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U.S. General Accounting Office (GAO)

EDO CONTROL: G20020007  
DOC DT: 12/21/01  
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Chairman Meserve

CRC NO: 02-0006

DESC: GAO Report Entitled, "Nuclear Regulation: NRC's  
Assurances of Decommissioning Funding During  
Utility Restructuring Could be Improved  
(GAO-02-48)

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**PAPER NUMBER:** LTR-02-0006 **LOGGING DATE:** 01/07/2002  
**ACTION OFFICE:** EDO

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**AFFILIATION:** GAO  
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**SUBJECT:** GAO report entitled "Nuclear Regulation: NRC's Assurance of Decommissioning Funding During Utility Restructuring Could Be Improved"

**ACTION:** Signature of Chairman  
**DISTRIBUTION:** Chairman, Comrs, OGC

**LETTER DATE:** 12/21/2001  
**ACKNOWLEDGED:** No  
**SPECIAL HANDLING:**

**NOTES:** Commission Correspondence  
**FILE LOCATION:** Adams

**DATE DUE:** 02/06/2001 **DATE SIGNED:**

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Washington, DC 20548

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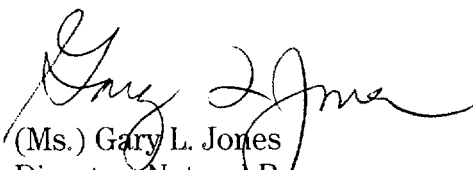
The Honorable Richard Meserve  
Chairman, Nuclear Regulatory Commission

Dear Mr. Chairman:

Enclosed is a copy of our report entitled *Nuclear Regulation: NRC's Assurances of Decommissioning Funding During Utility Restructuring Could Be Improved* (GAO-02-48). This report was prepared at the request of the Honorable Edward J. Markey, House of Representatives.

This report contains recommendations to you. As you know, 31 U.S.C. 720 requires the head of a federal agency to submit a written statement of the actions taken on our recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Reform not later than 60 days after the date of this letter and to the Senate and House Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of this letter.

Sincerely yours,

  
(Ms.) Gary L. Jones  
Director, Natural Resources  
and Environment

Enclosure

GAO

Report to the Honorable  
Edward J. Markey,  
House of Representatives

December 2001

# NUCLEAR REGULATION

## NRC's Assurances of Decommissioning Funding During Utility Restructuring Could Be Improved



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#### Abbreviations

ALARA	as-low-as-reasonably-achievable
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
DOE	Department of Energy
EPA	Environmental Protection Agency
FASB	Financial Accounting Standards Board
FERC	Federal Energy Regulatory Commission
GAO	General Accounting Office
GTCC	Greater Than Class C (waste)
NRC	Nuclear Regulatory Commission
PECO	PECO Energy Company (formerly, Philadelphia Electric Company)
PSEG	Public Service Electric and Gas Company
PUC	Public Utility Commission



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United States General Accounting Office  
Washington, DC 20548

December 3, 2001

The Honorable Edward J. Markey  
House of Representatives

Dear Mr. Markey:

This report responds to your request that we review how the Nuclear Regulatory Commission ensures, in a period of economic deregulation and restructuring of the electricity industry, that sufficient funds will be available to decommission nuclear power plants after the plants are permanently shut down.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after the date of this letter. At that time, we will send copies to the appropriate congressional committees; the Chairman, Nuclear Regulatory Commission; and the Director, Office of Management and Budget. We will also make copies available to others upon request.

Please contact me at (202) 512-3841 if you or your staff have any questions about this report. Key contributors to this report are listed in appendix II.

Sincerely yours,

(Ms.) Gary L. Jones  
Director, Natural Resources  
and Environment



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# Executive Summary

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The Nuclear Regulatory Commission (NRC) has licensed 125 commercial nuclear power plants to operate in the United States, each for a finite number of years. For safety reasons, after a licensee retires a plant, the licensee must eventually dismantle it. The spent (used) fuel is removed from the nuclear reactor and usually stored at the plant site until the fuel can be removed for disposal. The other radioactive wastes from dismantling the plant are shipped to one or more off-site disposal facilities. Upon completion of this process, called "decommissioning," the plant site can be reused for other purposes.

The costs of decommissioning, which vary according to the size of the plant and the level of contamination, generally fall within the range of \$300 million to \$400 million per plant. To ensure the availability of adequate funds to pay for this process, NRC requires its licensees to select a method or combination of methods for financing future decommissioning activities from among the acceptable methods specified in its regulations.

Traditionally, plant owners amass decommissioning funds through charges imbedded in predetermined electricity rates, which state utility commissions and/or the Federal Energy Regulatory Commission regulate. However, with the deregulation of the electric utility industry in many states, a competitive market instead of regulated rates now determines the price that some plant owners can charge for producing electricity. Consequently, these plant owners can no longer collect decommissioning funds through the traditional method.

Deregulation has led many states and their electric utilities to restructure much of their electricity industry to separate the producers of electricity from those who transmit and distribute (sell) electricity to customers. As part of this restructuring, the ownership and/or operation of plants has changed for more than half of the nuclear power plants in the United States. Since 1998, for example, utilities that own all or part of eight nuclear plants have contracted the operation of these plants to other companies. And other utilities have sold or are in the process of selling all or part of 15 plants. Finally, the reorganizations and mergers of electric utilities have resulted in the transfer of licenses for more than 30 plants to companies formed specifically to produce electricity. The number of these transfers highlights the importance of NRC's regulatory role in ensuring that new licensees are financially qualified to operate, maintain, and eventually decommission these plants. The transfers also underscore the need for consistent financial disclosure of decommissioning liabilities to

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the potential investors in new companies formed, at least in part, to produce electricity from nuclear power plants.

Concerned about the adequacy of decommissioning funds, particularly in deregulated markets, Representative Edward Markey asked GAO to determine how (1) transfers of licenses to operate or own nuclear power plants have affected assurances that adequate funds will be available to operate and decommission these plants, (2) various site cleanup standards and proposed new decommissioning methods affect projected decommissioning costs, and (3) changes in financial reporting standards affect the disclosure and funding of decommissioning liabilities.

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## Background

Before transferring a license to a new plant owner, NRC requires the prospective owner to demonstrate that it has both the technical ability and financial backing to safely own and operate the plant. NRC also requires owners to demonstrate that they will accumulate a prescribed minimum amount of funds to pay for the eventual decommissioning of their plants. Owners must ensure that these funds will be available by choosing one or a combination of the following options:

- periodic deposits (at least annually) into a trust fund outside of the owner's control;
- prepayment of the entire estimated decommissioning liability into a trust fund outside of the owner's control;
- obtaining a surety bond, insurance, letter of credit, or line of credit payable to a trust established for decommissioning costs; or
- guaranteeing the payment of decommissioning costs, provided that the guarantor (usually an affiliate or parent company to the owner) passes specific financial tests.

Until recently, essentially all plant owners chose to accumulate decommissioning funds through periodic deposits. However, in September 1998, NRC amended its regulations to restrict the use of this option in deregulated markets. Under the amended regulations, owners may rely on periodic deposits only to the extent that those deposits are guaranteed through regulated rates charged to consumers. In conjunction, NRC has issued written procedures, called a "standard review plan", describing how its staff should determine the adequacy of a prospective owner's financial qualifications to operate its plant(s) and its proposed method(s) for assuring the availability of funds to eventually decommission the plant(s).

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To estimate future decommissioning costs, plant owners may use a mathematical formula that is provided in NRC's regulations or a site-specific estimate, if the costs developed from it are higher. The formula assumes that plant sites will be cleaned up in compliance with NRC's standards. By the time that a plant is decommissioned, however, other cleanup standards could apply. For example, the Environmental Protection Agency (EPA) has more restrictive cleanup standards that could, in some circumstances, be applied to a nuclear power plant site, and some states are establishing cleanup standards for decommissioning nuclear power plants and/or other nuclear facilities.

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## Results in Brief

In most of the requests to transfer licenses to own or operate nuclear power plants that NRC has approved, the financial arrangements have either maintained or enhanced the assurance that adequate funds will be available to decommission those plants. Owners relying on outside companies to operate their plants have retained the responsibility for financing the future decommissioning of these plants and continue to collect funds for this purpose through their economically regulated sales of electricity. When new owners purchased all or parts of 15 plants from utility companies, the level of assurance was enhanced through the prepayment of the decommissioning trust funds and guarantees from affiliate or parent companies to pay any remaining decommissioning costs. However, when new owners proposed to continue relying on periodic deposits to external sinking funds, NRC's reviews were not always rigorous enough to ensure that decommissioning funds would be adequate. Moreover, NRC did not always adequately verify the new owners' financial qualifications to safely own and operate the plants. Accordingly, GAO is making a recommendation to ensure a more consistent review process for license transfer requests.

