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NUCLEAR REGULATORY COMMISSION

Challenges Facing NRC in Effectively Carrying Out Its Mission

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Highlights of [GAO-05-754T](#), a testimony before the Subcommittee on Clean Air, Climate Change, and Nuclear Safety, Committee on Environment and Public Works, U.S. Senate

Why GAO Did This Study

The Nuclear Regulatory Commission (NRC) has the regulatory responsibility to, among other things, ensure that the nation's 103 commercial nuclear power plants are operated in a safe and secure manner. While the nuclear power industry's overall safety record has been good, safety issues periodically arise that threaten the credibility of NRC's regulation and oversight of the industry.

Recent events make the importance of NRC's regulatory and oversight responsibilities readily apparent. The terrorist attacks on September 11, 2001, focused attention on the security of facilities such as commercial nuclear power plants, while safety concerns were heightened by shutdown of the Davis-Besse nuclear power plant in Ohio in 2002, and the discovery of missing or unaccounted for spent nuclear fuel at three nuclear power plants.

GAO has issued a total of 15 recent reports and testimonies on a wide range of NRC activities. This testimony (1) summarizes GAO's findings and associated recommendations for improving NRC mission-related activities and (2) presents several cross-cutting challenges NRC faces in being an effective and credible regulator of the nuclear power industry.

www.gao.gov/cgi-bin/getrpt?GAO-05-754T.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Jim Wells at (202) 512-3841 or wellsj@gao.gov.

NUCLEAR REGULATORY COMMISSION

Challenges Facing NRC in Effectively Carrying Out Its Mission

What GAO Found

GAO has documented many positive steps taken by NRC to advance the security and safety of the nation's nuclear power plants. It has also identified various actions that NRC needs to take to better carry out its mission. First, with respect to its security mission, GAO found that NRC needs to improve security measures for sealed sources of radioactive materials — radioactive material encapsulated in stainless steel or other metal used in medicine, industry, and research—which could be used to make a “dirty bomb.” GAO also found that, although NRC was taking numerous actions to require nuclear power plants to enhance security, NRC needed to strengthen its oversight of security at the plants. Second, with respect to its public health and safety, and environmental missions, GAO found that NRC needs to conduct more effective analyses of plant owners' funding for decommissioning to ensure that the significant volume of radioactive waste remaining after the permanent closure of a plant are properly disposed. Further, NRC needs to more aggressively and comprehensively resolve issues that led to the shutdown of the Davis-Besse nuclear power plant by improving its oversight of plant safety conditions. Finally, NRC needs to do more to ensure that power plants are effectively controlling spent nuclear fuel, including developing and implementing appropriate inspection procedures.

GAO has identified several cross-cutting challenges affecting NRC's ability to effectively and credibly regulate the nuclear power industry. Recently, NRC has taken two overarching approaches to its regulatory and oversight responsibilities. These approaches are to (1) develop and implement a risk-informed regulatory strategy that targets the most important safety-related activities and (2) strike a balance between verifying plants' compliance with requirements through inspections and affording licensees the opportunity to demonstrate that they are operating their plants safely. NRC must overcome significant obstacles to fully implement its risk-informed regulatory strategy across agency operations, especially with regards to developing the ability to identify emerging technical issues and adjust regulatory requirements before safety problems develop. NRC also faces inherent challenges in achieving the appropriate balance between more direct oversight and industry self-compliance. Incidents such as the 2002 shutdown of the Davis-Besse plant and the unaccounted for spent nuclear fuel at several plants raise questions about whether NRC has the risk information that it needs and whether it is appropriately balancing agency involvement and licensee self-monitoring. Finally, GAO believes that NRC will face challenges managing its resources while meeting increasing regulatory and oversight demands. NRC's resources have already been stretched by the extensive effort to enhance security at plants in the wake of the September 11, 2001, terrorist attacks. Pressure on NRC's resources will continue as the nation's fleet of plants age and the industry's interest in expansion grows, both in licensing and constructing new plants, and re-licensing and increasing the power output of existing ones.

Mr. Chairman and Members of the Subcommittee:

I am pleased to be here today to participate in the Subcommittee's oversight hearing on the Nuclear Regulatory Commission (NRC). NRC has the regulatory responsibility to ensure that the nation's 103 operating commercial nuclear power plants are operated in a safe and secure manner. These plants provide about 20 percent of the country's electricity, but safety of their operations is paramount, given the potentially devastating effects of a nuclear accident. While the nuclear power industry's overall safety record has been good, safety issues periodically arise that raise questions about NRC's regulation and oversight of the industry and challenge its credibility for guaranteeing the safety of the nation's aging fleet of nuclear power plants. NRC plays an important role in protecting public health and the environment through its regulation of the nuclear power industry and other civilian use of nuclear material, and we commend the Subcommittee for holding this hearing.

