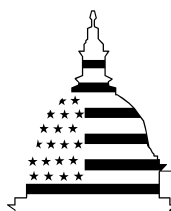


January 2003

Major Management Challenges and Program Risks

Department of Energy



G A O

Accountability * Integrity * Reliability

A Glance at the Agency Covered in This Report

The Department of Energy is a multibillion-dollar enterprise with multiple, diverse missions, including:

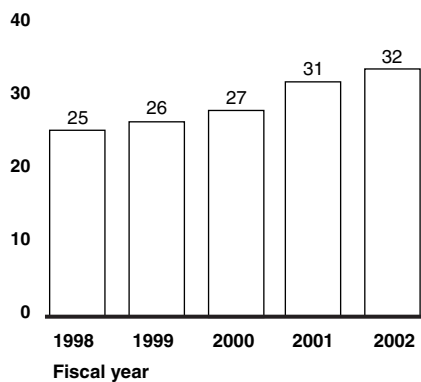
- fostering secure and reliable energy systems that are environmentally and economically sustainable,
- providing stewardship for the nation's nuclear weapons and nuclear material,
- cleaning up the environment to eliminate the legacy of early nuclear weapons development activities, and
- supporting U.S. leadership in energy-related science and technology.

To carry out these missions, the department has more than 50 major facilities in 35 states, including national laboratories, nuclear weapons production facilities, and facilities undergoing environmental cleanup.

The Department of Energy's Budgetary and Staff Resources

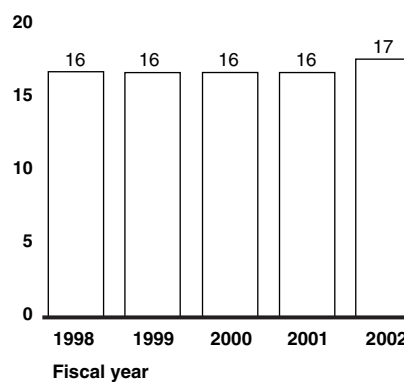
Budgetary Resources^{a, b}

Dollars in billions



Staff Resources^b

FTEs in thousands



Source: Budget of the United States Government.

^a Budgetary resources include new budget authority (BA) and unobligated balances of previous BA.

^b Budget and staff resources are actuals for FY 1998-2001. FY 2002 are estimates from the FY 2003 budget, which are the latest publicly available figures on a consistent basis as of January 2003. Actuals for FY 2002 will be contained in the President's FY 2004 budget to be released in February 2003.

This Series

This report is part of a special GAO series, first issued in 1999 and updated in 2001, entitled the *Performance and Accountability Series: Major Management Challenges and Program Risks*. The 2003 Performance and Accountability Series contains separate reports covering each cabinet department, most major independent agencies, and the U.S. Postal Service. The series also includes a governmentwide perspective on transforming the way the government does business in order to meet 21st century challenges and address long-term fiscal needs. The companion 2003 *High-Risk Series: An Update* identifies areas at high risk due to either their greater vulnerabilities to waste, fraud, abuse, and mismanagement or major challenges associated with their economy, efficiency, or effectiveness. A list of all of the reports in this series is included at the end of this report.

Department of Energy



Highlights of [GAO-03-100](#), a report to Congress included as part of GAO's Performance and Accountability Series

Why GAO Did This Report

In its 2001 performance and accountability report on the U.S. Department of Energy (DOE), GAO identified important issues facing the department as it works to carry out its multiple, complex, and highly diverse missions. The information GAO presents in this report is intended to help to sustain congressional attention on these challenges and a departmental focus on continuing to make progress in addressing these challenges and ultimately overcoming them. The report should help improve government for the benefit of the American public. This report is part of a special series of governmentwide and agency-specific issues.

What Remains to Be Done

GAO believes that DOE should:

- Continue its focus on security upgrades needed for meeting new terrorist threats.
- Ensure that the National Nuclear Security Agency (NNSA) continues progress with its major operational and organizational reforms.
- Establish results-oriented performance data to determine if contractor performance has improved.
- Complete initiatives to accelerate cleanup and reduce costs.
- Enhance efforts to ensure a stable, reliable energy supply.
- Manage infrastructure upgrade projects effectively.

www.gao.gov/cgi-bin/getrpt?GAO-03-100.

To view the full report, click on the link above. For more information, contact Robert A. Robinson, at 202-512-3841, or robinsonr@gao.gov.

What GAO Found

DOE has taken steps to address the specific performance and management challenges that we previously identified. However, each of these challenges requires more work and vigilance to be overcome. In addition, the agency must face emerging challenges to meet the nation's energy needs and upgrade DOE's deteriorating infrastructure.

- **Address security threats and problems.** DOE has upgraded its physical, cyber and document security. However, the terrorist attacks of September 11, 2001, changed the threat that DOE had planned for and will likely require new security measures and additional resources.
- **Improve management of the nation's nuclear weapons stockpile.** NNSA, an agency within DOE, continues to develop its new planning, programming, and budgeting system and redesign its organization. However, both activities are far from complete and will need continued executive leadership to ensure that these major changes are effectively implemented.
- **Resolve problems in contract management that place DOE at high risk for fraud, waste, and abuse.** DOE has made progress in implementing contract reforms by using alternative contract types, competing more contracts, and using performance-based requirements. However, it is unclear whether these reforms have improved contractor performance. To better ensure the effectiveness of its initiatives, DOE must establish clear goals, results-oriented outcome measures, and performance data.
- **Improve management for cleanup of DOE radioactive and hazardous wastes.** DOE's environmental management program has begun initiatives to improve contract management, streamline business practices, and increase the technical expertise of DOE staff. However, continued management leadership is needed to ensure that these initiatives are implemented in a safe manner to accomplish program goals of accelerating risk reduction and reducing overall cleanup costs.
- **Enhance DOE leadership in meeting the nation's energy needs.** Our nation's energy supply system is under stress and is a potential terrorist target. Enhanced DOE leadership is needed to research new energy technologies, help develop a competitive electricity generation system, and reduce the vulnerability of the U.S. economy to supply disruptions of petroleum.
- **Revitalize DOE's infrastructure.** DOE has a new program to spend billions of dollars to upgrade its production facilities, research and development laboratories, and other infrastructure. DOE needs to ensure that these major projects are managed effectively and efficiently.

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G A O

Accountability * Integrity * Reliability

United States General Accounting Office
Washington, D.C. 20548

January 2003

The President of the Senate
The Speaker of the House of Representatives

This report addresses the major management challenges facing the U.S. Department of Energy (DOE) as it works to carry out its multiple and highly diverse missions. These missions include maintaining nuclear weapons, fostering a reliable energy supply, cleaning up environmental contamination from prior weapons activities, and promoting U.S. leadership in science. It is part of a special series entitled the *Performance and Accountability Series: Major Management Challenges and Program Risks*, which GAO has issued biennially since January 1999.