Varying cleanup standards and proposed new decommissioning methods introduce additional uncertainty about the costs of decommissioning nuclear power plants in the future. Plants decommissioned in compliance with NRC's requirements may, under certain conditions, also have to meet, at higher cost, more stringent EPA or state standards. New decommissioning methods being considered by NRC, which involve leaving more radioactive waste on-site, could reduce short-term decommissioning costs yet increase costs over the longer term. Moreover, they would raise significant technical and policy issues concerning the disposal of low-level radioactive waste at plant sites instead of in regulated disposal facilities. Adding to cost uncertainty, NRC allows plant owners to wait until 2 years before their license is terminated—relatively late in the

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decommissioning process—to perform overall radiological assessments to determine whether any residual radiation anywhere at the site will need further clean-up in order to meet NRC’s site release standards. Accordingly, GAO is recommending that NRC reconcile its proposed decommissioning methods with existing waste disposal regulations and policies and require licensees to assess their plant sites for contamination earlier in the decommissioning process.

Changes to the Financial Accounting Standards Board’s financial reporting standard will require, for the first time, owners of facilities that require significant end-of-life cleanup expenditures—such as nuclear power plants—to consistently report estimated decommissioning costs as liabilities in their financial statements. When this standard takes effect in mid-2002, many companies that are licensed by NRC to own nuclear power plants will have to change their current financial-reporting practices, and the reporting of estimated decommissioning costs will become more uniform. However, the new accounting standard is not intended to, and will not, establish a legal requirement that these licensees set aside adequate funding for decommissioning costs.

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## Principal Findings

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### Effect of License Transfers on Decommissioning Funding

The level of assurance that adequate decommissioning funds will be available when licensees retire nuclear power plants has remained the same or increased for most of the license transfers that NRC has reviewed and approved. When plant owners contracted out the operation of their plants, NRC required the owners to continue collecting decommissioning funds through their regulated electricity rates, thus maintaining the previous level of assurance. When NRC reviewed and approved the sale of all or parts of 15 plants to new generating companies, the level of assurance was enhanced because the selling utilities generally prepaid the projected decommissioning funds. To the extent that a few decommissioning trust funds were not fully prepaid, either the selling utility or the new owners’ affiliated or parent companies provided additional guarantees consistent with NRC’s requirements.

In instances when new owners continued to rely on periodic deposits to the transferred trust funds, however, NRC’s review process did not consistently result in the same level of assurance that decommissioning funds would be adequate when the owners’ plants shut down. For

example, when a new company formed through a merger applied to transfer the licenses for the ownership of all or parts of 20 plants, including 4 retired plants, NRC did not verify whether there were contractual arrangements to transfer the decommissioning funds collected for the plants into the trust funds for those plants. Also, for the four plants that had permanently shut down, NRC did not request that the new owner (1) provide any more information on the status or plans for these prematurely shut down plants than it had for the 16 plants that were operating or (2) demonstrate how the owner planned to acquire the additional decommissioning funds as it had for another retired plant.

For the most part, NRC's reviews of new owners' financial qualifications have enhanced the level of assurance that they will safely own and operate their plants in a deregulated environment and not need to shut them down prematurely. However, NRC did not obtain the same degree of financial assurance in the case of one merger that created a new generating company that is now responsible for owning, operating, and decommissioning the largest fleet of nuclear plants in the United States. This new owner did not provide, and NRC did not request, guaranteed additional sources of revenue above the market sale of its electricity, as other new owners had. Moreover, NRC did not document its review of the financial information—including revenue projections, which were inaccurate—that the new owner submitted to justify its qualifications to safely own and operate 16 plants.

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### Effect of Regulatory Policies on Decommissioning Costs

Varying radiation cleanup standards and the possibility that NRC will approve alternative decommissioning methods are two of the most significant factors that add uncertainty to estimates of future decommissioning costs. Depending on future circumstances, for example, plants decommissioned according to NRC's radiation cleanup standards could also have to meet more stringent EPA or state standards, potentially increasing the cost of decommissioning. EPA has indicated that if NRC does not tighten its standards, EPA could reconsider its policy of exempting decommissioned nuclear plant sites from the stricter cleanup standards that EPA enforces under the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (also known as CERCLA or Superfund). In addition, the states of Maine, Massachusetts, New York, and New Jersey have already adopted radiation cleanup standards stricter than NRC's, and more states may do so. These stricter standards will require plant owners to incur significant additional decommissioning costs; for example, officials from one plant estimate that

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Maine's standard will add \$25 million to \$30 million to the decommissioning costs for that plant.

Alternative decommissioning methods under consideration for NRC's approval would have an unknown affect on overall decommissioning costs. Because the methods involve leaving more radioactive waste on-site—either buried as rubble or encased within the reactor containment structure—they would reduce the waste-disposal component of decommissioning costs. However, they could add considerably to long-term costs because of the need for extended institutional control of the sites. Moreover, these methods appear to conflict with NRC's technical requirements for licensing low-level radioactive waste disposal facilities. In addition, the proposed methods may run counter to the policy expressed in the Low-Level Radioactive Waste Policy Amendments Act, which encourages states to manage low-level radioactive wastes on a regional basis and to provide centralized disposal facilities.

Another potentially significant factor contributing to the uncertainty about decommissioning cost is the lack of information on the degree of contamination at some plant sites. NRC's decommissioning requirements allow plant owners to wait until 2 years before the proposed license termination date to perform an overall survey of their plant sites for radiation contamination. Postponing the survey until this late in the decommissioning process increases the risk that owners will incur unplanned cleanup expenses after significant portions of the available decommissioning funds have already been expended.

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## Disclosure of Liability for Decommissioning Costs

The Financial Accounting Standards Board has adopted a new financial reporting standard that, beginning in mid-2002, should result in more uniform reporting of decommissioning costs. Currently, companies disclose their liability for decommissioning costs using a number of different methods, making comparisons by investors difficult. Under the new standard, companies must report estimated decommissioning costs as liabilities in their financial statements, using a specified method to calculate the amount of the liability. However, the new standard applies not just to nuclear power plants but to other industries as well, and the method specified differs from the method that NRC requires for nuclear power plant licensees. The new standard will have no legal or regulatory affect on the actual accumulation of decommissioning funds and is not intended to do so.

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## Recommendations for Executive Action

To ensure that the decommissioning assurance methods and financial qualifications of all new plant owners are consistently verified, validated, and documented, GAO recommends that the Chairman, NRC, revise the Commission's standard review plan and related management controls for reviewing license transfers to include a checklist or step-by-step process for its staff, management, and prospective plant owners to follow.

GAO also recommends that the Chairman, NRC, amend the Commission's ongoing consideration of modifications to radiological criteria for terminating licenses and alternative decommissioning approaches to address

- how the burial or entombment of low-level radioactive waste at nuclear plant sites, leading to a potentially large number of contaminated sites scattered around the country, may affect the federal policy under the Low-Level Radioactive Waste Policy Act to manage radioactive waste on a regional basis, and
- concerns about whether these decommissioning approaches are technically compatible with provisions of the Low-Level Radioactive Waste Policy Act, the interstate compact agreements that implement the act, and NRC's technical regulations on licensing disposal facilities for low-level radioactive waste.

To reduce the likelihood that site contamination will go undetected until late in the cleanup process, GAO recommends that the Chairman, NRC, require licensees to survey their plant sites for radiation as soon as possible after the announcement of their intentions to permanently cease operations, rather than allowing them to wait until 2 years before decommissioning is supposed to be complete.

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## Agency Comments and GAO's Evaluation

GAO provided NRC with a draft of this report for review and comment. NRC said that GAO has provided constructive comments regarding documentation of the financial considerations associated with requests to transfer licenses for nuclear power plants. NRC also said it is concerned that GAO has not fully represented certain aspects of its review process for license transfers, nor entirely considered the various processes associated with the decommissioning of a nuclear plant. NRC provided specific comments on these matters, including reasons why, in some cases, it does not agree with GAO's recommendations. NRC's comments also, it said, supplied a more comprehensive perspective on our conclusions and recommendations. (NRC's comments are contained in app. I.)

Specifically, NRC disagreed that it should modify its review guidance to include a checklist or step-by-step process to be followed because many of the proposed license transfers are unique. GAO disagrees. Licensees have consistently used a few basic methods of providing decommissioning funding assurance. Revising the review guidance to ensure, on the basis of NRC's experiences to date, that each license transfer review is based on information that is consistent with other transfers that used similar methods of assurance could help NRC meet its goal of increasing its efficiency and effectiveness.

NRC also disagreed that it should address technical and policy issues associated with the potential on-site burial of radioactive waste from decommissioning nuclear plant sites because this waste would not be classified as low-level radioactive waste. GAO disagrees because it is difficult to discern why radioactive material buried on-site—material that has traditionally been shipped to disposal facilities designed and regulated for such purpose—does not merit the same protection as material sent to a low-level waste disposal site.