NRC was formed in 1975, to regulate the various commercial and institutional uses of nuclear energy, including nuclear power plants. NRC's mission is to regulate the nation's civilian use of nuclear material to ensure adequate protection of public health and safety, to promote the common defense and security, and to protect the environment. NRC's activities include, among other things, licensing nuclear reactors (including license transfers and operating experience evaluation), reviewing plant safety procedures, imposing enforcement sanctions for violations of NRC requirements, and participating in homeland security efforts (including threat assessment, emergency response, mitigating strategies, security inspections, and force-on-force exercises). NRC also has regulatory oversight for the decommissioning of nuclear reactors, including accumulating sufficient funds to carry out decommissioning, and for the interim storage of spent nuclear fuel — the used fuel periodically removed from reactors in nuclear power plants.

The importance of NRC's regulatory and oversight responsibilities is made readily apparent by recent events. The terrorist attacks on September 11, 2001, and the subsequent discovery of nuclear power plants on a list of possible terrorist targets have focused attention on the security of the nation's commercial nuclear power plants. Safety concerns were heightened by the discovery of a pineapple-sized cavity in the carbon steel reactor vessel head, and subsequent 2-year shutdown, of the Davis-Besse nuclear power plant in Ohio in 2002. Additional safety concerns were raised by the discovery of missing or unaccounted for spent nuclear fuel at three nuclear power plants. Further, the decommissioning of some of the

nations' aging nuclear power plants raises the issue of whether NRC is ensuring that plant owners are accumulating sufficient funds for decommissioning plants in a way that best protects public health, safety, and the environment.

Over the past 2 years, we have issued a total of 15 reports and testimonies on a wide range of NRC activities. (These reports are listed in Appendix I). While our work has primarily focused on identifying ways that NRC can strengthen its regulation and oversight of the nuclear power industry, we have documented a number of productive steps NRC has taken to improve its mission-related activities. One example is the substantial effort that NRC has made in working with the industry to enhance security at nuclear power plants since the September 11, 2001, terrorist attacks. Another example is NRC's considerable effort to analyze what went wrong at the Davis-Besse plant in 2002, and to incorporate the lessons learned into its processes. Today, my testimony will briefly summarize our recently completed NRC work. Specifically, this testimony (1) summarizes GAO's findings and associated recommendations for improving NRC mission-related activities and (2) provides some observations on cross-cutting challenges that NRC faces in being an effective and credible regulator of the nuclear power industry.

This testimony is based on seven of our recently issued reports. The other eight reports either address issues for which NRC is not the primary federal agency – such as radioactive waste disposal and nuclear nonproliferation — or concern internal NRC administrative matters — such as fee recovery and information technology management. We did not perform additional audit work in preparing this testimony. The work for our previously issued reports was conducted in accordance with generally accepted government auditing standards.

Summary

While NRC has improved its operations in a number of ways in recent years, GAO believes that the agency needs to take a number of additional actions to better fulfill its mission of ensuring that the nation's nuclear power plants and other civilian users of nuclear material operate in a safe and secure manner. First, operations related to NRC's security mission need to be improved. Specifically, we found that NRC has not developed adequate security measures for sealed sources of radioactive materials — radioactive material encapsulated in stainless steel or other metal used in medicine, industry, and research — which could be used to make a “dirty bomb.” We also found that despite taking numerous actions to respond to the heightened risks of a terrorist attack, NRC's oversight of physical

security at the nation's commercial nuclear power plants could be strengthened. Second, operations related to NRC's public health and safety, and environmental missions need to be improved. Specifically, we found that NRC's analyses of plant owners' contributions of funds for the decommissioning of nuclear power plants, and its processes for acting on reports that show insufficient funds, do not ensure that the significant radioactive waste hazards that exist following the permanent closure of a nuclear power plant will be properly addressed. Further, we found that the issues surrounding the shutdown of the Davis-Besse power plant reveal important weaknesses in NRC's oversight of the safety of nuclear power plant operations. Finally, we found that NRC has not taken adequate steps to ensure that power plants are effectively controlling spent nuclear fuel, including developing and implementing appropriate inspection procedures to verify plants' compliance with NRC requirements.

NRC faces several cross-cutting challenges in being an effective and credible regulator of the nuclear power industry. In response to the agency's limited resources and its desire to reduce the regulatory burden and cost on plants, NRC is taking two overarching approaches to meeting its regulatory and oversight responsibilities: (1) developing and implementing a risk-informed regulatory strategy that targets industry's most important safety-related or safety-significant activities, and (2) striking a balance between verifying plants' compliance with requirements through inspections and affording licensees the opportunity to demonstrate that they are operating their plants safely. We believe that NRC must overcome significant obstacles in implementing its risk-informed regulatory strategy across the agency, especially with regards to developing the ability to identify emerging technical issues and adjust regulatory requirements before safety problems develop. We also believe that NRC faces inherent challenges in balancing oversight and industry self-compliance, especially with regards to positioning the agency so it is able to identify diminishing performance at individual plants before they become a problem. Incidents such as the 2002 shutdown of the Davis-Besse plant and the unaccounted for spent nuclear fuel at several plants raise questions about whether NRC has the risk information that it needs and whether it is appropriately balancing agency involvement and licensee self-monitoring. Finally, we believe that NRC will face challenges managing its resources while meeting increasing regulatory and oversight demands. NRC's resources have already been stretched by the extensive effort to enhance security at plants in the wake of the September 11, 2001, terrorist attacks. Pressure on NRC's resources will continue as the nation's fleet of plants age and the industry's interest in expansion grows, both in

licensing and constructing new plants, and re-licensing and increasing the power output of existing ones.