This report discusses the actions that DOE has taken or are under way to address the challenges GAO reported in its series 2 years ago, in January 2001, and major events that have occurred that significantly influence the environment in which the department carries out its mission. Also, GAO summarizes the challenges that remain and new ones that have emerged.

This analysis should help the new Congress and the administration carry out their responsibilities and improve government for the benefit of the American people. For additional information about this report, please contact Robert A. Robinson, Managing Director, Natural Resources and Environment, at (202) 512-3841 or at robinsonr@gao.gov.

David M. Walker
Comptroller General
of the United States

Major Performance and Accountability Challenges

The Department of Energy's (DOE) diverse missions of maintaining the nation's nuclear weapons stockpile, fostering a reliable and sustainable energy supply for the nation, cleaning up contamination from prior weapons activities, and promoting leadership in science are not only technically difficult and complex but also, in many cases, politically sensitive. In our 2001 report on management challenges and program risks we identified six areas, or challenges, that warranted the attention of DOE's management. These issues were related to addressing security concerns, maintaining the nuclear weapons stockpile, improving contract management, cleaning up radioactive and hazardous wastes, achieving nonproliferation goals, and improving financial management. In that report we pointed out that many of those challenges are long-standing and that sustained management attention will be needed to correct the underlying weaknesses and implement needed improvements. We also pointed out that DOE has undertaken corrective action in all these areas, but because of the nature and difficulty of the challenges, achieving lasting improvements may take several years.

Over the past 2 years, two events—the terrorist attacks of September 11, 2001, and energy shortages in several western states—have further complicated DOE's missions. DOE could be an appealing target for terrorist groups because of its role in maintaining the nation's nuclear weapons stockpile and handling vast quantities of radioactive and hazardous materials. Heightened security will be needed at DOE facilities. DOE may also have to develop new security measures. Similarly, energy shortages have underscored the vulnerability of our energy supplies and raised questions about our almost exclusive reliance on petroleum in some sectors. A stable and reliable energy supply is critical for consumers, the U.S. economy, and our national security. DOE must address the ramifications of these events on its programs, in addition to addressing its ongoing management challenges and program risks.

DOE continues to be an agency with multiple challenges. In this year's report we identify six areas where DOE's management attention is needed. Four of the areas are continued from 2001. These include addressing security concerns, managing the nuclear weapons stockpile, improving contract management, and cleaning up radioactive and hazardous wastes. For the most part these were continued because of the difficult nature of the challenge itself or because new issues arose within the challenge. In the case of contract management, for example, corrective action will take many years to be fully realized. In the case of DOE security, the September 11 attacks raised new major security concerns for DOE to address. In

addition, we are adding two new management challenges. One relates to meeting the nation's energy needs and reducing our dependence on foreign oil. DOE can provide enhanced leadership in addressing this key national issue. The other relates to revitalizing DOE's infrastructure, which is in poor condition or reaching the end of its design life. DOE's performance in addressing these challenges will significantly affect its ability to efficiently and effectively carry out its missions. Two management challenges from 2001 were dropped. Financial management was dropped because, among other things, DOE had no material internal control weaknesses and received a clean opinion on its financial statements for fiscal year 2001. Achieving nonproliferation goals was dropped because of improvement DOE made to obtain better access to facilities and information in Russia, verify the use of program funds, and better coordinate DOE's nonproliferation programs.

Performance and Accountability Challenges

The graphic features a background of a stylized American flag with stars and stripes. On the right side, there is a detailed illustration of the United States Capitol building. The title "Performance and Accountability Challenges" is prominently displayed in the center in a bold, black, sans-serif font.

Performance and Accountability Challenges

- Address security threats and problems
- Improve management of the nation's nuclear weapons stockpile
- Resolve problems in contract management that place DOE at high risk for fraud, waste, and abuse
- Improve management for cleanup of DOE radioactive and hazardous wastes
- Enhance DOE leadership in meeting the nation's energy needs
- Revitalize DOE's infrastructure

Address Security Threats And Problems

The terrorist attacks of September 11, 2001, brought into sharp focus the necessity for all federal agencies to take threats to their facilities seriously. For DOE and the National Nuclear Security Administration (NNSA), a separately organized agency within DOE, the threats have taken on added importance.¹ DOE and NNSA facilities could be appealing targets to terrorist groups because of, among other things, their role in maintaining the nuclear weapons stockpile and handling vast quantities of radioactive and hazardous materials. Addressing this threat will likely require developing new security measures and committing significant additional resources. DOE must address this new challenge while addressing existing security problems that, in some instances, have plagued the department for many years. Further, DOE must balance security issues and cooperative scientific research with a variety of foreign countries.

As a result of the scope and magnitude of the September 11 attacks, DOE and NNSA undertook a number of short-term efforts to improve security. Immediately following the attacks, NNSA facilities instituted a heightened state of alert in accordance with DOE orders. In conjunction with this alert, security measures were enhanced to include additional barriers and access controls, increased vehicle searches, and increased patrols of perimeters and critical facilities. In addition, emergency operations centers at DOE headquarters and the field were staffed. Threat information on foreign intelligence activities was also distributed to field personnel. These activities increased DOE's security costs by many millions of dollars.

¹ NNSA's primary responsibility is to maintain the safety and reliability of the nation's nuclear weapons stockpile through the Stockpile Stewardship Program.

Figure 1: Adding Concrete Barriers That Secure an NNSA Storage Vault



Source: DOE.

DOE and NNSA also began several long-term activities to strengthen their overall security structure and program. Each NNSA facility was evaluated against various criteria including the possibility of nuclear detonation; radiological dispersion; and loss of program capability, technical staff, and life. Also, each site was asked to identify vulnerabilities and the projected cost of correcting them. From this work, NNSA compiled a prioritized list of needed security improvements. Work was also initiated to revise a key DOE security document called the Design Basis Threat. The Design Basis Threat describes the most credible and serious potential adversaries DOE facilities are likely to face. Revisions to this document could have significant consequences because it could change the security philosophy at DOE and NNSA sites. Finally, DOE and NNSA reviewed the security and assessed the vulnerability at each site, assessed nuclear materials management practices, and reviewed personnel security and transportation security. The results of these activities may, in the longer term, fundamentally change security at DOE and NNSA sites.