Finally, NRC disagreed that it should require licensees to make radiation surveys of their plant sites earlier because this proposed step would not add significant value to the decommissioning process. GAO disagrees, because plant employees most knowledgeable about historical plant operations and site conditions would more likely be available when a plant has been permanently shut down rather than later when decommissioning has been almost completed.



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# Chapter 1: Introduction

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Nuclear power plants generate about 20 percent of electricity in the United States. At the time of this review, there were 103 of these plants in operation.<sup>1</sup> No new nuclear power plants have been ordered since 1978, however, and 22 plants that previously operated under licenses issued by the Nuclear Regulatory Commission (NRC) have been permanently shut down. The licenses for 45 additional plants will expire within the next 15 years. The owners of these plants, therefore, will have to choose whether to retire their plants or to seek license extensions from NRC for up to an additional 20 years.

Radioactive contamination lingers long after power plants are closed. To protect public health and safety, the amount of residual radioactivity present at the site of a retired nuclear power plant must be reduced through a process known as decommissioning. After the spent (used) fuel has been removed from the plant's reactor vessel, the plant must be dismantled and the radioactive wastes shipped to one or more disposal facilities for radioactive wastes.<sup>2</sup> The decommissioning process is still relatively new—3 of the 22 retired commercial nuclear power plants have been decommissioned, 6 other plants are being decommissioned, and 13 plants are awaiting decommissioning. The process is also costly. Experience to date shows that decommissioning costs anywhere from \$300 million to \$400 million or more, depending on factors, such as plant size, the extent of contamination, and waste disposal costs.

NRC and plant owners must balance public health and safety with the cost and technical logistics of the decommissioning process. Moreover, the relatively high cost of decommissioning a nuclear power plant makes the process an issue for economic regulators, such as the Federal Energy Regulatory Commission (FERC) and state public utility commissions (PUC's), and the electricity industry in the relatively new environment of deregulating and restructuring the electricity industry.

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<sup>1</sup> These numbers do not include one plant—the Tennessee Valley Authority's Brown's Ferry Unit 1 plant—that is licensed to operate. That plant, however, has not operated since March 1985, has no fuel loaded, and cannot load fuel and restart without NRC's approval.

<sup>2</sup> The Department of Energy (DOE) is responsible for disposing of the spent fuel from commercial nuclear power plants in a geologic repository. Pending the approval and completion of the proposed Yucca Mountain repository project, owners of nuclear plants are storing their spent fuel at plant sites. NRC does not consider spent fuel storage and disposal costs as decommissioning costs.

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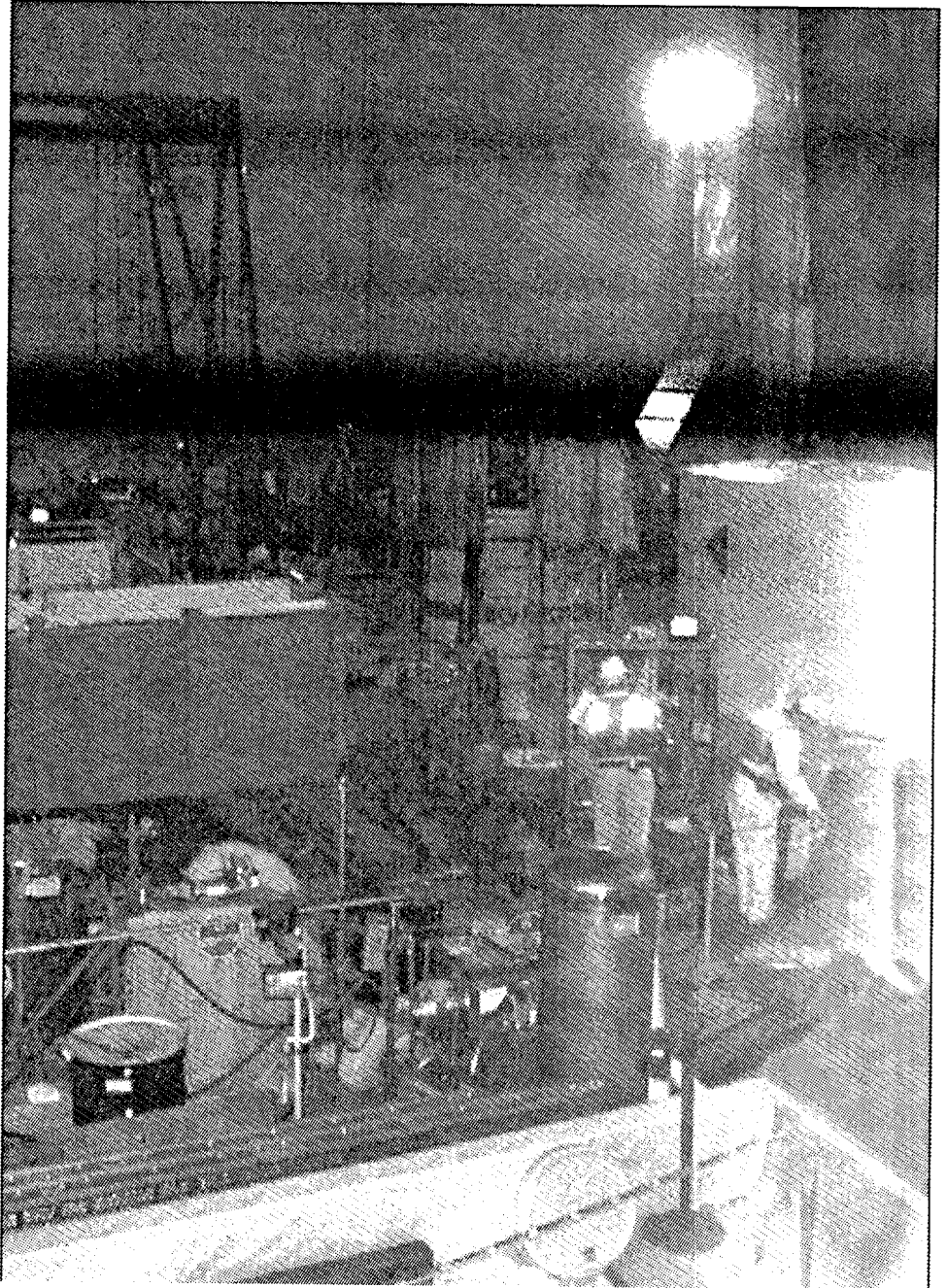
## Decommissioning Regulations Outline Technical Procedures

Before obtaining a license to operate a nuclear power plant, the licensee must agree with NRC to decommission the plant after the plant has been permanently shut down. NRC established its decommissioning requirements in regulations issued in 1988. Under these regulations, NRC expected that decommissioned sites, with rare exceptions, would reduce levels of radiation to allow the plant site to be released for unrestricted use once the license was terminated. Licensees had two decommissioning alternatives.<sup>3</sup> They could either begin major site decontamination and dismantling activities shortly after the termination of operations or maintain the plant and site in a safe condition up to several decades before dismantling the plant. Delaying full-scale decontamination and dismantling activities could be advantageous if (1) more time was needed to accrue decommissioning funds by continuing to collect funds from ratepayers after the plant has closed; (2) other units operating at the site would be disrupted unless all were decommissioned simultaneously at a future time; (3) a reduction in waste disposal volume, cost, or radiation exposure was possible because of a reduction in residual radiation over time; or (4) a licensed disposal facility for radioactive waste was unavailable. (Figure 1 shows ongoing decontamination and dismantling activities at one plant.)

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<sup>3</sup> A third alternative—encasing radioactive wastes within the reactor building—was used by the DOE to decommission three of its small reactors. NRC, in promulgating its decommissioning regulations in 1988, opposed use of this decommissioning method for its licensees unless warranted to protect public health and safety. Since then, no licensee has proposed using this decommissioning method.

**Figure 1: Ongoing Decommissioning Work Within the Containment Building at the Connecticut Yankee Atomic Power Company Haddam Neck Plant**



Source: GAO.

When power operations at a nuclear power plant cease, the licensee must notify NRC, permanently remove the fuel from the reactor vessel, and confirm this action to NRC. Within 2 years, the licensee must provide a report to NRC addressing, among other things, decommissioning plans and the estimated costs of these activities. NRC then publishes a notice of receipt, makes the document available for public comment, and holds a public meeting in the vicinity of the plant to discuss decommissioning plans. The licensee may not perform any major decommissioning activities until 90 days after NRC receives the post-shutdown decommissioning activities report and the certifications of permanent cessation of operations and fuel removal. NRC currently requires that decommissioning be completed within 60 years unless public health and safety reasons require that an extension be granted.

Concurrent with plant decommissioning, a licensee must supply NRC a plan for terminating its license at least 2 years before the planned termination date. At the end of the license termination process, the licensee must conduct a final radiation survey to prove that the site meets radiological criteria for release and must include the survey with the plan. The licensee remains accountable to NRC until decommissioning has been completed and the license is terminated.

