If a large number of these employees chose to retire at one time, the facilities may not be able to ensure that critical knowledge is passed along to the

newest generation of nuclear weapons workers. In general, the contractors felt that they were in a position to overcome the challenge imposed by anticipated future retirements, but some indicated that the uncertain outcome of future events could alter the impact of these retirements. According to contractor human resource officials, one issue that could influence the pace of future retirements is the contract rebidding process currently underway at Los Alamos. DOE announced that it will place the Los Alamos contract up for bid in 2005 and the Lawrence Livermore contracts up for bid some time after September 30, 2007, for the first time since their establishment. The current contractor for both of these facilities is the University of California. One concern about rebidding the contract is that it could be awarded to a new contractor that may provide a less attractive pension benefit package or may not bring some of the education advantages workers receive as employees of the University of California. These concerns could potentially result in multiple early retirements and affect a facility's ability to perform its mission if the contract changes hands. NNSA may have mitigated some of these concerns when it issued an acquisition plan in September 2004 that required potential bidders on the contract to offer current workers at Los Alamos the same level of pension benefits as the current contractor. Furthermore, a different contractor may want to reassess the recruiting and retention strategies that will be used, such as the university recruiting program or fellowships offered, to ensure that they reflect any affiliations the new contractor may have. This could impact the contractor's access to particular skill sets. Until this process is completed, it will be difficult to determine how Los Alamos's critical skills capabilities are affected or whether this same issue will arise with future contract rebids.

Finally, some NNSA contractors expressed concern that unexpected mission changes could affect their ability to recruit and retain individuals with needed critical skills. These facilities stated that unexpected changes in their long-term missions could make it difficult to plan for future skill needs and prevent them from obtaining the right mix of critical skills during recruiting. For example, one manager said it was critical for his facility to be responsive to programmatic changes, but to maintain that responsiveness they must have a mix of critically skilled workers who meet the needs of the current mission, as well as the needs required by a shift in the mission. A manager at another facility said he finds it difficult to plan for future skill needs because the NNSA mission for his facility is not stable in the short term. Furthermore, in 2001, President Bush announced his intent to significantly reduce the nation's total operationally deployed nuclear weapons force by 2012. This could have ramifications in terms of

the types and numbers of critically skilled workers required to meet this reduction and to ensure the safety and reliability of the remaining weapons in the stockpile. NNSA is guarding against the effects of this mission shift by continuing an advanced concepts program to enable scientists and engineers at the nuclear weapons laboratories to retain critical skills and to provide the United States with means to respond to new, unexpected, or emerging threats in a timely manner.

Conclusion

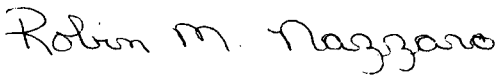
While NNSA contractors have been generally effective in recruiting and retaining the critically skilled workforce needed currently, are well poised to maintain the critically skilled workforce that will be needed in the near future, and have successfully mitigated many of the challenges they have already faced, the future will almost certainly bring additional challenges and uncertainties the contractors will need to continue to stay aware of and address. Although some of these challenges may be outside the contractors' immediate control—such as changes in economic conditions or shifts in NNSA's mission—the test that lies ahead for these contractors will be in identifying these new challenges early and developing strategies to mitigate them wherever possible. In order for the nuclear weapons facilities to be able to locate and employ the critically skilled workforce needed to ensure the safety and reliability of the stockpile, NNSA and its contractors will need to remain vigilant and focused in their recruiting and retention efforts, as well as anticipate, and appropriately plan for, future critical skill needs and shortages.

Agency Comments

We provided NNSA with a draft of this report for its review and comment. In oral comments, NNSA agreed with the report.

We are sending copies of this report to the Secretary of Energy; the Director, Office of Management and Budget; and other interested parties. We will also make copies available to others upon request. In addition, the report will be available at no charge on the GAO Web site at http://www.gao.gov.

If you or your staffs have any questions, please call me at (202) 512-3841. Key contributors to this report are listed in appendix III.