All of these efforts to respond to the September 11 attacks must be coordinated with efforts to address previously identified security weaknesses. Over the last several years, DOE began more than 70 initiatives to improve security. In a March 2002 report we pointed out that many initiatives have been successfully implemented.² These initiatives have eliminated the backlog of security clearance investigations and reinvestigations, strengthened controls over cyber security, and upgraded the counterintelligence program. However, we also pointed out that several initiatives are still in progress and some may take years to implement fully. In addition, during the last couple of years, other security problems or concerns have arisen.

In the March 2002 report we pointed out, among other things, that NNSA, which was created in March 2000 in part to improve security, still did not have a fully operational structure. The lines of authority from headquarters through NNSA field offices to the contractors for security oversight had not been clearly laid out. Also, there was still some confusion about the roles and authorities of DOE and NNSA security offices. Some contractor and NNSA field staff told us they had received differing guidance from DOE and from NNSA security offices and were uncertain about which to follow. A report by the Center for Strategic and International Studies,³ dated April 2002, found similar problems and recommended that DOE/NNSA clarify lines of responsibility and authority for security. In particular, the study wanted a more clearly defined chain of command. In December 2002, NNSA announced its plans for implementing a new organizational structure, which it expects to have in place in 2004.

In the information security area, we pointed out in an August 2001 report that while DOE laboratories have taken steps to improve control over their classified information, DOE could make further improvements.⁴ DOE's requirements for documenting when someone needs to know specific classified information lack specificity, allowing laboratory managers wide

² U.S. General Accounting Office, *Nuclear Security: Lessons to Be Learned from Implementing NNSA's Security Enhancements*, [GAO-02-358](#) (Washington, D.C.: Mar. 29, 2002).

³ Center for Strategic and International Studies, *Science and Security in the 21st Century: A Report to the Secretary of Energy on the Department of Energy Laboratories* (Washington, D.C.: April 2002).

⁴ U.S. General Accounting Office, *Nuclear Security: DOE Needs to Improve Control Over Classified Information*, [GAO-01-806](#) (Washington, D.C.: Aug. 24, 2001).

discretion in interpretation and implementation. Some managers provided long-term blanket approvals to hundreds of staff for all classified information in a vault or computer system. We also found that recent revisions to DOE's Classified Matter Protection and Control Manual did not include some security requirements that were in place prior to 1998. For example, the revised manual did not require approving reproduction of top-secret documents and maintaining an access list for each top-secret document.

The cyber security area is another area where DOE has initiated upgrades, but more improvements are warranted. The previously mentioned report by the Center for Strategic and International Studies made a number of recommendations to DOE to improve its cyber security. These included placing a higher priority on the timely implementation of cyber security solutions that are already developed and doing more to evaluate emerging technologies that are being developed by other agencies and by the private sector. DOE's Inspector General pointed out in an August 2001 report⁵ that while DOE had made improvements in its unclassified cyber security program, the program did not adequately protect data and information systems as required by the Government Information Security Reform Act. It found problems in DOE's contingency planning, computer incident reporting, and training. According to the report, these weaknesses and others increased the risk that critical systems could be compromised or disabled by malicious or unauthorized users.

⁵ U.S. Department of Energy, *The Department's Unclassified Cyber Security Program*, DOE/IG-0519 (Washington, D.C.: Aug. 30, 2001).

Another area of particular concern to DOE is physical security, especially since September 11. In our aforementioned March 2002 report we found that there was some confusion over who in DOE was responsible for accelerating upgrades to physical security. In a December 2001 report,⁶ DOE's Inspector General pointed out that improvements are needed at Lawrence Livermore National Laboratory for the site to comply with its overall security plan, protect certain types of nuclear material, and provide clearer guidance for site protective-force operations. Another DOE Inspector General report,⁷ dated March 2002, found that because of problems with DOE's clearance and badging controls, an unauthorized individual could gain access to department headquarters.

New initiatives are likely to result from ongoing security evaluations initiated in response to the September 11 attacks. As a result, additional improvements are likely. However, our past work has shown that DOE has had difficulty making lasting security improvements, and security problems have recurred. In our view, this difficulty is in part due to DOE's culture, because, in some instances, there has been a pattern of behavior where security is a secondary priority. Changing this culture, which has developed over decades, will require sustained management attention. Such attention will be needed to ensure that security improvements are effectively and consistently built into DOE's culture as it evolves to meet new management challenges.

Improve Management of the Nation's Nuclear Weapons Stockpile

NNSA spends more than \$5.5 billion per year to maintain the safety and reliability of the nation's nuclear weapons stockpile through the Stockpile Stewardship Program.⁸ NNSA was created to correct long-standing and widely recognized management problems at DOE. NNSA has made progress in developing a planning, programming, and budgeting system and in clarifying its organization. However, NNSA needs to do more to have the effective and efficient management structure necessary for accomplishing its mission.

⁶ U.S. Department of Energy, *Lawrence Livermore National Laboratory Protective Force and Special Response Team*, DOE/IG-0534 (Washington, D.C.: December 2001).

⁷ U.S. Department of Energy, *Personnel Security Clearances and Badge Access Controls At Department Headquarters*, DOE/IG-0548 (Washington, D.C.: Mar. 26, 2002).

⁸ NNSA is also responsible for preventing the proliferation of weapons of mass destruction and designing, building, and maintaining naval nuclear propulsion systems.

Numerous studies have identified problems with DOE's planning, programming, and budgeting, which NNSA inherited. The problems include the lack of a unified planning and programming process, the absence of integrated long-range program plans, and the failure to fully link existing plans to budgets and management controls. Without a sound, integrated planning, programming, and budgeting process, it has been difficult for officials to ensure that decisions with resource implications are weighed against one another completely and consistently. In our December 2000 report on the management of the Stockpile Stewardship Program, we recommended that NNSA take action to improve and integrate its planning processes and budgetary data to provide information needed to manage this highly complex program.⁹ Overall, DOE agreed with these recommendations.

In response to our report and recommendations, NNSA's Administrator changed NNSA's planning, programming, and budgeting process by instituting a process similar to that used by the Department of Defense. The Administrator originally set a goal of having fully established NNSA's version of the Department of Defense's process—referred to by NNSA as the Planning, Programming, Budgeting, and Evaluation process—by the fiscal year 2003 budget cycle. Subsequently, this date was pushed back to the fiscal year 2004 budget cycle because development was taking longer than expected.

As we reported in December 2001 and again in February 2002, while NNSA has made some progress in implementing some elements of the planning phase of the Planning, Programming, Budgeting, and Evaluation process for the fiscal year 2004 budget cycle, work on the other phases of the process has gone much more slowly. For example, NNSA has not finalized how the programming and evaluation phases of the process will work. NNSA is also just beginning to develop the automated systems needed to support its process. In addition, except for budgeting personnel, NNSA does not have sufficient personnel with the skills to conduct the analytical functions typically associated with the multiple phases of the Planning, Programming, Budgeting, and Evaluation process.