Regulatory and Oversight Functions Vital to NRC's Mission Need to be Improved

Our recent analyses of NRC programs identified several areas where NRC needs to take action to better fulfill its mission and made associated recommendations for improvement. With respect to NRC's security mission, we found that the security of sealed radioactive sources and the physical security at nuclear power plants need to be strengthened. With respect to its public health and safety, and environmental missions, we found several shortcomings that need to be addressed. NRC's analyses of plant owners' contributions could be improved to better ensure that adequate funds are accumulating for the decommissioning of nuclear power plants. By contrast, we found that NRC is ensuring that requirements for liability insurance for nuclear power plants owned by limited liability companies are being met. Further, to ensure the safety of nuclear power plants NRC must more aggressively and comprehensively resolve oversight issues related to the shutdown of the Davis-Besse plant. Finally, NRC's methods of ensuring that power plants are effectively controlling spent nuclear fuel need to be improved.

Operations Related to NRC's Security Mission Could Be Improved

In August 2003, we reported on federal and state actions needed to improve security of sealed radioactive sources.¹ Sealed radioactive sources, radioactive material encapsulated in stainless steel or other metal, are used worldwide in medicine, industry, and research. These sealed sources could be a threat to national security because terrorists could use them to make "dirty bombs." We were asked among other things to determine the number of sealed sources in the United States. We found that the number of sealed sources in use today in the United States is unknown primarily because no state or federal agency tracks individual sealed sources. Instead, NRC and the agreement states² track numbers of specific licensees. NRC and the Department of Energy (DOE) have begun to examine options for developing a national tracking system, but to date,

¹GAO: *Nuclear Security Federal and State Action Needed to Improve Security of Sealed Radioactive Sources*, GAO-03-804 Washington, D.C.: Aug. 6, 2003.

²Agreement states are the 33 states that have entered into an agreement with the NRC under subsection 274(b) of the Atomic Energy Act (AEA) under which NRC relinquishes to the states portions of its regulatory authority to license and regulate source, byproduct, and certain quantities of special nuclear material.

this effort has had limited involvement by the agreement states. NRC had difficulty locating owners of certain generally licensed devices it began tracking in April 2001, and has hired a private investigation firm to help locate them. Twenty-five of the 31 agreement states that responded to our survey indicated that they track some or all general licensees or generally licensed devices, and 17 were able to provide data on the number of generally licensed devices in their jurisdictions, totaling approximately 17,000 devices. GAO recommended that NRC (1) collaborate with states to determine the availability of the highest risk sealed sources, (2) determine if owners of certain devices should apply for licenses, (3) modify NRC's licensing process so sealed sources cannot be purchased until NRC verifies their intended use, (4) ensure that NRC's evaluation of federal and state programs assesses the security of sealed sources, and (5) determine how states can participate in implementing additional security measures. NRC disagreed with some of our findings.

In September 2003, we reported that NRC's oversight of security at commercial nuclear power plants needed to be strengthened.³ The September 11, 2001, terrorist attacks intensified the nation's focus on national preparedness and homeland security. Among possible terrorist targets are the nation's nuclear power plants which contain radioactive fuel and waste. NRC oversees plant security through an inspection program designed to verify the plants' compliance with security requirements. As part of that program, NRC conducted annual security inspections of plants and force-on-force exercises to test plant security against a simulated terrorist attack. GAO was asked to review (1) the effectiveness of NRC's security inspection program and (2) legal challenges affecting power plant security. At the time of our review, NRC was reevaluating its inspection program. We did not assess the adequacy of security at the individual plants; rather, our focus was on NRC's oversight and regulation of plant security.

We found that NRC had taken numerous actions to respond to the heightened risk of terrorist attack, including interacting with the Department of Homeland Security and issuing orders designed to increase security and improve defensive barriers at plants. However, three aspects of NRC's security inspection program reduced the agency's effectiveness in overseeing security at commercial nuclear power plants. First, NRC

³GAO: *Nuclear Regulatory Commission: Oversight of Security at Commercial Nuclear Power Plants Needs to Be Strengthened*, GAO-03-752 (Washington, D.C.: Sept. 4, 2003).