NRC's 1988 decommissioning regulations outlined several acceptable approaches for decommissioning nuclear power plants, but regulations did not establish acceptable residual radioactivity levels for the unrestricted release of decommissioned sites. In 1996, NRC published its final rule on the decommissioning of nuclear power plants. This final rule (1) redefined the decommissioning process; (2) defined terminology related to decommissioning; (3) required licensees to provide the NRC with early notification of planned decommissioning activities at their facilities; and (4) explicitly stated the applicability of certain NRC requirements that are specific for reactors that are permanently shut down. However, NRC did not amend its regulations to include radiological criteria for license termination until 1997. The final rule included radiological criteria for releasing decommissioned sites for both unrestricted and restricted future uses. For restricted future uses, licensees must provide safeguards to ensure that access to the site will be restricted until dose levels decay to the radiation level set for unrestricted site releases. The safeguards include requirements for physical barriers, security, monitoring, maintenance, financial assurance provisions, and other institutional controls to ensure that access to the site remains restricted for the entire interment period.

On the basis of its regulations restricting the dosages to members of the public under both the unrestricted and restricted release scenarios, NRC is also now considering two alternative decommissioning approaches. One approach, called rubblization, would permit licensees to demolish plant concrete that is contaminated with radioactivity into rubble and bury the rubble in the underground portion of the dismantled plant. The other approach, called entombment, would involve the permanent encasement of the radioactive contaminants from a partially dismantled plant within the remaining structure of the plant. NRC is also considering extending the timeframe for completing decommissioning from 60 to 100 years or more. As with other decommissioning alternatives, licensees selecting rubblization or entombment would be required to demonstrate compliance with NRC's regulations for license termination, including a demonstration that residual radiation doses at the site are as low as is reasonably achievable.

NRC has primary regulatory authority over nuclear power plant operations and decommissioning, but it is not the only entity that promulgates radiation protection standards. The Environmental Protection Agency (EPA) also issues radiation standards and administers the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), which governs cleanups of federal and non-federal facilities. EPA has authority to evaluate NRC-regulated sites once the sites are decommissioned. NRC and EPA have historically disagreed over radiation protection standards. Differences in legislative mandates, agency missions, and regulatory strategies contribute to this disagreement, which remains essentially unchanged today despite resolution efforts spanning a number of years. States also have authority to issue their own standards, which may be more stringent than either NRC's or EPA's. Consequently, whereas NRC may approve decommissioning plans and terminate the NRC operating license based on its standards, plant owners may still be subject to other federal and state standards once the NRC license is terminated.

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## Decommissioning Regulations Outline Financial Procedures

NRC has authority under the Atomic Energy Act of 1954, as amended, to require licensees to accumulate the funds necessary to decommission their nuclear power plants. Prior to 1988, NRC only required licensees to certify that sufficient funding would be available to decommission their plants when needed and did not require any specific financial provisions. On July 26, 1988, NRC strengthened its technical and financial requirements for decommissioning and offered several options for providing financial assurance. The options included:

- prepayment of the entire estimated decommissioning liability in cash or liquid assets into a separate, segregated account outside the licensee's control;
- external sinking funds segregated from other licensee assets and outside licensee control that are established and maintained by periodic funding;
- surety methods or insurance; or
- for federal licensees only, a statement of intent that decommissioning funds will be obtained when necessary.

Essentially, most if not all utilities eventually elected the option to establish external sinking funds (trust funds) to finance future decommissioning costs. Under this option, decommissioning funds are accumulated over the operational life of a nuclear power plant as part of the cost charged to customers for the electricity they use.

In establishing its regulations, NRC recognized that the external sinking fund option allowed the rate-setting authority of FERC and state public utility commissions to control the rate at which decommissioning funds could be accumulated. Given the additional uncertainty involved in estimating future decommissioning costs, NRC required only that licensees provide "reasonable assurance" that sufficient funds would be available to decommission their nuclear power plants when they are shut down. In 1998, NRC also began requiring licensees to provide financial reports every 2 years on the status of their decommissioning funds. NRC provided licensees with a mathematical formula to initially determine and periodically adjust the estimated amounts required in the funds for radiological decontamination of their plant sites. Licensees may also base their decommissioning trust funds on site-specific estimates of decommissioning costs if these estimates exceed the amounts calculated using NRC's formula.

The length of time that a nuclear power plant remains in operation depends on several factors. NRC typically issues operating licenses for 40 years. Licensees with economically viable plants that still meet NRC's operational requirements may opt to extend operations rather than close their doors. On the other hand, licensees with financially marginal plants may decide to cease operations rather than shoulder large cost requirements for equipment upgrades or repairs, or to address NRC's concerns. An operational accident could also bring a premature end to operations, as could local public and political sentiment or NRC closure for safety reasons. As decommissioning funds are typically accumulated over the expected operational lifetime of the plant, plants that close prematurely may not have accumulated sufficient funds and may have to

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defer the decommissioning process. Furthermore, where several units are situated at the same site, licensees may delay decommissioning work until all plants can be decommissioned at the same time.

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## Deregulation of Electric Utilities and Resultant Industry Restructuring

Historically, nuclear power plants were constructed and operated primarily by investor-owned utilities.<sup>4</sup> Beginning in the mid-1990s, however, many states began to deregulate the electricity industry and to mandate or encourage industry restructuring. Under deregulation, subject to federal oversight, the ownership and control of electricity generation was separated from the transmission and distribution functions to facilitate competition. Traditional utilities continue to serve the transmission and distribution functions, while new business entities—formed through operating arrangements, plant sales, corporate realignments, and mergers—often handle the electricity production function. In recent years, NRC has reviewed more than 60 license transfer requests. These transfer requests have affected about half the nuclear plants in the United States, and some licenses were transferred several times for multiple reasons.

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<sup>4</sup> In addition, smaller investor-owned utilities, publicly-owned utilities, or cooperatives own or have owned a few entire plants or shares of some plants.

**Figure 2: Map of Nuclear Power Plants in the United States and Status of Deregulation by State**



Note: Includes Browns Ferry Unit 1, which has no fuel loaded and requires Commission approval to restart.

Source: Nuclear Regulatory Commission and Energy Information Administration Illustrations, as modified by GAO.

While the move to deregulate the electric industry has resulted in changes that affect the status of licensees in some states, many licensees today still remain investor-owned utilities that operate as state-regulated monopolies. NRC has provided its staff, managers, and licensees with guidance on how it will review requests to transfer licenses, including determining whether the new license holders would continue to operate under economic regulation or in an economically deregulated environment. This guidance



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is in the form of a standard review plan on nuclear power plant licensees' financial qualifications to operate their plants and assurances that the licensees will provide adequate funds to decommission the plants. The review plan discusses each of the review procedures that the NRC staff should use, as appropriate, to determine the adequacy of a prospective licensee's financial qualifications and decommissioning funding method(s). For example, the review plan discusses how NRC's staff should evaluate external sinking fund trust documents and other decommissioning financial assurance mechanisms.

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## Objectives, Scope, and Methodology

Concerned about the adequacy of decommissioning funds, particularly in deregulated markets, Representative Edward Markey asked us to determine how (1) transfers of licenses to operate or own nuclear power plants affected the level of assurance that adequate funds will be available to operate and decommission these plants, (2) various site cleanup standards and proposed alternative decommissioning approaches affect projected decommissioning costs, and (3) proposed changes in financial reporting standards affect disclosure and funding of decommissioning liabilities.

To determine how license transfers for nuclear power plants affected NRC's level of assurance that adequate funds will be available to decommission these plants, we reviewed NRC's Standard Review Plan on Power Reactor Licensee Financial Qualifications and Decommissioning Funding Assurance, as well as related memoranda, regulations, policy statements, regulatory analyses, and regulatory guidance. We contacted NRC's Office of Inspector General to discuss the weaknesses it had reported in licensee's biennial reports to NRC regarding decommissioning fund balances. At NRC's headquarters in Rockville, Maryland, we met with officials from NRC's offices of Nuclear Reactor Regulation and Nuclear Material Safety and Safeguards to discuss decommissioning financial assurance issues regarding non-owner operating arrangements, nuclear plant sales, corporate reorganizations, and mergers. We also reviewed licensee information provided to NRC regarding these license transfers, and analyzed NRC's review and approval documents related to license transfer requests submitted for 9 non-owner operating arrangements, 19 sales, 3 corporate reorganizations, and one merger.

To determine how site cleanup standards and proposed alternative decommissioning approaches affect projected decommissioning costs, we obtained, from EPA and NRC, and reviewed memoranda, regulations and other documentation addressing decommissioning and radiation

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protection standards. We reviewed published GAO reports that dealt with decommissioning financial assurance, nuclear waste disposal, radiation protection standards, and other related issues. We also reviewed a recent National Research Council report that questioned the reliability of long-term institutional management controls at nuclear waste sites. We also contacted EPA and NRC staff regarding efforts to resolve interagency disagreement over radiation protection standards and related issues, and met with staff from NRC's offices of Nuclear Reactor Regulation and Nuclear Material Safety and Safeguards to discuss issues regarding radiation protection standards, past decommissioning methods and experience, and proposed decommissioning alternatives and their potential impact on decommissioning cost. In addition, we reviewed the minutes from an August 1999 NRC public workshop dealing with decommissioning and proposed waste disposal options.