⁹ U.S. General Accounting Office, *Nuclear Weapons: Improved Management Needed to Implement Stockpile Stewardship Program Effectively*, GAO-01-48 (Washington, D.C.: Dec. 14, 2000).

NNSA may face additional hurdles as it implements its Planning, Programming, Budgeting, and Evaluation process for the fiscal year 2004 budget cycle. Rather than function as the fully implemented system envisioned by the Administrator for the fiscal year 2004 cycle, NNSA's Planning, Programming, Budgeting, and Evaluation process should be considered a prototype that will likely have to be refined and developed in future years. Furthermore, it is too soon to tell whether the proposed process, when fully implemented, will effectively address widely recognized problems in NNSA's existing planning, programming, and budgeting practices and whether the process will include effective evaluation procedures.

With respect to organization, the Congress established NNSA, in part, to correct confused lines of authority and responsibility within the nuclear weapons complex that had contributed to a wide variety of problems, such as cost overruns and schedule slippages. In February 2002, after several delays and almost 2 years after its creation, NNSA announced a new organizational structure that represents a significant step toward addressing important, long-standing organizational problems by removing excess management layers, streamlining and clarifying the relationship between NNSA's headquarters offices and its field structure, and potentially holding federal and contractor staff more accountable.

However, NNSA's reorganization is far from complete. As we noted in our February 2002 testimony on NNSA's proposed plans, NNSA's proposal did not address several key, long-standing organizational problems. For example, NNSA's proposal did not address the fact that the nuclear weapons science function and nuclear weapons production function are managed separately, although their work must be closely coordinated to achieve mission goals. As we noted in our aforementioned December 2000 report on the management of the Stockpile Stewardship Program, this split adversely affects coordination within the nuclear weapons complex. More recently, in December 2002, NNSA announced its plans for implementing its new organizational structure. While NNSA's plans further clarify how NNSA will implement the structure it announced in February 2002, numerous important issues, such as how NNSA will achieve the 20 percent federal staff reduction it promises while maintaining effective federal oversight, remain to be resolved before September 2004, when the reorganization is to be fully implemented. As NNSA implements its new organization, it is vital that its chains of command are enforced and that federal and contractor staff are held accountable. Otherwise, NNSA's reorganization could simply be one more in a long line of missed

opportunities. Underpinning NNSA's efforts to improve the management of the Stockpile Stewardship Program is the need to address its human capital challenges. Numerous studies have pointed out the need to deal comprehensively with the challenge of recruiting and training the next generation of technical and managerial staff before the end of this decade. However, as we pointed out in our December 2001 report on NNSA's implementation efforts, NNSA still lacked a long-term strategic approach that can ensure a well-managed workforce. While NNSA managers agreed that a strategic approach was needed, no timetable for developing one existed because NNSA managers were waiting for the outcome of NNSA's reorganization process.

Finally, because the United States is no longer designing and building nuclear weapons, extending the life of each of the nine weapon types in the current stockpile is a key component of the Stockpile Stewardship Program. To fully understand the cost of these life extension projects, the Conference Report on the Energy and Water Development Appropriation Act for Fiscal Year 2002 (P.L. 107-66) directed NNSA to develop a series of cost reports known as Nuclear Weapon Acquisition Reports. In our July 2002 report we reviewed the Nuclear Weapon Acquisition Reports and found that while they represented a good beginning, additional information, such as the cost of associated research and development, was needed to make them a more effective project management tool for NNSA and the Congress.¹⁰ We made recommendations, which NNSA agreed with in part, to improve the quality and usefulness of the Nuclear Weapon Acquisition Reports.

Resolve Problems in Contract Management That Place DOE at High Risk for Fraud, Waste, and Abuse

DOE's contract management represents a significant challenge to the department. DOE is the largest civilian contracting agency in the federal government. About 90 percent of its annual budget is spent on contracts. DOE relies primarily on contractors to carry out its diverse missions and to operate its facilities. Since 1990, we have designated DOE's contract management, which we have broadly defined to include contract administration and project management, as a high-risk area; we maintain that designation in this year's high-risk report. In our January 2001 report on DOE's major management challenges, we reported ongoing problems with the department's approach to selecting an appropriate contract type,

¹⁰ U.S. General Accounting Office, *NNSA: Nuclear Weapon Reports Need to Be More Detailed and Comprehensive*, [GAO-02-889R](#) (Washington, D.C.: July 3, 2002).

using competition to award contracts, incorporating performance-based measures into contracts, and minimizing cost and schedule overruns on major projects. Although DOE has made progress in addressing these problems through contract reforms, it is a long-term effort, and many challenges remain.

- With respect to selecting the appropriate contract type, we reported in 2002 that DOE has encouraged the use of alternative contract types, such as fixed-price contracts, that are tailored to the required work and the financial and technical risks associated with that work.¹¹ However, the department is still in the process of implementing a more systematic approach for determining the best contract type for a given situation.
- Regarding efforts to increase competition, DOE has increased the proportion of major site contracts awarded competitively to 56 percent as of 2001, up from 38 percent as of 1996. All but one of the 11 contracts that had not been competitively awarded as of 2001 were for managing research and development centers, including weapons laboratories, that are exempted by statute from mandatory competition. DOE has continued to noncompetitively extend most of these contracts, including some for contractors that have experienced performance problems, such as the University of California contract to manage and operate the weapons laboratories at Los Alamos and Livermore. It is unclear if DOE can successfully address the performance problems using contract mechanisms.

¹¹ U.S. General Accounting Office, *Contract Reform: DOE Has Made Progress, but Actions Needed to Ensure Initiatives Have Improved Results*, [GAO-02-798](#) (Washington, D.C.: Sept. 13, 2002).

- Regarding the use of performance-based measures in contracts, DOE has reported that all of its major site contracts now incorporate performance-based concepts to define requirements and measure results. In addition, DOE has increased the emphasis on performance-based contracting by increasing the percentage of available fee (available payment to the contractor) tied to objective performance measures. However, developing good performance measures has continued to be a challenge for the department. For example, a 2001 DOE Office of Inspector General review of performance-based incentive measures at three sites concluded that the department did not use performance-based measures in a way that would consistently result in improved contractor performance.¹² DOE acknowledges that it must make further progress in this area.