inspectors often used a process that minimized the significance of security problems found in annual inspections by classifying them as “non-cited violations” if the problem had not been identified frequently in the past or if the problem had no direct, immediate, adverse consequences at the time it was identified. Non-cited violations do not require a written response from the licensee and do not require NRC inspectors to verify that the problem has been corrected. For example, guards at one plant failed to physically search several individuals for metal objects after a walk-through detector and a hand-held scanner detected metal objects in their clothing. These individuals were then allowed unescorted access throughout the plant’s protected area. By extensively using non-cited violations for serious problems, NRC may overstate the level of security at a power plant and reduce the likelihood that needed improvements are made. Second, NRC did not have a routine, centralized process for collecting, analyzing, and disseminating security inspections data to identify problems that may be common to plants or to provide lessons learned in resolving security problems. Such a mechanism may help plants improve their security. Third, although NRC’s force-on-force exercises can demonstrate how well a nuclear plant might defend against a real-life threat, several weaknesses in how NRC conducted these exercises limited their usefulness. Weaknesses included (1) using more personnel to defend the plant during these exercises than during normal operations, (2) using attacking forces that are not trained in terrorist tactics, and (3) using unrealistic weapons (rubber guns) that do not simulate actual gunfire. Furthermore, at the time, NRC has made only limited use of some available improvements that would make force-on-force exercises more realistic and provide a more useful learning experience.

Finally, we also found that even if NRC strengthens its inspection program, commercial nuclear power plants face legal challenges in ensuring plant security. First, federal law generally prohibits guards at these plants from using automatic weapons, although terrorists are likely to have them. As a result, guards at commercial nuclear power plants could be at a disadvantage in firepower, if attacked. Second, state laws regarding the permissible use of deadly force and the authority to arrest and detain intruders vary, and guards were unsure about the extent of their authorities and may hesitate or fail to act if the plant is attacked. GAO made recommendations to promptly restore annual security inspections and revise force-on-force exercises. NRC disagreed with many of GAO’s findings, but did not comment on GAO’s recommendations.

In September 2004, we testified on our preliminary observations regarding NRC's efforts to improve security at nuclear power plants.⁴ The events of September 11, 2001, and the subsequent discovery of commercial nuclear power plants on a list of possible terrorist targets have focused considerable attention on plants' capabilities to defend against a terrorist attack. NRC is responsible for regulating and overseeing security at commercial nuclear power plants. We were asked to review (1) NRC's efforts since September 11, 2001, to improve security at nuclear power plants, including actions NRC had taken to implement some of GAO's September 2003 recommendations to improve security oversight, and (2) the extent to which NRC is in a position to assure itself and the public that the plants are protected against terrorist attacks. The testimony reflected the preliminary results of GAO's review. We are currently performing a more comprehensive review in which we are examining (1) NRC's development of its 2003 design basis threat (DBT), which establishes the maximum terrorist threat that commercial nuclear power plants must defend against, and (2) the security enhancements that plants have put in place in response to the design basis threat and related NRC requirements. We expect to issue a report on our findings later this year.

In the earlier work, we found that NRC responded quickly and decisively to the September 11, 2001, terrorist attacks with multiple steps to enhance security at commercial nuclear power plants. NRC immediately advised plants to go to the highest level of security using the system in place at the time, and issued advisories and orders for plants to make certain enhancements, such as installing more physical barriers and augmenting security forces, which could be quickly completed to shore up security. According to NRC officials, their inspections found that plants complied with these advisories and orders. Later, in April 2003, NRC issued a new DBT and required the plants to develop and implement new security plans to address the new threat by October 2004. NRC is also improving its force-on-force exercises, as GAO recommended in its September 2003 report. While its efforts had enhanced security, NRC was not yet in a position to provide an independent determination that each plant has taken reasonable and appropriate steps to protect against the new DBT. According to NRC officials, the facilities' new security plans were on schedule to be implemented by October 2004. However, NRC's review of the plans, which are not available to the general public for security

⁴GAO, *Nuclear Regulatory Commission: Preliminary Observations on Efforts to Improve Security at Nuclear Power Plants*, [GAO-04-1064T](#) (Washington, D.C.: Sept. 14, 2004).

reasons, had primarily been a paper review and was not detailed enough for NRC to determine if the plans would protect the facility against the threat presented in the DBT. In addition, NRC officials generally were not visiting the facilities to obtain site-specific information and assess the plans in terms of each facility's design. NRC is largely relying on the force-on-force exercises it conducts to test the plans, but these exercises will not be conducted at all facilities for 3 years. We also found that NRC did not plan to make some improvements in its inspection program that GAO previously recommended. For example, NRC was not following up to verify that all violations of security requirements had been corrected, nor was the agency taking steps to make "lessons learned" from inspections available to other NRC regional offices and nuclear power plants.