To acquire a first-hand perspective on decommissioning, we obtained and reviewed the license termination plans from and made visits to the Connecticut Yankee Atomic Power Company plant at Haddam, Connecticut, and the Maine Yankee Atomic Power Company plant at Wiscasset, Maine. At the Haddam plant, we met and discussed decommissioning issues with officials from the Connecticut Yankee Atomic Power Company, Bechtel Power Corporation (the decommissioning contractor), and the Connecticut Department of Environmental Protection. We also toured the Haddam Plant and observed ongoing decommissioning work within the reactor building (containment). In addition, we met with local members of the Citizens Awareness Network, a non-profit volunteer organization, to discuss issues and concerns regarding the decommissioning of the Haddam Plant. In Maine, we met with two state senators knowledgeable about the controversy over original decommissioning plans to rubble the Maine Yankee site and the involvement of the state legislature in the Maine Yankee decommissioning. We also met with a member of Friends of the Coast—a local citizens' environmental organization. We contacted officials from the Maine Department of Environmental Protection and Department of Human Services by telephone and discussed Maine Yankee decommissioning issues. In Washington, D.C., we met with members of the Nuclear Energy Institute, Union of Concerned Scientists, Nuclear Information and Resource Service, and Public Citizen to discuss decommissioning issues. In addition, we attended the Fifth Biennial Industry Conference on Decommissioning held in October 2000 and a NRC public decommissioning workshop held in November 2000.

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To determine how a recently adopted financial reporting standard will affect the disclosure and funding of decommissioning liabilities, we reviewed the annual reports and/or annual filings with the Securities and Exchange Commission (Forms 10 K) for 55 utility companies that own nuclear power plants. From those, we determined the methods currently used to account for decommissioning costs. We also reviewed FASB Exposure Draft No. 206-B entitled "Accounting for Obligations Associated with the Retirement of Long-Lived Assets," (adopted in June 2001 as FASB Statement No. 143) as well as selected responses of public accounting firms and utility companies to the Exposure Draft. From our review, we determined how the new standard would affect the financial statements of utility companies with nuclear power plants.

We performed our review between June 2000 and August 2001 in accordance with generally accepted government auditing standards.

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## Chapter 2: Most Restructuring License Transfers Have Maintained or Enhanced Assurance of Decommissioning Funding

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As a result of restructuring in the electricity industry, NRC has approved requests to transfer the licenses to own or operate more than one-half of the nuclear power plants in the United States. Some license transfer requests involved a single owner of one or more plants transferring licenses to own or operate the plant(s) to one or more new owners or operators. Other requests involved transfers of licenses to own or operate one or more plants from multiple owners of these plants. For most of the requests that NRC reviewed to transfer licenses for one or more plants, the level of assurance that the plants' decommissioning funds will be adequate has been maintained or enhanced. For example, when plant owners requested that their operating licenses for eight plants be transferred to a contractor, NRC maintained the existing level of assurance by continuing to hold the plant owners responsible for collecting decommissioning funds. In addition, when NRC approved requests to transfer licenses related to the sale of 15 plants, decommissioning funding assurances were increased because the selling utilities prepaid all or most of the projected decommissioning costs, and either the sellers or the new owners provided additional financial guarantees for those projected costs that were not prepaid. However, when NRC approved requests to transfer licenses in which the new licensee intended to rely on periodic deposits into external sinking funds for decommissioning, it did not always obtain the same level of financial assurance as when plants were sold or their operations contracted out. Among other things, NRC approved two requests to transfer ownership of 25 plants without verifying that the new owners would have guaranteed access to the decommissioning charges that their affiliated utilities would collect.

NRC also requires prospective new owners of plants that will not be selling their electricity at regulated rates to demonstrate their financial qualifications to safely own and operate the nuclear power plants that they are acquiring. In almost all of its reviews of new owners' financial qualifications, NRC has required additional guarantees from parent or affiliated companies that the new owners would have sufficient revenue to cover the plants' operating costs. However, when reviewing one prospective owner's financial qualifications, NRC did not require additional guarantees and did not validate the information submitted by the new owner to demonstrate that the company was financially qualified to safely own and operate the largest fleet of nuclear plants in the United States.

## Funding Assurance Is Maintained for License Transfers Related to Contracting Out Operations

The level of assurance that decommissioning funds will be adequate has been maintained in all license transfer approvals that allowed plant owners to contract out plant operations. For example, traditional electric utilities that own 17 nuclear power plants have used companies that specialize in the operation, maintenance, and decommissioning of nuclear power plants to help them operate or decommission their plants. The owners of fifteen of these plants had to get NRC's approval to transfer their operating licenses. For the other two plants, NRC decided that the proposed arrangements did not require transfers of operating licenses. (See table 1.) For all 15 operating license transfers, NRC continues to hold the owners responsible for accumulating decommissioning funds, and the owners continue to collect these funds through regulated electricity rates. Accordingly, these operating license transfers have not changed the level of decommissioning funding assurance for these plants.

**Table 1: Nuclear Power Plants With Non-owner Operating Arrangements**

Nuclear power plant	Operator's business arrangement with owner(s)	NRC operating license transfer required?
Duane Arnold Energy Center	Operating services agreement <sup>a</sup>	Yes
Kewaunee Nuclear Power Plant	Operating services agreement <sup>a</sup>	Yes
Monticello Nuclear Generating Plant	Operating services agreement <sup>a</sup>	Yes
Palisades Plant	Operating services agreement <sup>a</sup>	Yes
Point Beach Nuclear Plant, Unit 1	Operating services agreement <sup>a</sup>	Yes
Point Beach Nuclear Plant, Unit 2	Operating services agreement <sup>a</sup>	Yes
Prairie Island Nuclear Generating Plant, Unit 1	Operating services agreement <sup>a</sup>	Yes
Prairie Island Nuclear Generating Plant, Unit 2	Operating services agreement <sup>a</sup>	Yes
John M. Farley, Unit 1	Affiliated company <sup>b</sup>	Yes
John M. Farley, Unit 2	Affiliated company <sup>b</sup>	Yes
Edwin I Hatch, Unit 1	Affiliated company <sup>b</sup>	Yes
Edwin I Hatch, Unit 2	Affiliated company <sup>b</sup>	Yes
River Bend, Unit 1	Affiliated company <sup>b</sup>	Yes
Vogtle, Unit 1	Affiliated company <sup>b</sup>	Yes
Vogtle, Unit 2	Affiliated company <sup>b</sup>	Yes
Clinton Power Station	Management services agreement <sup>c</sup>	No
Maine Yankee Atomic Power Plant	Management services agreement <sup>c</sup>	No

<sup>a</sup>Operating licenses for eight plants were transferred to one company, Nuclear Management Company, which was formed by the plants' electric utility owners to provide operating and eventual decommissioning services for the plants. NRC approved the operating license transfers but continues to hold the utility-owners responsible for collecting decommissioning funds for the plants through their regulated electricity rates.

<sup>b</sup>Seven transfers of operating licenses resulted from corporate reorganizations or mergers in which an existing operations organization split off from an electric utility and formed a new affiliated company specializing in nuclear plant operations. The utility owners continue to collect decommissioning funds for the plants through their regulated electricity rates.

<sup>a</sup>In two cases, in which utility owners entered into management services agreements with outside companies to assist them with operating and decommissioning their plants, NRC did not require operating license transfers. In both cases, NRC determined that because the management services provided by the operating companies did not involve activities that would require a license, such as maintenance of safety-related equipment or the emergency preparedness program, and because the utility owners retained final decision-making authority, no transfer of operating authority had taken place that required NRC's approval. The utility owners continued to collect decommissioning funds through their regulated electricity rates.

Source: GAO's analysis of NRC data.

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## **Prepayment and Company Guarantee Methods Have Enhanced Funding Assurances When Licenses Are Transferred**

When NRC has approved license transfers for plants that chose the prepayment and guarantee methods, assurance of adequate decommissioning funding has been enhanced. To date, all the transfers that NRC has reviewed as a result of plant sales have chosen either total prepayment or a combination of these methods. For example, as a direct response to deregulation legislation in many Northeast, Mid-Atlantic, and Midwest states, NRC has approved the transfer of the ownership interests in 15 nuclear power plants from traditional electric utilities to newly formed generating companies. The utilities selling 13 of these plants proposed to transfer prepaid decommissioning trust funds to the generating companies. NRC concurred with these proposals and also imposed conditions on how the new owners must manage these funds to ensure that they are preserved and accumulate as projected in a market environment. For the other two plants, the selling utility—the Power Authority of the State of New York—chose to retain control of the prepaid decommissioning trust funds for its two plants and not transfer them to the new owners (Entergy Nuclear Indian Point 3 and Entergy Nuclear Fitzpatrick). Because the Power Authority would no longer be a licensed owner or operator of the two plants, NRC imposed additional conditions upon these license transfers, allowing NRC intercession to release funds for decommissioning if the Power Authority does not comply with its responsibility to do so.