Despite this progress in implementing contract reforms, it is unclear whether contractors' performance has improved. Instead of measuring outcome-oriented performance results, DOE has primarily gauged progress by measuring its implementation of the contract reform initiatives and by reviewing performance measures in individual contracts. Therefore, objective performance information on overall results is scarce.

Nevertheless, there are indications that the performance of DOE's contractors may not have improved. For example, DOE continues to have difficulty keeping some of its major projects on schedule and within budget. In our September 2002 report, we found that in comparing cost and schedule performance for ongoing major DOE projects there was no significant improvement in performance for similar projects between 1996 and 2001. In both 1996 and 2001, more than half of the projects reviewed had both schedule delays and cost increases. Furthermore, as shown in table 1, the proportion of projects experiencing cost growth of more than double the initial cost estimates or schedule delays of 5 years or longer increased during the 6-year period.

¹² U.S. Department of Energy, *Use of Performance-Based Incentives at Selected Departmental Sites*, DOE/IG-0510 (Washington, D.C.: July 9, 2001).

Table 1: Comparison of Significant Cost Overruns and Schedule Delays for Ongoing Projects in 2001 with Ongoing Projects in 1996

	Number of projects	
	1996	2001
Number of projects reviewed	25 ^a	16 ^b
Projects with a revised cost estimate more than double the initial cost estimate	7 (28%)	6 (38%)
Projects with schedule delays of 5 years or more	8 (32%)	6 (38%)

Source: DOE and GAO.

^aWe evaluated 34 projects in 1996 with estimated costs greater than \$100 million. However, 9 of the projects were environmental restoration projects, and DOE's original and/or current cost estimates did not estimate costs through project completion. In 1998, DOE divided these environmental restoration projects into multiple projects at each site. Therefore, we excluded these projects from our current analysis.

^bThere are 10 additional projects with total project costs greater than \$200 million, but those projects either have been recently started or have been suspended.

Recent cost and schedule overruns include the following:

- DOE's original 1992 baseline for the Yucca Mountain Site Characterization Project, a high-level waste repository, estimated a total project cost of \$6.3 billion and a completion date for submitting the license application of October 2001. According to the department's latest estimate, the license application will not be submitted until December 2004, with an estimated cost of almost \$8.4 billion. We reported in December 2001 that DOE had stopped using the baseline to manage the program in March 1997 and instead had been using revised estimates that had never been approved and incorporated into the official baseline for the project.¹³ Without developing a baseline cost and schedule estimate and using a formal procedure to approve cost and schedule changes, DOE cannot ensure that the project is being managed effectively.

¹³ U.S. General Accounting Office, *Nuclear Waste: Technical, Schedule, and Cost Uncertainties of the Yucca Mountain Repository Project*, GAO-02-191 (Washington, D.C.: Dec. 21, 2001).

- The Tritium Extraction Facility, which is being built at DOE's Savannah River Site to produce a radioactive isotope crucial to the nation's nuclear weapons program, was originally scheduled for completion by February 2006 at a cost of \$401 million. DOE's Office of Inspector General reported in June 2002 that the total project cost could increase to as much as \$500 million, may not be completed until almost a year later than originally scheduled and may not contain all elements originally specified.¹⁴ The Inspector General found that inadequate project management controls resulted in the lack of a viable baseline for the project. The report added that, as a result, the department lacks assurance that the facility will be available when needed or that project funds are being expended efficiently. Delays in completing the project could adversely affect the overall performance of DOE's Stockpile Stewardship Program.
- The National Ignition Facility will be a stadium-sized laser facility that may, for the first time, simulate in a laboratory the thermonuclear conditions created in nuclear explosions. Our August 2000 report noted that DOE estimates that the facility will cost almost \$3.3 billion and will not be completed until 2008—more than \$1 billion and 6 years later than originally estimated.¹⁵ Despite efforts by the department to make management improvements, when we revisited the National Ignition Facility project in June 2001, we found that DOE oversight problems persisted and that they continued to place the project at risk.

¹⁴ U.S. Department of Energy, *The Department of Energy's Tritium Extraction Facility*, DOE/IG-0560 (Washington, D.C.: June 24, 2002).

¹⁵ U.S. General Accounting Office, *National Ignition Facility: Management and Oversight Failures Caused Major Cost Overruns and Schedule Delays*, [GAO/RCED-00-271](#) (Washington, D.C.: Aug. 8, 2000).

In an effort to improve cost and schedule performance on major projects, DOE began an initiative in 1999 to implement recommendations in a National Research Council review¹⁶ on improving project management. In October 2000, DOE issued a new policy and guidance on managing and controlling projects, and in 2001 it established a project tracking system that required monthly status reporting on all projects with total costs over \$5 million. DOE has also, among other things, improved front-end planning for projects, required baseline validation for every project with a cost over \$5 million, instituted an industry recognized management system for all projects greater than \$20 million, and developed a competency-based career ladder for project managers. These are promising steps, which could help DOE take corrective action on projects in a timely manner. However, improvements may be difficult to achieve. For example, in its November 2001 follow-up assessment, the National Research Council found that change had been inordinately slow, and the Council found no evidence that DOE's project management practice and performance in the field had actually improved.¹⁷

To better ensure the effectiveness of initiatives such as contract reform, we recommended in our September 2002 report that DOE incorporate the best management practices common in high-performing organizations. Such an approach would help ensure that DOE sets clearly defined goals, establishes results-oriented outcome measures, develops results-oriented performance data to evaluate the effectiveness of its initiatives, and takes corrective actions as needed. DOE has agreed to implement this recommendation.

DOE's ability to resolve problems with contract and project management may also be affected by human capital concerns. In past reviews of major DOE projects such as the National Ignition Facility and in our January 2001 report on DOE's major management challenges, we have cited inadequate oversight of contractors' activities as a factor in poor performance on these projects. Furthermore, DOE faces the same human capital challenges that exist governmentwide—an aging workforce whose retirements over the next decade will severely deplete the knowledge and skills required to support DOE's missions. DOE has efforts under way to address skill gaps

¹⁶ National Research Council, *Improving Project Management in the Department of Energy* (Washington, D.C.: June 1999).

¹⁷ National Research Council, *Progress in Improving Project Management at the Department of Energy—2001 Assessment* (Washington, D.C.: November 2001).

in its procurement and project management organizations and to develop the necessary technical and managerial expertise for adequate oversight of its contractors through training and certification programs.

Effective contract and project management are vital for DOE because the department relies heavily on contractors to achieve its national security, research, and environmental cleanup missions. Over the long term, DOE may resolve all of the challenges in its contract management and become a more effective department. Until then, DOE's ongoing challenges in contract management can increase costs and expose the government to billions of dollars in financial risks.