Robin M. Nazzaro
Director, Natural Resources
and Environment

List of Congressional Committees

The Honorable John Warner
Chairman
The Honorable Carl Levin
Ranking Minority Member
Committee on Armed Services
United States Senate

The Honorable Duncan L. Hunter
Chairman
The Honorable Ike Skelton
Ranking Minority Member
Committee on Armed Services
House of Representatives

The Honorable Ted Stevens
The Honorable Daniel K. Inouye
Committee on Appropriations
United States Senate

Honorable C.W. Bill Young
Honorable John P. Murtha
Committee on Appropriations
House of Representatives

Scope and Methodology

As part of our overall approach to examine the National Nuclear Security Administration (NNSA) contractors' ability to recruit and retain the critically skilled workforce needed to maintain the safety and reliability of the nuclear weapons stockpile, we visited six of the eight nuclear weapons complex facilities—Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Sandia National Laboratories, the Kansas City Plant, the Pantex Plant, and the Y-12 Plant. The remaining two sites—the Savannah River Site and the Nevada Test Site—have the smallest number of critically skilled workers and we conducted extensive telephone interviews with human resource and workforce, planning managers at these facilities. We also sent each facility a standard set of interview questions and received responses from each facility.

As part of our review of the contractors' efforts, we interviewed a nonprobability sample of 20 managers from all eight facilities.[1] We requested names of at least two managers in the Stockpile Stewardship Program from the human resource managers at each facility. We then conducted structured interviews with these managers, either in person or by telephone. In particular, we discussed the managers' involvement in recruiting, retaining, and planning for workforce needs at the facility. We also gained their perspective on the ongoing recruiting and retentions challenges their facilities face and whether they felt their facility would be able to maintain the critically skilled workforce needed to fulfill their mission.

To describe the approaches NNSA contractors are using to recruit and retain a critically skilled workforce, we spoke with human resource managers at each of the eight NNSA nuclear weapons complex facilities. Specifically, we discussed the approaches the facilities use to recruit and retain a critically skilled workforce and the ways in which NNSA has supported the contractors' efforts. We also reviewed documentation of the recruitment and retention approaches used at each facility, including human resource managers' responses to our written request for specific information. In addition, we interviewed NNSA officials at headquarters, the site offices for most of the facilities, and the NNSA Service Center in Albuquerque, New Mexico. We discussed with these officials the ways in which they have supported contractors' efforts to recruit and retain their

[1]Results from nonprobability samples cannot be used to make inferences about a population, because in a nonprobability sample some elements of the population being studied have no chance or an unknown chance of being selected as part of the sample.

critically skilled workforce. To assess the similarities of approaches used by organizations with comparable workforces, we spoke with human resource representatives from six research and advanced technology organizations with comparable workforces to determine the extent to which these industries use recruiting and retention approaches similar to those used by NNSA. These organizations are as follows:

- Applied Physics Laboratory in Laurel, Maryland: a division of the Johns Hopkins University, operates specialized research and test facilities;
- Charles Stark Draper Laboratory in Cambridge, Massachusetts: an independent laboratory that contracts with a number of government agencies;
- Exelon Corporation headquartered in Chicago, Illinois: an energy service provider;
- Jet Propulsion Laboratory in Pasadena, California: operated by the California Institute of Technology for the National Aeronautics and Space Administration;
- Lockheed Martin Corporation headquartered in Bethesda, Maryland: a major federal government contractor; and
- Naval Research Laboratory in Washington, D.C.: operated by the Navy.

We also spoke with two industry associations representing manufacturing and nuclear materials industries—the National Association of Manufacturing and Institute of Nuclear Materials Management. We selected these eight organizations based on the following criteria: their selection by the Chiles Commission as benchmarking organizations; their geographic dispersal; and their representation of different high technology, laboratory, or manufacturing industry segments. We reviewed the Chiles Commission report and determined it was methodologically sound enough for the purposes of this report.