In three transfers the accumulated trust funds did not cover small portions—less than 8 percent—of the projected decommissioning costs. In these cases, either the buyer's or the seller's parent or affiliated companies passed NRC's financial test and provided contractual guarantees that they would provide additional funds as needed. Consequently, NRC has assurances that all approved new plant owners will have adequate funds available to decommission their plants in a deregulated environment. Table 2 lists the 15 plant sales that NRC has approved, along with the projected amount of decommissioning funding needed and the amount available in the trust funds at the time of the sales.

Chapter 2: Most Restructuring License  
Transfers Have Maintained or Enhanced  
Assurance of Decommissioning Funding

**Table 2: Decommissioning Funds Needed, Transferred, and Assurance Methods Used for Nuclear Power Plants Approved for Sale**

Dollars in millions				
Nuclear power plant	Percent sold	Projected funds needed	Funds approved to transfer	Decommissioning assurance method
Clinton Power Station	100.00	\$347.880	\$210.000	Prepayment + 2% interest <sup>a</sup>
James A Fitzpatrick	100.00	\$358.000	\$343.968 <sup>b</sup>	Prepayment + 2% interest <sup>a</sup> + guarantee
Hope Creek	5.00	\$18.014	\$9.681	Prepayment + 2% interest <sup>a</sup>
Indian Point, Unit 3	100.00	\$292.000	\$315.225 <sup>b</sup>	Prepayment + guarantee
Millstone, Unit 1 <sup>c</sup>	100.00	\$504.481	\$293.712	Prepayment + guarantee + 2% interest <sup>a</sup>
Millstone, Unit 2	100.00	\$298.630	\$252.944	Prepayment + 2% interest <sup>a</sup>
Millstone, Unit 3	93.47	\$316.728	\$246.838	Prepayment + 2% interest <sup>a</sup>
Oyster Creek	100.00	\$333.462	\$400.000	Prepayment
Peach Bottom, Unit 2	15.02	\$56.401	\$44.775 <sup>d</sup>	Prepayment + 2% interest <sup>a</sup> + guarantee
Peach Bottom, Unit 3	15.02	\$56.401	\$46.202 <sup>d</sup>	Prepayment + 2% interest <sup>a</sup> + guarantee
Pilgrim	100.00	\$327.000 <sup>e</sup>	\$396.000	Prepayment
Salem, Unit 1	14.82	\$44.000	\$36.837	Prepayment + 2% interest <sup>a</sup>
Salem, Unit 2	14.82	\$44.000	\$35.635	Prepayment + 2% interest <sup>a</sup>
Three Mile Island, Unit 1	100.00	\$268.870	\$303.000	Prepayment
Vermont Yankee	100.00	\$328.300 <sup>f</sup>	\$280.000 <sup>f</sup>	Prepayment + 2% interest <sup>a</sup>

<sup>a</sup>NRC requirements in 10 CFR 50.75(E)(1)(i) and (ii) for the prepayment and external sinking fund assurance methods, respectively, allow licensees to take credit for future earnings on their trust funds at a real rate of return (i.e., adjusted for inflation) of up to 2 percent per year. Licensees may claim higher rates if specifically authorized by their rate regulator.

<sup>b</sup>The seller does not plan to transfer these funds to the new owner and will instead retain the trusts after the plants are sold. The seller has provided a guarantee that the funds will remain available for decommissioning. In addition, the seller has agreed, as a condition of the trust agreements that, since it will no longer be licensed, NRC may intercede to release the funds, if needed.

<sup>c</sup>This plant, permanently shut down in July 1998, has been defueled and placed in a "Cold and Dark" state by the seller. These funds are based on a site-specific estimate and include the buyer's parent company guarantee of \$25,423,666. The funds are intended to support annual monitoring costs of \$2,947,285 during SAFSTOR and to accumulate until 2054, when final decommissioning is anticipated.

<sup>d</sup>These funds are the cumulative funds collected by 2 utilities with equal selling shares; however, one utility has collected less than half of this amount. Originally both utilities, as subsidiaries of a single holding company, were to complete their sales at the same time and their combined funds were sufficient for prepayment assurance. However, the utility with the larger accumulation of funds delayed its transfer awaiting approval from its state public utility commission. Because the utility with less accumulated funds consummated its sale first, the other affiliated utility has guaranteed to make up the difference up to 50 percent of their cumulative amount until it completes its divestiture.

<sup>e</sup>This amount is the NRC generic formula estimate. A site-specific site cost estimate placed costs between \$396 million and \$466 million. The seller agreed to transfer \$396 million to the buyer's decommissioning trust account and to create a provisional trust account of \$70 million to cover the potential taxes that might be due. Any funds left in the provisional trust account after taxes, as of December 31, 2002, will be deposited in the decommissioning trust account.

<sup>f</sup>These are the amounts NRC approved in 2000; however in January 2001, the Vermont Public Service Board nullified this sale and, in the hope of receiving a better offer, ordered that the plant be sold at auction. These amounts will most likely change when the sale is consummated.

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Source: GAO's analysis of NRC data.

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## Funding Assurance Was Not Always Maintained in License Transfers That Continued to Rely on the External Sinking Fund Method

In approving license transfer requests that continued to rely on the external sinking fund method of decommissioning financial assurance, NRC's reviews did not consistently maintain the level of assurance that decommissioning funds would be adequate, as it had for license transfers that relied on prepayment or company guarantees. In most cases, the new owners, as a result of corporate reorganizations or mergers, are no longer considered traditional electric utilities that will collect decommissioning funds through predetermined rates, but instead are affiliated with electric utilities authorized by their state regulators to collect non-bypassable charges for decommissioning.<sup>1</sup> These affiliated utilities will not be licensed by NRC. While NRC's review plan does not explicitly describe procedures for its staff to follow in these situations, it does imply that the new owners should provide NRC with additional information regarding the calculation and collection of these charges and ways they will be deposited into their trust funds. NRC, however, did not consistently request this additional information, when owners did not provide it. Consequently, NRC was unable to consistently maintain assurance that these funds would accumulate adequately when new owners rely on the traditional external sinking fund assurance method in a deregulated environment.

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## NRC Did Not Always Verify That New Plant Owners Would Have Access to Collected Decommissioning Charges

Our review of NRC's approval of license transfers for 28 plants from 3 corporate reorganizations and one merger revealed that the new plant owners had varying degrees of access to the future decommissioning charges collected for their plants. Even though NRC's regulations allow non-bypassable charges as an acceptable accumulation mechanism for external sinking funds, it assumes that NRC licensees will either collect these charges or have direct access to them. NRC did not consistently assure that when unlicensed affiliated utilities collect the charges, they would deposit them into the new owners' decommissioning trust funds.

For 3 of the 28 plants—units 1, 2, and 3 of the Palo Verde nuclear power facility in Arizona—NRC placed conditions on its approval of the license

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<sup>1</sup> Non-bypassable charges are charges imposed over an established period of time by a government authority (such as a public utility commission) that affected entities are required to pay to cover the costs associated with the decommissioning of a nuclear power plant. Such charges include, but are not limited to, wire charges, stranded cost charges, transition charges, exit fees, or other similar charges.



transfers that contractual arrangements for collection and deposit of earmarked funds into the new licensees' decommissioning trust funds be completed. The three units are jointly owned by several traditional electric utilities, including the Public Service Company of New Mexico and El Paso Electric Company of Texas. These two companies are reorganizing their corporate structures to comply with new requirements to supply energy in New Mexico under deregulation. In accordance with these deregulation efforts, the two companies requested that NRC transfer their respective ownership licenses in the Palo Verde plants to new generating companies formed out of their corporate reorganizations—Manzano Energy Corporation in New Mexico and MiraSol Generating Company in Texas. In effect, these new generating companies also will inherit the external sinking funds intended to cover their respective shares of responsibility to eventually decommission the Palo Verde units. However, these external sinking funds were not sufficient to qualify as prepayment of estimated decommissioning costs. Therefore, each company provided NRC with copies of contractual agreements requiring their affiliated utilities to:

- collect decommissioning funds through their charges for distributing electricity in their service areas (also known as non-bypassable wires charges) imposed by their respective state public utility commissions or other regulatory entities, and
- deposit the collected money into the new generating companies' decommissioning trust funds periodically.