Improve Management for Cleanup of DOE Radioactive and Hazardous Wastes

DOE continues to face challenges in cleaning up the many DOE facilities and sites that were contaminated with radioactive and hazardous wastes during more than 50 years of nuclear weapons research and production.¹⁸ Although DOE has reported completing cleanups at 74 of its 114 sites, some of the most complex and costly cleanup work remains to be done. For example, DOE must develop and implement new technologies to retrieve from aging storage tanks, process, and package millions of gallons of high-level radioactive wastes for long-term storage or disposal. At one site alone this is expected to cost over \$50 billion.

¹⁸ Environmental cleanup includes addressing contaminated soil, groundwater, and surface water, as well as treating and disposing of hazardous and radioactive wastes.

Figure 2: Waste Storage Tank Under Construction at DOE's Hanford Site, September 1947



Source: DOE.

DOE has estimated that the total cost of cleaning up its sites will exceed \$220 billion (an increase of over \$70 billion in just 4 years) and take more than 70 years to complete.¹⁹ However, only about one-third of the environmental management budget is going toward actual cleanup activities and risk-reduction work. The remainder is spent on maintenance, fixed costs, and other activities required to support safety and security.

¹⁹ The most recent estimate of \$220 billion reflects the life-cycle costs of the cleanup program through the year 2070. DOE's Office of Environmental Management is responsible for cleaning up radioactive and hazardous wastes at DOE sites.

In February 2002, recognizing that since the program's inception in 1989 more than \$60 billion has been spent without a corresponding reduction in actual risk, DOE's Assistant Secretary for Environmental Management reported the results of a "top to bottom review" of the environmental management program and its management systems.²⁰ The report concluded that DOE's financial liability under current cleanup plans would continue to grow well beyond the estimated \$220 billion if significant changes to the program were not made. The report also stated that without higher performance standards and breakthrough business processes, cost growth and schedule delays will continue to obstruct cleanup, and the risk to workers, the public, and the environment will not be reduced.

The report recommended a series of initiatives to address the problems identified in the February 2002 review. These include developing an accelerated, risk-based cleanup strategy; improving contract management and establishing more meaningful performance measures for contractors; improving project management; and streamlining business practices. In addition, the report recommended implementing an effective human capital strategy to increase the technical expertise of DOE staff and improve accountability for results. Through these and other initiatives, DOE hopes to rapidly reduce environmental risk to workers and the public, shorten the overall cleanup time frame of 70 years by at least 30 years, and reduce overall cleanup costs by tens of billions of dollars. DOE is in the process of developing the specific steps to carry out these initiatives safely and is now in the process of negotiating with its regulators at various sites to determine the best way to implement the accelerated approach.

DOE's initiatives following the February 2002 review are not DOE's first attempt to develop a risk-based approach to cleanup. In the past, the Congress, GAO, and others have recommended that DOE implement such a risk-based approach, and DOE has made several attempts to do so. However, in our May 2002 report we noted that a 1999 study to evaluate these efforts concluded that none of the attempts had been successful.²¹ Past problems included poor documentation of risks, inconsistent scoring

²⁰ U.S. Department of Energy, *A Review of the Environmental Management Program* (Washington D.C.: Feb. 4, 2002).

²¹ U.S. General Accounting Office, *Waste Cleanup: Status and Implications of DOE's Compliance Agreement*, [GAO-02-567](#) (Washington, D.C.: May 30, 2002); Consortium for Risk Evaluation with Stakeholder Participation, *Peer Review of the U.S. Department of Energy's Use of Risk in Its Prioritization Process*, (New Brunswick, N.J.: Dec. 15, 1999).

of risks between sites, and DOE's failure to integrate any of the risk-based approaches into the decision-making process. We concluded that a major challenge for DOE in successfully implementing its accelerated cleanup initiative is to follow through on its plan to develop and implement a risk-based method to prioritize various cleanup activities. DOE management leadership and resolve are needed to overcome the barriers encountered in past attempts at establishing a risk-based cleanup approach.

Some of the problems with the DOE's environmental management program that were highlighted in the February 2002 review have also been the subject of GAO and DOE's Inspector General reports during the past 2 years. For example, we reported in 2001 that to improve use of cleanup resources, DOE would need to improve project baselines and integrate activities among DOE sites. As we reported in January 2001, DOE has made some progress in establishing project baselines, but has had continuing difficulty integrating waste treatment and disposal activities among its sites. For example, in our February 2001 report on the progress of the closure of the Rocky Flats site, we stated that one of the significant integration challenges was overcoming the limited number of transportation casks available to ship huge quantities of radioactive waste. Integrating waste treatment and disposal, as well as consolidating nuclear materials, has taken on increased importance in the post September 11 environment. DOE plans to improve security by consolidating all special nuclear materials in safeguarded facilities and accelerating disposal of transuranic waste currently stored at numerous sites around the country.

Other examples of challenges the environmental management program faces include managing complex cleanups, developing and deploying new technologies, and developing meaningful performance measures. For example, in 2001, we reported that the scheduled closure of the Rocky Flats site by 2006 was unlikely because of technical concerns, equipment limitations, uncertainty about contamination, and a variety of potential safety issues. To improve the chance of achieving the target closure date and cost, we recommended that DOE clarify the authority for reconciling competing demands on resources and establish a process for reconciling

these competing demands in a timely manner. DOE agreed with and has implemented this recommendation. In May 2001 and January 2002, DOE's Inspector General found that two Ohio sites, Miamisburg and Ashtabula, were not on schedule to meet their established closure dates because the cleanup was more difficult than originally anticipated, and DOE understated both time and cost to complete it.²² In a 2002 report, DOE's Inspector General noted that performance measures for the cleanup program focused more on discrete tasks or accomplishments, such as the number of high-level waste canisters placed in storage, than on the overall progress in site cleanup.²³ As a result, DOE reported that the program was generally successful in meeting its goals even though the cleanup program had experienced substantial cost growth and schedule slippages. The Inspector General concluded that the lack of adequate performance measures deprived the department of a valuable tool that could have helped identify problems resulting in cost growth and schedule slippages. In response to this report, DOE's Assistant Secretary for Environmental Management pledged to require cleanup sites to identify the key performance measures that will capture overall performance. These key performance measures will be included in integrated project baselines that will enable the sites to track cost and schedule progress.

The task of cleaning up DOE's contaminated sites and facilities is a daunting one that has a huge price tag and could take a substantial portion of the 21st century. DOE is in the process of changing its business and contracting processes, as well as rethinking its cleanup approach at many of its sites. In addition, DOE is seeking options that will accelerate risk reduction and reduce the overall cleanup cost. Congressional, regulator, and local community buy-in to new approaches is essential for success. While the environmental management program initiatives are innovative, successful results are not guaranteed. Continued management leadership and focus will be needed to ensure that these initiatives are implemented in a safe and cost-effective manner that provides for the accelerated cleanup of DOE sites.

