

Highlights

Highlights of GAO-04-415, a report to congressional requesters

Why GAO Did This Study

In March 2002, 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. After the Nuclear Regulatory Commission (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 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.

What GAO Recommends

Because the nation's nuclear power plants are aging, GAO is recommending that NRC take more aggressive actions to mitigate the risk of serious safety problems occurring at Davis-Besse and other nuclear power plants.

NRC disagreed with two of the report's five recommendations—that it develop (1) additional means to better identify safety problems early and (2) guidance for making decisions whether to shut down a plant. GAO continues to believe these recommendations are appropriate and should be implemented.

www.gao.gov/cgi-bin/getrpt?GAO-04-415

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 REGULATION

NRC Needs to More Aggressively and Comprehensively Resolve Issues Related to the Davis-Besse Nuclear Power Plant's Shutdown

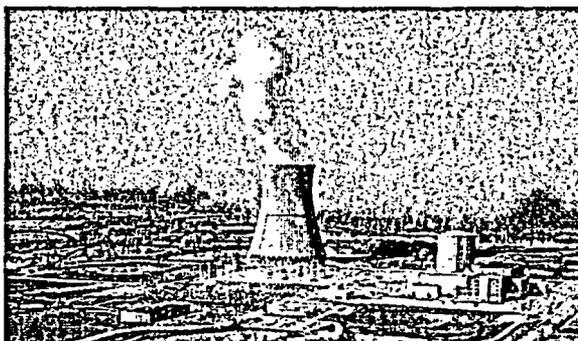
What GAO Found

NRC should have but did not identify or prevent the corrosion at Davis-Besse because its oversight did not generate accurate information on plant conditions. NRC inspectors were aware of indications of leaking tubes and corrosion; however, the inspectors did not recognize the indications' importance and did not fully communicate information about them. 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, NRC did not modify its inspections to identify these conditions.

NRC's process for deciding to allow Davis-Besse to delay its shutdown lacks credibility. Because NRC had no guidance specifically for making a decision on whether a plant should shut down, it used guidance for deciding whether a plant should be allowed to modify its operating license. NRC did not always follow this guidance and generally did not document how it applied the guidance. The risk estimate NRC used to help decide whether the plant should shut down was also flawed and underestimated the amount of risk that Davis-Besse posed. Further, even though underestimated, the estimate still exceeded risk levels generally accepted by the agency.

NRC has taken 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. However, NRC has not yet completed all of its planned actions and, more importantly, has no plans to address three systemic weaknesses underscored by the incident. 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 continue to persist.

The Davis-Besse Nuclear Power Plant in Oak Harbor, Ohio



Source: FirstEnergy.

NRC's analysis of the underlying causes for failing to identify the corrosion of the reactor vessel head, and NRC's action plan developed in response to the task force recommendations. We also reviewed other NRC lessons-learned task force reports and their recommendations, our prior reports to identify issues related to those at Davis-Besse, and NRC's Office of the Inspector General reports. We met with NRC officials responsible for implementing task force recommendations to obtain a clear understanding of the actions they were taking and the status of their efforts, and discussed NRC's recommendations with NRC regional officials, on-site inspectors, and representatives from public interest groups. We conducted our review from November 2002 through May 2004 in accordance with generally accepted government auditing standards.

Results in Brief

NRC should have but did not identify or prevent the vessel head corrosion at Davis-Besse because both its inspections at the plant and its assessments of the operator's performance yielded inaccurate and incomplete information on plant safety conditions. With respect to inspections, NRC resident inspectors had information revealing potential problems, such as boric acid deposits on the vessel head and air monitors clogged with boric acid deposits, but this information did not raise alarms about the plant's safety. NRC inspectors did not know that these indications could signal a potentially significant problem and therefore did not fully communicate their observations to other NRC staff, some of whom might have recognized the significance of the problem. However, even if these staff had been informed, according to NRC officials, the agency would have taken action only if these indications were considered significant safety concerns. Furthermore, NRC's assessments of Davis-Besse, which include inspection results as well as other data, did not provide complete and accurate information on FirstEnergy's performance. For example, NRC consistently assessed Davis-Besse's operator as a "good performer" during those years when the corrosion was likely occurring, and the operator was not correctly identifying the source of boric acid deposits. NRC had been aware for several years that corrosion and cracking were issues that could possibly affect safety, but did not view them as immediate safety concerns and therefore had not fully incorporated them into its oversight process.

NRC's process for deciding whether Davis-Besse could delay its shutdown to inspect for nozzle cracking lacks credibility because the guidance NRC used was not intended for making such a decision and the basis for the decision was not fully documented. In the absence of written guidance specifically intended to direct the decision-making process for a shutdown,

NRC used guidance designed for considering operator requests for license amendments. This guidance describes safety factors that NRC should consider in deciding whether to approve a license amendment, as well as a process for considering the relative risk the amendment could pose. However, the guidance does not specify how NRC should use the safety factors, and we could not determine if NRC appropriately followed this guidance because it did not clearly document the basis for its decision. For example, NRC initially decided that several safety factors were not met and considered issuing a shutdown order. Regardless, the agency allowed FirstEnergy to delay its shutdown, even though it is not clear whether—and if so, how—the safety factors were subsequently met. Further, NRC did not provide a rationale for its decision for more than a year. NRC also did not follow other aspects of its guidance. In the absence of specific guidance, and with little documentation of the decision-making process, we could not judge whether the agency's decision was reasonable. Our consultants identified substantial problems with how NRC developed and used its risk estimate when making the decision. For example, NRC did not perform an analysis of the uncertainty associated with the risk estimate; if it had, our consultants believe the uncertainty would have been so large as to render NRC's risk estimate of questionable value. Further, the risk estimate indicated that the likelihood of an accident occurring at Davis-Besse was greater than the level of risk generally accepted as being reasonable by NRC.