NRC approved the license transfers subject to obtaining final copies of the agreements between the affiliated utilities and the new generating companies and schedules showing how the decommissioning charges approved by the New Mexico and Texas state public utility commissions would fund the total decommissioning costs.<sup>2</sup> In both cases, NRC assured that the decommissioning charges collected by their affiliated utilities would be deposited into the new companies' external sinking funds and that the states' public utility commissions were assuring that the charges collected would be sufficient to cover the total decommissioning costs.

However, NRC approved applications to transfer the licenses for the other 25 plants without verifying that the new owners would have the same degree of access to the decommissioning charges or that the states' public

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<sup>2</sup> The New Mexico legislature has extended the implementation of deregulation in its state for 5 years, and as a result, these corporate reorganizations have been postponed.

utility commissions would ensure the collection of the total decommissioning costs. For example, the Public Service Electric and Gas Company's (PSEG) corporate reorganization involved decommissioning trust funds for 5 plants. The New Jersey Board of Public Utilities authorized PSEG to continue collecting decommissioning funds through its distribution rates, yet NRC approved the trust funds to be transferred to PSEG Nuclear, the newly-formed generating company. NRC did not question the access PSEG Nuclear had to the funds collected by PSEG, its affiliate utility. In addition, NRC did not require a copy of a contractual agreement between the affiliates that guaranteed periodic deposits to the new owner's decommissioning trust funds as it did for Manzano Energy and MiraSol Generating Company. In support of its approval for these transfers, NRC staff told us that they also used publicly available sources of information, such as state restructuring laws or public utility commission web sites, when new owners did not provide information with their applications. Unfortunately, the staff did not document the content or use of such information in the records of these license transfer approvals so we could not verify the adequacy of NRC's review. Also, in the case of the five plants, the New Jersey restructuring legislation had authorized these charges. After 4 years, the Board of Public Utilities planned annual reevaluations to determine whether the decommissioning funds were overfunded or underfunded and then to authorize further charges accordingly. NRC's records do not show that its staff evaluated how New Jersey's proposed charges would affect the accumulation of the total costs needed to decommission each individual plant, despite guidance in its review plan and previous instances when the prepayment and company guarantee methods had been used. Yet, NRC approved the transfers after assuring itself that, in the aggregate, the 5 plants would achieve the full funding of their required decommissioning costs by the time they cease operations.

More significantly, in the merger of two companies that involved 20 nuclear plants in Illinois, New Jersey and Pennsylvania, the existing and new companies involved in the merger did not provide, nor did NRC request, copies of contractual agreements documenting that monies to be collected from utility customers in the states would be deposited in the respective decommissioning trust funds for each of the 20 plants. In this restructuring transaction, Unicom (the parent company of the electric utility known as Commonwealth Edison Company) and PECO Energy Company merged to form a parent entity—Exelon Corporation—and several wholly-owned subsidiary companies, including Exelon Generation Company, Commonwealth Edison, and PECO. The generating subsidiary company became the legal owner of Exelon Corporation's electricity

generating assets. These assets included Commonwealth Edison's 10 operating nuclear power plants and 3 retired nuclear plants that have not yet been decommissioned. In addition, the assets included six operating and one retired nuclear power plant owned by PECO. The latter two subsidiary companies transmitted and distributed the electricity supplied by the generating subsidiary to electricity customers. As a part of this electricity restructuring, both Commonwealth Edison and PECO retained their responsibilities to collect charges from their customers for the future decommissioning of the 20 nuclear power plants now owned by Exelon Generation Company.

When Commonwealth Edison and PECO requested that NRC approve their proposed merger, the two utilities submitted similar, if not identical, statements that they would continue to collect decommissioning funds for their 20 nuclear power plants through their electricity distribution rates. The utilities added that they would also, as a matter of contract, transfer the funds collected to Exelon Generation Company—which would hold the operating licenses for the 20 plants—for deposit in each plant's respective decommissioning trust fund. However, unlike the license transfer cases involving the restructuring of Public Service Company of New Mexico and El Paso Electric, discussed above, Commonwealth Edison and PECO did not enclose copies of any intercompany agreements or rulings from their respective public utility commissions documenting these fund transfer arrangements. Furthermore, NRC neither requested either of the two utilities to submit such documentation nor, in the orders transferring the licenses for the 20 plants, did the NRC place any conditions that guaranteed that the utilities would collect and deposit decommissioning funds into the plants' trust funds held by Exelon Generation Company. Nevertheless, NRC's documents approving the Exelon merger state that Commonwealth Edison and PECO will collect the decommissioning costs through their distribution rates and then, as a matter of contract, pay these amounts to their affiliate, Exelon Generation Company, for deposit in the trust funds for each plant.

NRC's staff told us that they did not request documentation regarding Exelon Generation Company's access to the collected charges because this issue was covered by the deregulation legislation enacted in Illinois and Pennsylvania, copies of which they had obtained from publicly available sources. Conversely, because the implementation of the deregulation legislation in New Mexico and Texas had been delayed, the NRC staff needed to be sure that it received final copies of any agreements in the Palo Verde plants' transfers in order to assess their viability against any new legislative changes. However, neither Illinois' nor Pennsylvania's

deregulation legislation refers to an unregulated newly-formed company's access to the charges collected by regulated affiliated utilities. We did locate an inter-company agreement attached to Commonwealth Edison's public-utility commission submission for approval of the merger, providing evidence that such an agreement exists and that the Illinois public utility commission is overseeing this access issue. However, NRC had no record of this agreement or the Commonwealth Edison and PECO submissions to their respective state public utility commissions. Also, while NRC staff told us that they accepted the companies' application as sworn statements that contractual arrangements existed, they did not document the basis for this opinion in their evaluation of the license transfer.

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### Accumulation of Decommissioning Funds for Retired Plants Is Also a Concern

Concerns have also surfaced over whether the collection of utility surcharges is sufficient to cover total decommissioning costs when plants are prematurely shut down. NRC's review plan provides procedures for verifying the accuracy of annual deposits to such funds when plants are operating. However, when plants are prematurely shutdown, the plan does not provide staff procedures to follow, leaving them instead to determine how to review the funds on a case-by-case basis. NRC's approval documents state that the decommissioning funding mechanism for all 20 of Exelon Generation Company's plants—16 operating and 4 retired—is the regulated charge collected by its distributing utility affiliates and that the collecting utility will make deposits into the decommissioning trust funds over the generating life of each plant. If the plants no longer generate electricity, it is not clear from the information the utilities submitted or NRC's review plan just how the funds would be collected, much less (as discussed above) how the deposits would be made to the trust accounts of the closed plants. NRC staff subsequently told us that their review of the Illinois and Pennsylvania restructuring laws showed that they allow for the collection of non-bypassable charges for plants that are shutdown and that their evaluation report was in error on this point. However, the staff evaluation of this publicly available information is not documented in NRC's license transfer records for this merger.

In addition, NRC did not apply the same review standards when it approved the transfers for these four retired plants as it did for another retired plant,<sup>3</sup> Millstone 1, which was recently sold along with its sister

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<sup>3</sup> The four retired plants are Dresden, Unit 1 and Zion, Units 1 and 2 in Illinois and Peach Bottom, Unit 1 in Pennsylvania.

plants that are currently operating. Dominion Resources, Inc., the new owners' parent company, showed NRC the expected annual accumulation of funds, forecast an expected shortfall of \$26 million resulting from additional annual monitoring costs incurred while the plant awaits the retirement of its sister plants, and provided a company guarantee for this expected shortfall. In contrast, neither Commonwealth Edison nor PECO provided more detailed information for the 4 retired plants than they did for the 16 operating plants. The application documents that Commonwealth Edison and PECO provided and NRC's approval documents make it difficult to discern

- which phase of dismantlement these 4 plants are in;
- how much, if any, of the trust funds has been spent so far shutting down the plants;
- whether Exelon Generation Company will incur unanticipated long-term stewardship expenses as a result of having to monitor these plants (as was the case of the Millstone retired plant); or
- which costs in the site specific estimates of these retired plants might impact Exelon Generation Company's ability to effectively decommission the facilities or safely operate their collocated plants.

NRC staff told us that their regulations do not require this level of detail to review the status of decommissioning funds for retired plants; however, they could not document that these plants had been evaluated on a case-by-case basis as their review plan recommends. Despite these ambiguities, NRC concluded that Exelon Generation Company had provided adequate assurance, even though it continued to rely on the external sinking funds transferred from Commonwealth Edison and PECO, that it would, in a deregulated environment, accumulate sufficient funds to decommission almost one-fifth of the nuclear plant fleet of the United States.

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## NRC's Reviews of New Owners' Financial Qualifications Have Been Complete, With One Significant Exception

Although NRC generally followed the guidance contained in its review plan when reviewing the financial qualifications of prospective licensees, it did not follow this guidance when it reviewed the financial qualifications of Exelon Generation Company to own and operate the 20 nuclear power plants formerly owned by Commonwealth Edison and PECO.