Operations Related to NRC's Public Health and Safety and Environmental Missions Can Be Improved

In October 2003, we reported that NRC needs to more effectively analyze whether nuclear power plant owners are adequately accumulating funds for decommissioning plants.⁵ Following the closure of a nuclear power plant, a significant radioactive waste hazard remains until the waste is removed and the plant site is decommissioned. In 1988, NRC began requiring owners to (1) certify that sufficient financial resources would be available when needed to decommission their nuclear power plants and (2) require them to make specific financial provisions for decommissioning. In 1999, GAO reported that the combined value of the owners' decommissioning funds was insufficient to ensure enough funds would be available for decommissioning. GAO was asked to update its 1999 report, and to evaluate NRC's analysis of the owners' funds and the agency's process for acting on reports that show insufficient funds.

We found that although the collective status of the owners' decommissioning fund accounts has improved considerably since GAO's last report, some individual owners were not on track to accumulate sufficient funds for decommissioning. Based on our analysis and using the most likely economic assumptions, we concluded that the combined value of nuclear power plant owners' decommissioning fund accounts in 2000—about \$26.9 billion—was about 47 percent greater than needed at that point to ensure that sufficient funds would be available to cover the approximately \$33 billion in estimated decommissioning costs when the

⁵GAO: *Nuclear Regulation: NRC Needs More Effective Analysis to Ensure Accumulation of Funds to Decommission Nuclear Power Plants*, [GAO-04-32](#) (Washington, D.C.: Oct. 30, 2003).

plants are permanently closed. This value contrasts with GAO's prior finding that 1997 account balances were collectively 3 percent below what was needed. However, overall industry results can be misleading. Because funds are generally not transferable from funds that have more than sufficient reserves to those with insufficient reserves, each individual owner must ensure that enough funds are available for decommissioning their particular plants. We found that 33 owners with ownership interests in a total of 42 plants had accumulated fewer funds than needed through 2000, to be on track to pay for eventual decommissioning. In addition, 20 owners with ownership interests in a total of 31 plants recently contributed less to their trust funds than we estimated they needed in order to put them on track to meet their decommissioning obligations.

NRC's analysis of the owners' 2001 biennial reports was not effective in identifying owners that might not be accumulating sufficient funds to cover their eventual decommissioning costs. In reviewing the 2001 reports, NRC reported that all owners appeared to be on track to have sufficient funds for decommissioning. In reaching this conclusion, NRC relied on the owners' future plans for fully funding their decommissioning obligations. However, based on the owners' actual recent contributions, and using a different method, GAO found that several owners could be at risk of not meeting their financial obligations for decommissioning when these plants stop operating. In addition, for plants with more than one owner, NRC did not separately assess the status of each co-owner's trust funds against each co-owner's contractual obligation to fund decommissioning. Instead, NRC assessed whether the combined value of the trust funds for the plant as a whole were reasonable. Such an assessment for determining whether owners are accumulating sufficient funds can produce misleading results because owners with more than sufficient funds can appear to balance out owners with less than sufficient funds, even though funds are generally not transferable among owners. Furthermore, we found that NRC had not established criteria for taking action when it determines that an owner is not accumulating sufficient decommissioning funds.

We recommended that NRC (1) develop an effective method for determining whether owners are accumulating decommissioning funds at sufficient rates and (2) establish criteria for taking action when it is determined that an owner is not accumulating sufficient funds. NRC disagreed with these recommendations, suggesting that its method is effective and that it is better to deal with unacceptable levels of financial assurance on a case-by-case basis. GAO continues to believe that limitations in NRC's method reduce its effectiveness and that, without

criteria, NRC might not be able to ensure owners are accumulating decommissioning funds at sufficient rates.

In May 2004, we issued a report on NRC's liability insurance requirements for nuclear power plants owned by limited liability companies.⁶ An accident at one of the nation's commercial nuclear power plants could result in personal injury and property damage. To ensure that funds would be available to settle liability claims in such cases, the Price-Anderson Act requires licensees of these plants to have primary insurance—currently \$300 million per site. The act also requires secondary coverage in the form of retrospective premiums to be contributed by all licensees of nuclear power plants to cover claims that exceed primary insurance. If these premiums are needed, each licensee's payments are limited to \$10 million per year and \$95.8 million in total for each of its plants. In recent years, limited liability companies have increasingly become licensees of nuclear power plants, raising concerns about whether these companies—which shield their parent corporations' assets—will have the financial resources to pay their retrospective premiums. We were asked to determine (1) the extent to which limited liability companies are the licensees for U.S. commercial nuclear power plants, (2) NRC's requirements and procedures for ensuring that licensees of nuclear power plants comply with the Price-Anderson Act's liability requirements, and (3) whether and how these procedures differ for licensees that are limited liability companies.