Responding to the Davis-Besse incident, NRC has taken several significant actions to help prevent boric acid from corroding reactor vessel heads at nuclear power plants. NRC issued requirements that licensees more extensively examine their reactor vessel heads, revised NRC inspection guidance used to identify and resolve licensee problems before they affect operations, augmented training to keep its inspectors better informed about boric acid and cracking issues, and revised guidance to better ensure that licensees implement commitments to change their operations. However, NRC has not yet implemented more than half of its planned actions, and resource constraints could affect the agency's ability to fully and effectively implement the actions. More importantly, NRC is not addressing three systemic problems underscored by the Davis-Besse incident. First, its process for assessing safety at nuclear power plants is not adequate for detecting early indications of deteriorating safety. In this respect, the process does not effectively identify changes in the operator's performance or approach to safety before a more serious safety problem can develop. Second, NRC's decision-making guidance does not specifically address shutdown decisions or explain how different safety

considerations, such as quantitative estimates of risk, should be weighed. Third, NRC does not have adequate management controls for systematically tracking actions that it has taken in response to incidents at plants to determine if the actions were sufficient to resolve underlying problems and thereby prevent future incidents. Analyses of earlier incidents at other plants identified several issues, such as inadequate communication, that contributed to the Davis-Besse incident. Such management controls may have helped to resolve these issues before the Davis-Besse incident occurred. While NRC is monitoring how it implements actions taken as a result of the Davis-Besse incident, the agency has not yet committed to a process for assessing the effectiveness of actions taken.

Given NRC's actions in response to Davis-Besse, severe vessel head corrosion is unlikely to occur at a plant any time soon. However, in part because of unresolved systemic problems, another incident unrelated to vessel head corrosion could occur in the future. As a result, we are recommending that NRC take more aggressive and specific actions in several areas, such as revising how it assesses plant performance, establishing a more specific methodology for deciding to shut down a plant, and establishing management controls for monitoring and assessing the effectiveness of changes made in response to task force findings.

In commenting on a draft of this report, NRC generally addressed only those findings and recommendations with which it disagreed. While commenting that it agreed with many of our findings, the agency said that the report overall does not appropriately characterize or provide a balanced perspective on NRC's actions surrounding the discovery of the reactor vessel head condition at Davis-Besse or its efforts to incorporate the lessons learned from that experience into its processes. More specifically, NRC stated that the report does not acknowledge that NRC must rely heavily on its licensees to provide complete and accurate information. NRC also expressed concern about the report's characterization of its use of risk estimates. We believe that the report fairly and accurately describes NRC's actions regarding the Davis-Besse incident. Nonetheless, we expanded our discussion of NRC's roles and responsibilities to point out that licensees are required to provide NRC with complete and accurate information.

NRC disagreed with our recommendations to develop (1) specific guidance and a well-defined process for deciding when to shut down a plant and (2) a methodology to assess early indications of deteriorating safety at nuclear

power plants. NRC stated that it has sufficient guidance to make plant shutdown decisions. NRC also stated that, as regulators, the agency is not charged with managing licensees' facilities and that direct involvement with those aspects of licensees' operations that could provide it with information on early indications of deteriorating safety crosses over to a management function. We continue to believe that NRC should develop specific guidance and a well-defined process to decide when to shut down a plant. In absence of such guidance for making the Davis-Besse shutdown decision, NRC used its guidance for considering operators' requests for amendments to their licenses. This guidance describes safety factors that NRC should consider in deciding whether to approve license changes, as well as a process for considering the relative risk the amendment would pose. This guidance does not specify how NRC should use the safety factors. We also continue to believe that NRC should develop a methodology to assess aspects of licensees' operations as a means to have an early warning of developing safety problems. In implementing this recommendation, we envision that NRC would be analyzing data for changes in operators' performance or approach to safety, not prescribing how the plants are managed.

Background

NRC's Role and Responsibilities

NRC, as an independent federal agency, regulates the commercial uses of nuclear material to ensure adequate protection of public health and safety and the environment. NRC is headed by a five-member commission appointed by the President and confirmed by the Senate; one commissioner is appointed as chairman.⁵ NRC has about 2,900 employees who work in its headquarters office in Rockville, Maryland, and its four regional offices. NRC is financed primarily by fees that it imposes on commercial users of the nuclear material that it regulates. For fiscal year 2004, NRC's appropriated budget of \$626 million includes about \$546 million financed by these fees.

NRC regulates the nation's commercial nuclear power plants by establishing requirements for plant owners and operators to follow in the design, construction, and operation of the nuclear reactors. NRC also

⁵Two commissioner positions are currently vacant.