²² U.S. Department of Energy, *Remediation and Closure of the Miamisburg Environmental Management Project*, DOE/IG-0501 (Washington, D.C.: May 2, 2001) and U.S. Department of Energy, *Remediation and Closure of the Ashtabula Environmental Management Project*, DOE/IG-0541 (Washington, D.C.: Jan. 15, 2002).

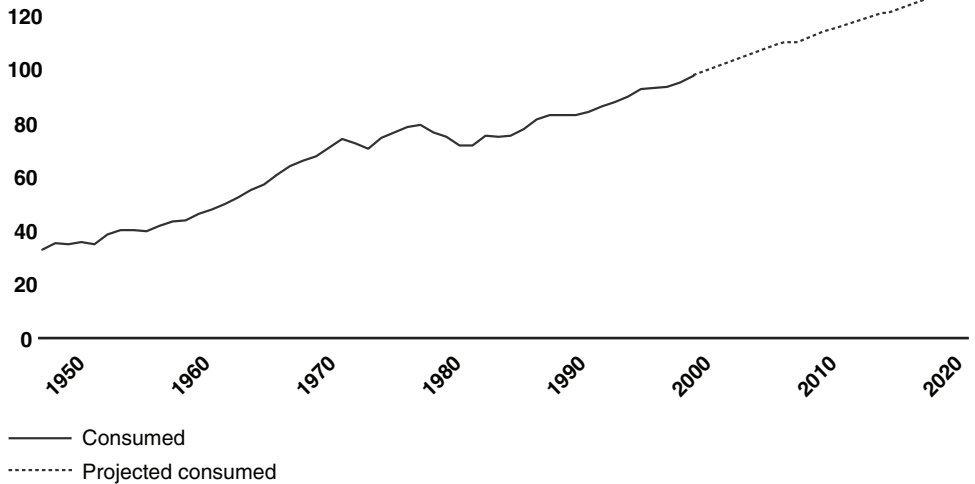
²³ U.S. Department of Energy, *Environmental Management Performance Measures*, DOE/IG-0561 (Washington, D.C.: June 27, 2002).

Enhance DOE Leadership in Meeting the Nation's Energy Needs

Providing leadership in addressing the nation's energy needs represents a major challenge for the department because a stable and reliable energy supply is critical for consumers, the U.S. economy, and our national security. Today, our nation's energy supply system is under stress. Figure 3 shows that total U.S. energy consumption has grown about 180 percent in the last 50 years and is expected to increase another 32 percent between 2000 and 2020.

Figure 3: Total U.S. Energy Consumption 1950 to 2020

140 Quadrillion BTUs



Source: Energy Information Administration.

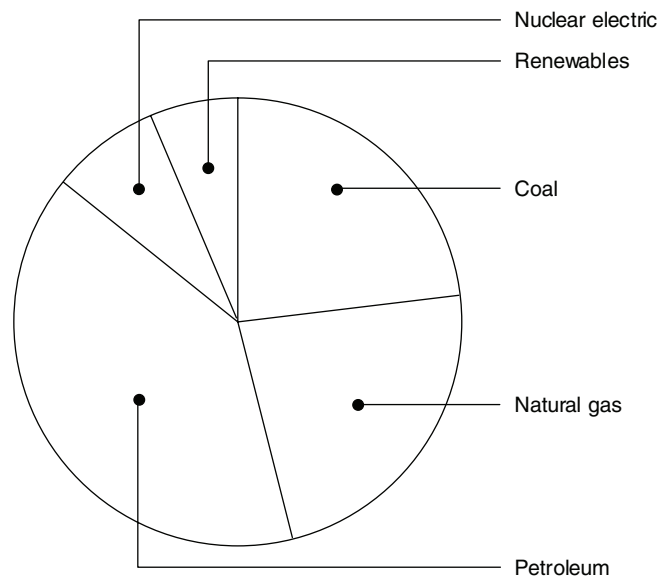
In some energy markets—such as electricity, natural gas, home heating oil, and gasoline—demand has periodically outstripped available and reliable supply. For example, in several western states unmet electrical demand led to price increases and rolling blackouts. Moreover, the security of oil supplies to meet the nation's ever increasing needs is at risk. More than 50 percent of U.S. petroleum is imported, much of it from the volatile Persian Gulf region where conflicts underscore the ease with which supplies can be disrupted. More recently, these traditional energy supply issues have been compounded by another threat—the vulnerability of the nation's domestic energy infrastructure to terrorist attacks. The large-scale infrastructure for oil, gas, and electricity systems makes them difficult and expensive to

protect. This concern has resonated after September 11, adding another dimension to the challenge of providing reliable energy supplies.

DOE is in a unique position to help ensure that the nation's energy needs are met. First, because DOE is the federal agency responsible for energy policy its leadership and direction will influence other federal agencies and state and local activities, as well as the energy industry. DOE's role is important because the U.S. government is the nation's single largest energy user. Second, DOE plays a vital role in linking federal government research and development and other government efforts with the energy industry in the United States. This link helps ensure that industry produces adequate energy supplies that are reliable, safe, affordable, diverse, innovative, and environmentally friendly. While DOE is in a unique position, it cannot solve the problem alone. This is because DOE does not control the economics or environmental policies that can affect the marketplace.

In the past, DOE has undertaken numerous efforts to address energy supply problems for all sources of energy. The nation's current sources of energy to meet consumption in 2001 are shown in figure 4.

Figure 4: U.S. Energy Consumption by Source, Fiscal Year 2001



Source: Energy Information Administration.

In the future, DOE intends to play a major role in fostering U.S. energy supplies by, among other things, helping to develop a competitive electricity generation system, reducing the vulnerability of the U.S. economy to potential disruptions in petroleum supply (e.g., by fully developing the Strategic Petroleum Reserve), researching clean coal and other fossil and renewable energy technologies to transition away from petroleum, and making sure that the energy infrastructure serves the needs of the public. DOE budgeted about \$2.3 billion in 2002 to address this issue, and nearly one-third of all the department's general performance goals relate to "energy resources."²⁴ In testifying on DOE's fiscal year 2003 budget, Secretary Abraham stated that after September 11 our nation's energy security is national security. Furthermore, he laid out new priorities for the department—centered on an overarching mission of national security—and proposed the largest budget in the department's history.