We found that of the 103 operating nuclear power plants, 31 were owned by 11 limited liability companies. Three energy corporations—Exelon, Entergy, and the Constellation Energy Group—were the parent companies for eight of these limited liability companies. These 8 subsidiaries were the licensees or co-licensees for 27 of the 31 plants. We also found that NRC requires all licensees for nuclear power plants to show proof that they have the primary and secondary insurance coverage mandated by the Price-Anderson Act. Licensees sign an agreement with NRC that requires the licensee to keep the insurance in effect. American Nuclear Insurers also has a contractual agreement with each of the licensees that obligates the licensee to pay the retrospective premiums to American Nuclear Insurers if these payments become necessary. A certified copy of this agreement, which is called a bond for payment of retrospective premiums,

⁶GAO, *Nuclear Regulation: NRC's Liability Insurance Requirements for Nuclear Power Plants Owned by Limited Liability Companies*, [GAO-04-654](#) (Washington, D.C.: May 28, 2004).

is provided to NRC as proof of secondary insurance. Finally, we found that NRC does not treat limited liability companies differently than other licensees with respect to the Price-Anderson Act's insurance requirements. Like other licensees, limited liability companies must show proof of both primary and secondary insurance coverage. American Nuclear Insurers also requires limited liability companies to provide a letter of guarantee from their parent or other affiliated companies with sufficient assets to pay the retrospective premiums. These letters state that the parent or affiliated companies are responsible for paying the retrospective premiums if the limited liability company does not. American Nuclear Insurers informs NRC that it has received these letters.

In May 2004, we also issued a report documenting the need for NRC to more aggressively and comprehensively resolve issues related to the shutdown of the Davis-Besse nuclear power plant.⁷ The most serious safety issue confronting the nation's commercial nuclear power industry since Three Mile Island in 1979, was identified at the Davis-Besse plant in Ohio in March of 2002. After NRC allowed Davis-Besse to delay shutting down to inspect its reactor vessel for cracked tubing, the plant found that leakage from these tubes had caused extensive corrosion on the vessel head—a vital barrier in preventing a radioactive release. GAO determined (1) why NRC did not identify and prevent the corrosion, (2) whether the process NRC used in deciding to delay the shutdown was credible, and (3) whether NRC is taking sufficient action in the wake of the incident to prevent similar problems from developing at other plants.

We found that NRC should have, but did not identify or prevent the corrosion at Davis-Besse because agency oversight did not produce accurate information on plant conditions. NRC inspectors were aware of indications of leaking tubes and corrosion; however, the inspectors did not recognize the importance of the indications and did not fully communicate information about them to other NRC staff. NRC also considered FirstEnergy—Davis-Besse's owner—a good performer, which resulted in fewer NRC inspections and questions about plant conditions. NRC was aware of the potential for cracked tubes and corrosion at plants like Davis-Besse but did not view them as an immediate concern. Thus, despite being aware of the development of potential problems, NRC did not modify its

⁷GAO, *Nuclear Regulation: NRC Needs to More Aggressively and Comprehensively Resolve Issues Related to the Davis-Besse Nuclear Power Plant's Shutdown*, [GAO-04-415](#) (Washington, D.C.: May 17, 2004).

inspection activities to identify such conditions. Additionally, NRC's process for deciding to allow Davis-Besse to delay its shutdown lacked credibility. Because NRC had no guidance for making the specific decision of whether a plant should shut down, it instead used guidance for deciding whether a plant should be allowed to modify its operating license. However, NRC did not always follow this guidance and generally did not document how it applied the guidance. Furthermore, the risk estimate NRC used to help decide whether the plant should shut down was also flawed and underestimated the risk that Davis-Besse posed. Finally, even though it underestimated the risk posed by Davis-Besse, the risk estimate applied to the plant still exceeded levels generally accepted by the agency. Nevertheless, Davis-Besse was allowed to delay the plant's shutdown.

After this incident, NRC took several significant actions to help prevent reactor vessel corrosion from recurring at nuclear power plants. For example, NRC has required more extensive vessel examinations and augmented inspector training. I would also like to note that, in April 2005, NRC proposed a \$5.45 million fine against the licensee of the Davis-Besse plant. The principal violation was that the utility restarted and operated the plant in May 2000, without fully characterizing and eliminating leakage from the reactor vessel head. Additional violations included providing incomplete and inaccurate information to NRC on the extent of cleaning and inspecting the reactor vessel head in 2000.

While NRC has not yet completed all of its planned actions, we remain concerned that NRC has no plans to address three systemic weaknesses underscored by the incident at Davis-Besse. Specifically, NRC has proposed no actions to help it better (1) identify early indications of deteriorating safety conditions at plants, (2) decide whether to shut down a plant, or (3) monitor actions taken in response to incidents at plants. Both NRC and GAO had previously identified problems in NRC programs that contributed to the Davis-Besse incident, yet these problems continued to persist. Because the nation's nuclear power plants are aging, GAO recommended that NRC take more aggressive actions to mitigate the risk of serious safety problems occurring at Davis-Besse and other nuclear power plants.

In April 2005, we issued a report outlining the need for NRC to do more to ensure that power plants are effectively controlling spent nuclear fuel.⁸ Spent nuclear fuel—the used fuel periodically removed from reactors in nuclear power plants—is too inefficient to power a nuclear reaction, but is intensely radioactive and continues to generate heat for thousands of years. Potential health and safety implications make the control of spent nuclear fuel of great importance. The discovery, in 2004, that spent fuel rods were missing at the Vermont Yankee plant in Vermont generated public concern and questions about NRC’s regulation and oversight of this material. GAO reviewed (1) plants’ performance in controlling and accounting for their spent nuclear fuel, (2) the effectiveness of NRC’s regulations and oversight of plants’ performance, and (3) NRC’s actions to respond to plants’ problems controlling their spent fuel.