To assess the effectiveness of the approaches used to recruit and retain critically skilled workers, we collected a variety of workforce data from each facility, including total numbers of Defense Program and critically skilled workers and average ages of these workers broken out by job classification, hiring and attrition trends, average retirement ages, and forecasted needs for critically skilled workers. To assess the reliability of

these data, we reviewed relevant documentation, interviewed cognizant contractor officials, and obtained reponses from key database officials to a series of data reliability questions covering issues such as data entry, access, quality control procedures, and the accuracy and completeness of the data. Follow-up questions were added whenever necessary. We determined that the data were sufficiently reliable for the purposes of this report. In addition, we obtained documentation of each facility's workforce planning process and evaluated that process using our five principles of strategic workforce planning.[2] These five principles are (1) involving management and employees in developing and implementing the strategic workforce plan, (2) determining critical skills needs through workforce gap analysis, (3) developing workforce strategies to fill gaps, (4) building needed capabilities to support workforce strategies, and (5) monitoring and evaluating progress in achieving goals. We also interviewed human resource managers at each facility to determine the kinds of recruiting and retention strategies they have implemented to support their workforce planning processes. To determine the extent to which NNSA monitors and evaluates contractor progress we interviewed NNSA site officials responsible for performance management, as well as each facility's human resource managers. Finally, we analyzed the responses of stockpile stewardship managers to our structured interview to determine whether the managers believe their facility had and could maintain the critically skilled workforce needed to fulfill their mission, the reasons for these beliefs, and the extent to which the managers are involved in the workforce planning process.

Regarding the ongoing challenges that NNSA contractors face in recruiting and retaining a critically skilled workforce, we spoke with human resource, workforce planning, and stockpile stewardship program managers. Specifically, we discussed ongoing recruitment and retention challenges, strategies used to mitigate those challenges, and future uncertainties that may affect the facilities' abilities to recruit and retain the critically skilled workers needed. To further identify any remaining challenges and uncertainties, we reviewed the contractors' responses to our written questions. To assess the extent to which the remaining challenges, and the strategies used to mitigate these challenges, are similar to those of organizations with comparable workforces, we spoke with human resource representatives from the six research and advanced technology

[2]See GAO-04-39.

organizations with comparable workforces and the two industry associations.

We conducted our work from February 2004 through January 2005 in accordance with generally accepted government auditing standards.

Critical Skills Performance Measures in NNSA Facilities' Performance Evaluation Plans for Fiscal Year 2004

NNSA facility	Performance measure
Lawrence Livermore National Laboratory Los Alamos National Laboratory	Utilize University of California strengths to recruit, retain, and develop the workforce basis • Recruit and retain a skilled and diverse workforce that meets the laboratories' long-range core and critical skills requirements by implementing a human resource strategy that leverages student programs and University of California relationships.
Sandia National Laboratories	Sandia management focuses on renewal and retainment of its workforce and the transfer of knowledge to ensure the future of the Nuclear Weapons Complex such that it can continue to perform its mission for the nation in the future years. • Sandia implements a comprehensive program for workforce planning and diversity that includes recruitment, training, and knowledge transfer necessary to meet the long-range core and critical skills requirements.
Kansas City Plant	Demonstrate effective workforce planning to assure the current and future workforce critical skills, including technical, program/project managers and administrative personnel, are adequate to meet future workforce skills needs and are consistent with contract performance.
Pantex Plant	Develop and exercise critical skills, capabilities, and personnel. • Fill planned critical skill vacancies calculated from the latest biannual report "Maintenance of Nuclear Weapons Expertise Data for NNSA Performance Metrics." • Maintain planned staffing in critical skill personnel calculated from the latest biannual report "Maintenance of Nuclear Weapons Expertise Data for NNSA Performance Metrics." Complete required training and qualification of critical skill personnel with appropriate clearance and/or PAP.
Savannah River Plant	Focus Area – Technical Capability • Knowledge preservation • Engineering qualifications • Filled critical skill positions
Y-12 Plant	BWXT Y-12 will take measures to ensure that the critical skills needed to support the Y-12 workload are available and fully trained or in a training program to ensure ability to perform duties as required in the future. • The critical skills database is complete and updated on a quarterly basis to consistently provide accurate numbers of vacant critical skills positions. • Programs are in place to continually replenish the pipeline of new critical skills employees and ensure the appropriate development programs are available to allow the new employees to perform critical duties.
Nevada Test Site	Demonstrate improvement in the following emphasis areas selected from the Project Management Body of Knowledge: • Improve Critical Skills Management: Identify critical skills of project managers and ensure they possess the requisite skills to successfully perform defined tasks.

Source: NNSA.

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