Over the past several years, in briefings, testimonies, and reports, GAO has addressed a number of issues related to the energy supply challenge. Much of this work points out ways for DOE to better meet its goals and more effectively focus its budgetary resources on developing technologies that are competitive in the marketplace. For example, in testimony on the department's attempts to reduce the consumption of petroleum in the transportation sector, we pointed out that DOE's recent involvement in a \$1.2 billion multiyear partnership with the automotive industry would not develop a cost-competitive vehicle that consumers would buy.²⁵ In another instance, while DOE's research and development efforts were focused at developing large-scale wind turbines to produce electricity, we found that other companies elsewhere in the marketplace had already fielded similar turbines.

DOE has a history of achieving technical progress in the energy area. However, many times it does not study the energy marketplace to ensure that the results of its efforts ultimately address the energy supply challenge. Given the department's large budgetary outlays for research and development, the importance of a reliable energy supply to the quality of

²⁴ In general, the energy resources area promotes the development and deployment of energy systems and practices that will provide current and future generations with energy that is clean, reasonably priced, and reliable.

²⁵ U.S. General Accounting Office, *Research and Development: Lessons Learned from Previous Research Could Benefit Freedom Car Initiative*, [GAO-02-810T](#) (Washington, D.C.: June 6, 2002).

life, and the complex and evolving marketplace in which DOE must work, this challenge will require enhanced management attention and monitoring.

Revitalize DOE's Infrastructure

DOE faces a major challenge in making the right investments to ensure that it has world-class research and development facilities for supporting its national security, science, environmental, and energy missions. The department's physical infrastructure includes more than 50 major facilities in 35 states, encompassing thousands of structures. Many of these facilities are in poor condition, and others are reaching the end of their design life. For example, DOE's national laboratories were built during World War II and the early Cold War. Over 60 percent of the laboratory space is more than 30 years old, and 35 percent is more than 40 years old. DOE has begun to receive funding from the Congress to improve its infrastructure, and its offices are developing plans for improvements. The cost of upgrading DOE's infrastructure will exceed several billion dollars. DOE's challenge will be to spend this money effectively and efficiently, in a way that is consistent with its most important missions.

DOE's infrastructure problems and their effect on operations are well known. For example, DOE noted in its 2000 Strategic Plan that the poor condition of its facilities adversely impacts the safety, cost, and continuity of research activities and hurts laboratories' ability to attract and retain highly qualified scientists to work on important mission needs.²⁶ DOE's Inspector General has also reported on the poor condition of the department's infrastructure, noting that conditions are deteriorating at an "alarming pace." Facilities in poor condition are costly to maintain and difficult to keep in regulatory compliance. In a September 2000 report, the Inspector General said that the deteriorating conditions are causing some Nuclear Weapons Stockpile Stewardship milestones and goals to slip, restoration costs to increase, and future nuclear weapons production work to be at risk.²⁷

²⁶ U.S. Department of Energy, *Strategic Plan*, DOE/CR-0070 (Washington, D.C.: September 2000).

²⁷ U.S. Department of Energy, *Management of the Nuclear Weapons Production Infrastructure*, DOE/IG-0484 (Washington, D.C.: September 2000).

Many factors contribute to DOE's infrastructure deficiencies, including deferred maintenance. For example, the Inspector General's September 2000 report also noted that the department has deferred substantial maintenance and upgrades on its nuclear weapons production facilities. Table 2 shows the total amount of building maintenance that DOE has deferred as of September 2002.

Table 2: Number of DOE Buildings and Estimated Deferred Maintenance as of September 2002

Program Office	Number of Buildings	Average Age of Buildings	Deferred Maintenance (in thousands)
Environmental Management	3,176	29	\$411,145
Fossil Energy	430	16	479
National Nuclear Security Administration	4,101	33	782,562
Nuclear Energy	293	30	8,771
Power Administrations	663	28	133
Science	1,740	32	580,668
Other	304	34	9,758
Total	10,707	31	\$1,793,515

Source: DOE and GAO.

The Inspector General also pointed out that DOE had not implemented a process to fully link workload, production capacity, and budget data to nuclear weapons production facility requirements, placing at risk current and future goals of the Stockpile Stewardship Program. Other factors contributing to infrastructure deficiencies have been pointed out by DOE's Office of Science, which reports that its unfunded backlog of capital investment projections and deferred maintenance are due to aging of the laboratories, changing technology and mission activities, and insufficient capital investment and maintenance spending in the past. For example, the department allocates about 0.7 percent of replacement plant value for maintenance of the science laboratories, as compared with 1.5 percent to 3 percent for industry and academia and as suggested in guidelines from the National Research Council for federal facilities.²⁸ The Office of Science's

²⁸ U.S. Department of Energy, *Infrastructure Frontier: A Quick Look Survey of the Office of Science Laboratory Infrastructure* (Washington, D.C.: April 2001).

April 2001 report on laboratory infrastructure noted that inadequate maintenance could lead to scientific mission failure, occupational health and safety risks, lost productivity, and expensive emergency repairs.

DOE's deteriorating infrastructure threatens mission accomplishment and will require substantial funding to ameliorate. DOE's Inspector General reports that DOE and Department of Defense officials estimated that \$5 billion to \$8 billion over current budgeted amounts will need to be invested over the next 10 years to offset the effects of delayed or neglected infrastructure activities in the nuclear weapons complex.²⁹ For science laboratories, DOE estimates that over \$300 million in deferred maintenance has been cataloged.

DOE recognizes the critical problems caused by the crumbling infrastructure and is making changes. The department has various infrastructure improvement initiatives underway, has pledged to improve internal processes for identifying needs and linking budgets to infrastructure requirements, and has made infrastructure needs a special management focus. For example, in fiscal year 2001, NNSA obtained new, increased, and direct appropriations to initiate a Facilities and Infrastructure Recapitalization Program to address an integrated, complex-wide priority list of maintenance and infrastructure investment activities above the current base operating levels supported by the much larger Readiness and Technical Base and Facilities Program (which is nearly 25 percent of NNSA's budget). Funding is anticipated to be \$200 million to \$500 million a year for the next 10 years. DOE's Office of Science obtained \$10 million in fiscal year 2002 for a new Facilities and Infrastructure Program to eliminate and clean up excess space. However, the seriousness of the infrastructure deficiencies, combined with competing needs from existing and emerging missions such as homeland security and historical weaknesses in project management, make implementing plans for infrastructure revitalization a management challenge for the department.

²⁹ U.S. Department of Energy, *Management of the Nuclear Weapons Production Infrastructure*, DOE/IG-0484 (Washington, D.C.: September 2000).

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Subject(s) covered in this report	Contact person
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Improve Management for Cleanup of DOE Radioactive and Hazardous Wastes	
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