We found that nuclear power plants’ performance in controlling and accounting for their spent fuel has been uneven. Most recently, three plants—Vermont Yankee and Humboldt Bay (California) in 2004, and Millstone (Connecticut) in 2000—have reported missing spent fuel. Earlier, several other plants also had missing or unaccounted for spent fuel rods or rod fragments. NRC regulations require plants to maintain accurate records of their spent nuclear fuel and to conduct a physical inventory of the material at least once a year. The regulations, however, do not specify how physical inventories are to be conducted. As a result, plants differ in the regulations’ implementation. For example, physical inventories at plants varied from a comprehensive verification of the spent fuel to an office review of the records and paperwork for consistency. Additionally, NRC regulations do not specify how individual fuel rods or segments are to be tracked. As a result, plants employ various methods for storing and accounting for this material. Further, NRC stopped inspecting plants’ material control and accounting programs in 1988. According to NRC officials, there was no indication that inspections of these programs were needed until the event at Millstone. At the time of our review, NRC was collecting information on plants’ spent fuel programs to decide if it needs to revise its regulations and/or oversight. It had its inspectors collect basic information on all facilities’ programs. It also contracted with the Department of Energy’s Oak Ridge National Laboratory in Tennessee to review NRC’s material control and accounting programs for nuclear

⁸GAO, *Nuclear Regulatory Commission: NRC Needs to Do More to Ensure that Power Plants Are Effectively Controlling Spent Nuclear Fuel*, [GAO-05-339](#) (Washington, D.C.: Apr. 8, 2005).

material. NRC is planning to request information from plants and plans to visit over a dozen plants for more detailed inspection. The results of these efforts may not be completed until late 2005, over 5 years after the incident at Millstone that initiated NRC's efforts. However, we believed NRC has already collected considerable information indicating problems or weaknesses in plants' material control and accounting programs for spent fuel.

GAO recommended that NRC (1) establish specific requirements for the way plants control and account for loose rods and fragments as well as conduct their physical inventories, and (2) develop and implement appropriate inspection procedures to verify plants' compliance with the requirements.

NRC Faces Several Broad Challenges in Effectively Regulating and Overseeing Nuclear Power Plants

Based on our recent work at NRC, we have identified several cross-cutting challenges that NRC faces as it works to effectively regulate and oversee the nuclear power industry. First, NRC must manage the implementation of its risk-informed regulatory strategy across the agency's operations. Second, and relatedly, NRC must strive to achieve the appropriate balance between more direct involvement in the operations of nuclear power plants and self-reliance and self-reporting on the part of plant operators to do the right things to ensure safety. Third, and finally, NRC must ensure that the agency effectively manages resources to implement its risk-informed strategy and achieve the appropriate regulatory balance in the current context of increasing regulatory and oversight demands as the industry's interest in expansion grows.

NRC Must Manage the Implementation of Its Risk-Informed Regulatory Strategy

Nuclear power plants have many physical structures, systems, and components, and licensees have numerous activities under way, 24-hours a day, to ensure that plants operate safely. NRC relies on, among other things, the agency's on-site resident inspectors to assess plant conditions and oversee quality assurance programs, such as maintenance and operations, established by operators to ensure safety at the plants. Monitoring, maintenance, and inspection programs are used to ensure quality assurance and safe operations. To carry out these programs, licensees typically prepare numerous reports describing conditions at plants that need to be addressed to ensure continued safe operations. Because of the significant number of activities and physical structures, systems, and components, NRC adopted a risk-informed strategy to focus inspections on those activities and pieces of equipment that are considered to be the most significant for protecting public health and

safety. Under the risk-informed approach, some systems and activities that NRC considers to have relatively less safety significance receive little agency oversight. With its current resources, NRC can inspect only a relatively small sample of the numerous activities going on during complex plant operations. NRC has adopted a risk-informed approach because it believes that it can focus its regulatory resources on those areas of the plant that the agency considers the most important to safety. NRC has stated the adoption of this approach was made possible by the fact that safety performance at plants has improved as a result of more than 25 years of operating experience.

Nevertheless, we believe that NRC faces a significant challenge in effectively implementing its risk-informed strategy, especially with regards to improving the quality of its risk information and identifying emerging technical issues and adjusting regulatory requirements before safety problems develop. The 2002 shutdown of the Davis-Besse plant illustrates this challenge, notably the shortcomings in NRC's risk estimate and failure to sufficiently address the boric acid corrosion and nozzle cracking issues. We also note that NRC's Inspector General considers the development and implementation of a risk-informed regulatory oversight strategy to be one of the most serious management challenges facing NRC.

NRC Must Balance Oversight and Industry Self-Compliance

Under the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974, as amended, NRC and the operators of nuclear power plants share the responsibility for ensuring that nuclear reactors are operated safely. NRC is responsible for issuing regulations, licensing and inspecting plants, and requiring action, as necessary, to protect public health and safety. Plant operators have the primary responsibility for safely operating their plants in accordance with their licenses. NRC has the authority to take actions, up to and including shutting down a plant, if licensing conditions are not being met and the plant poses an undue risk to public health and safety.

NRC has sought to strike a balance between verifying plants' compliance with requirements through inspections and affording licensees the opportunity to demonstrate that they are operating their plants safely. While NRC oversees processes, such as the use of performance measures and indicators, and requirements that licensees maintain their own quality assurance programs, NRC, in effect, relies on licensees and trusts them to a large extent to make sure their plants are operated safely. While this approach has generally worked, we believe that NRC still has work to do to effectively position itself so that it can identify problems with

diminishing performance at individual plants before they become serious. For example, incidents such as the 2002 discovery of the extensive reactor vessel head corrosion at the Davis-Besse plant and the unaccounted for spent nuclear fuel at several plants across the country, raise questions about whether NRC is appropriately balancing agency involvement and self-monitoring by licensees. An important aspect of NRC's ability to rely on licensees to maintain their own quality assurance programs is a mechanism to identify deteriorating performance at a plant before the plant becomes a problem. At Davis-Besse, NRC inspectors viewed the licensee as a good performer based on its past performance and did not ask the questions that should have been asked about plant conditions. Consequently, the inspectors did not make sure that the licensee adequately investigated the indications of the problem and did not fully communicate the indications to the regional office and NRC headquarters.

NRC Must Manage Agency Resources to Meet Increasing Regulatory and Oversight Demands

Finally, Mr. Chairman, I would also like to comment briefly on NRC's resources. While we have not assessed the adequacy of NRC's resources, we have noted instances, such the shutdown of the Davis-Besse plant, where resource constraints affected the agency's oversight or delayed certain activities. NRC's resources have been challenged by the need to enhance security at nuclear power plants after the September 11, 2001, terrorist attacks, and they will continue to be challenged as the nation's fleet of nuclear power plants age and the industry's interest grows in both licensing and constructing new plants, and re-licensing and increasing the output of existing plants. Resource demands will also increase when the Department of Energy submits for NRC review, an application to construct and operate a national depository for high-level radioactive waste currently planned for Yucca Mountain, Nevada. We believe that it is important for NRC and the Congress to monitor agency resources as these demands arise in order to ensure that NRC can meet all of its regulatory and oversight responsibilities and fulfill its mission to ensure adequate protection of public health, safety, and the environment.

Conclusion

In closing, we recognize and appreciate the complexities of NRC's regulatory and oversight efforts required to ensure the safe and secure operation of the nation's commercial nuclear power plants. As GAO's recent work has demonstrated, NRC does a lot right but it still has important work to do. Whether NRC carries out its regulatory and oversight responsibilities in an effective and credible manner will have a significant impact on the future direction of our nation's use of nuclear power.

Finally, we note that NRC has generally been responsive to our report findings. Although the agency does not always agree with our specific recommendations, it has continued to work to improve in the areas we have identified. It has implemented many of our recommendations and is working on others. For example, with respect to nuclear power plant security, NRC has restored its security inspection program and resumed its force-on-force exercises with a much higher level of intensity. It is also strengthening these exercises by conducting them at individual plants every 3 years rather than every 8 years, and is using laser equipment to reduce the exercises' artificiality. Another example involves sealed radioactive sources. NRC is working with agreement states to develop a process for ensuring that high-risk radioactive sources cannot be obtained before verification that the materials will be used as intended. NRC anticipates that an NRC-agreement state working group will deliver a recommended approach to NRC senior management later this year. In addition, NRC continues to work on its broader challenges. For example, the agency intends to develop additional regulatory guidance to expand the application of risk-informed decision making, including addressing the need to establish quality requirements for risk information and specific instructions for documenting the decision making process and its conclusions.

We will continue to track NRC's progress in implementing our recommendations. In addition, as members of this subcommittee are aware, GAO has been asked to review the effectiveness of NRC's activities for overseeing nuclear power plants, that is, its reactor oversight process. An important part of that work would be to review the agency's risk-informed regulatory strategy and its effectiveness in identifying deteriorating plant performance as well as whether NRC is making progress toward effectively balancing agency inspections and self-monitoring by licensees.

Mr. Chairman, this completes my prepared statement. I would be pleased to respond to any questions that you or other Members of the subcommittee may have.

GAO Contacts and Staff Acknowledgements

For further information about this testimony, please contact me at (202) 512-3841 (or at wellsj@gao.gov). John W. Delicath, Ilene Pollack, and Raymond H. Smith, Jr. made key contributions to this testimony.

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