NRC requires prospective new owners of plants that do not qualify for "electric utility" status—licensees that will not be selling their electricity at regulated rates—to demonstrate that they are financially qualified to safely own and operate the nuclear power plants that they are acquiring. To review this aspect of proposed license transfers, NRC's review plan

recommends that prospective new licensees demonstrate their financial qualifications to safely own and operate their nuclear power plants for the next 5-years by means of (1) contractual agreements with utilities that will purchase electric power from the licensee; (2) the sale of power from the licensee's non-nuclear generating capacity; (3) projections of market prices for the sale of power not covered by agreements; or (4) parent or affiliate company guarantees or lines of credit for contingency operating funds. NRC also compares a licensee's expected annual electricity production from its plants with past performance to determine the reasonableness of these projections. NRC uses this information to determine whether the prospective owners have demonstrated that they possess, or have reasonable assurance of obtaining, sufficient revenue to safely own and operate each plant.

For 19 sales, 2 reorganizations, and 1 merger—collectively involving transfers of licenses for almost 50 nuclear power plants—that we reviewed,<sup>4</sup> NRC found that the new licensees did not qualify for electric utility status.<sup>5</sup> Except for the merger, NRC received additional guarantees from parent or affiliated companies that the new owners would have sufficient revenue to cover the plants' operating costs. For example, the prospective new owners provided NRC additional assurance that they would produce enough revenue to cover the expected operating expenses of their plants through power purchase agreements, contingency funds, and lines of credit from affiliated or parent companies. In addition, one new generating company cited anticipated revenue from the sale of non-nuclear power that amounted to almost 75 percent of its total electricity production to supplement its ability to support its minority interest in 3 plants.

For each of the sales and reorganizations, the new owners provided some form of financial assurance for their ability to safely own and operate the plants they proposed to own in addition to the market sale of the electricity produced by the plants. NRC staff evaluated this information according to the guidance in its review plan. For the merger, however, the new owner did not submit and NRC did not request additional guarantees.

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<sup>4</sup> The number of license transfers or transactions reviewed and plants affected are not equivalent. In many cases plant owners have reorganized, merged or sold their interests in the same plants and many plants have multiple owners.

<sup>5</sup> In one other reorganization, NRC found that the new licensee qualified as an electric utility.

In addition, NRC did not validate the information submitted by the new owner to demonstrate that the company was financially qualified to safely own and operate the largest fleet of nuclear plants in the United States.

When Unicom (Commonwealth Edison) and PECO merged into Exelon Corporation, the subsidiary Exelon Generation Company, which would hold the NRC operating licenses for the two companies' 16 operational and 4 retired nuclear power plants, did not meet NRC's definition of an electric utility. However, in their applications to NRC, Commonwealth Edison and PECO asked NRC to transfer their plants' licenses to Exelon Generation Company on essentially the same terms and conditions contained in their existing licenses—licenses which reflected that, as economically regulated utilities, Commonwealth Edison and PECO had guaranteed access to revenues to own and operate their nuclear plants. Commonwealth Edison and PECO addressed the issue of assurance that Exelon Generation Company would be financially qualified to own and operate their nuclear power plants by providing NRC with 5-year projections of expenses from the production and purchase of electricity and revenues from the market sale of this electric power. Among other things, this information included the estimated costs of:

- operating the new company's 16 operational nuclear power plants;<sup>6</sup>
- purchasing excess electric power from six nuclear power plants owned, or to be owned, by AmerGen Corporation. AmerGen, which was half-owned by PECO, was created to market electricity generated from power plants purchased and operated for that purpose. At that time, AmerGen owned three nuclear power plants and was attempting to purchase three other nuclear plants; and
- purchasing electricity from other suppliers for resale to Exelon customers, fuel costs, asset depreciation, and other administrative costs.

In addressing its potential revenue, Commonwealth Edison and PECO provided NRC with projections of revenues from, primarily, the sale of electricity produced by the 16 nuclear plants and the resale of the electricity purchased from AmerGen and other suppliers. Additional income, amounting to 6 percent of the total electric power to be sold, was

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<sup>6</sup> Of these 16 plants, Commonwealth Edison and PECO owned majority interest and operated 14 plants. At two plants, Salem-Units 1 and 2, PECO owned a 42.59 percent interest and PSEG Nuclear operates the plants. Neither Commonwealth Edison nor PECO estimated annual electricity generation costs and revenue for individual plants.

derived from the market sale of 5,000 megawatts of power from non-nuclear plants.

Although Commonwealth Edison and PECO provided a financial projection to NRC in their license transfer applications, neither company provided, nor did NRC request, any additional support—power purchase agreements, contingency fund guarantees, or lines of credit—that would enable NRC to validate the Exelon Generation Company’s financial qualifications to own and operate the largest fleet of nuclear plants in the United States. Also, Exelon did not provide, and NRC did not request, the 5-year projections of operating costs and estimated annual electricity generation for individual plants. For this reason, NRC could not, as its review plan recommends, compare plant-specific costs and production estimates to plants of similar size and type to confirm the reasonableness of the projections. Nonetheless, NRC concluded that Exelon’s projected revenues, based solely on the market sale of electricity, would be sufficient to cover the costs associated with owning and operating 16 plants, even if it experienced simultaneous 6-month shutdowns of several of these nuclear plants.

Furthermore, NRC eventually transferred the licenses to Exelon Generation Company on the basis of projected financial information that both the affected companies and NRC knew to be inaccurate. When Commonwealth Edison and PECO updated their projected income statements for NRC in March 2000, they included income from three nuclear plants that AmerGen was attempting to purchase. However, there were no notes on this income statement to clarify that the statements included projected revenue from sales of electricity to be produced at nuclear plants that AmerGen did not yet own. (In contrast, Exelon Corporation did disclose this contingency in merger-related filings submitted to the Securities and Exchange Commission.) In June 2000, the merging utilities notified NRC that their March 2000 income statement was the most accurate. A month earlier, however, AmerGen had notified NRC that it had withdrawn its bid to purchase the two Nine Mile Point plants in New York. By December 2000 it was also apparent that AmerGen’s bid to purchase the Vermont Yankee plant would not succeed. Therefore, AmerGen owned just 3 of the 6 plants Exelon Generation Company had included in its financial qualification statement. In January 2001—over 1 year after receiving the initial merger applications—NRC transferred Commonwealth Edison’s and PECO’s licenses to own and/or operate 20 nuclear power plants to Exelon Generation Company on the basis in part of projected financial information known to be inaccurate by the companies and NRC.



In defense of their review of the merger, NRC staff told us that their regulations only require that licensees demonstrate financial assurance through credible projections of 5 years of expenses and revenues. Also, because Exelon Generation Company was to be the licensee for all 16 operating plants, there was no compelling need to require plant specific information. The NRC staff maintain that they did perform an analysis of the impact of AmerGen's lost bids for the Nine Mile Point and Vermont Yankee plants and determined that there was no material impact on Exelon Generation Company's financial qualifications. Unfortunately, NRC did not document this evaluation in its review file and did not update the financial projections in their evaluation report to accommodate this analysis.

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## Conclusions

NRC's inconsistent review and documentation of license transfer requests creates the appearance of different requirements for different owners or different types of transfers. Good business practices suggest that NRC follow one review process with all of its licensees. While its standard review plan offers a sound basis for obtaining consistency, NRC is clearly not consistently achieving the desired results. One modification that could help NRC's staff and management maintain consistency in their reviews of license transfers is the use of detailed checklists or step-by-step processes delineated more precisely within its standard review plan.

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## Recommendation for Executive Action

To ensure that the decommissioning assurance methods and financial qualifications of all new nuclear plant owners are consistently verified, validated, and documented, we recommend that the Chairman, NRC, revise the Commission's standard review plan and related management controls for reviewing license transfers to include a checklist or step-by-step process for its staff, its management, and prospective owners to follow.

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## Agency Comments and Our Response

We provided NRC with a draft of this report for its review and comment. (See app. I for NRC's comments.) NRC disagreed with our recommendation. According to NRC, revising its review plan will not greatly enhance the effectiveness of its license transfer reviews because many of these transfers have been complex and unique. We disagree. When NRC drafted its review plan, it had no experience in regulating licensees that generate electricity in competitive markets. Since then, NRC has processed over 60 requests to transfer licenses. Although the details of each transfer request may have been unique, the affected

licensees have consistently used the same few basic methods permitted by NRC's regulations, such as prepayment and/or parent company guarantees, to provide NRC with assurance that decommissioning funding and financial qualifications are being met. However, NRC's reviews of these license transfer requests have been inconsistent. Therefore, revising the review plan to ensure, on the basis of NRC's experiences to date, that each decision to approve a license transfer is based on consistent supporting information could increase NRC's efficiency and effectiveness, thereby helping NRC to achieve one of its primary performance goals.<sup>7</sup>

NRC raised several issues regarding its reviews of the adequacy of decommissioning funding and the financial qualifications of new owners of plants. NRC said its reviews of the PSEG and Exelon license transfers were adequate and complete, led to the conclusion that there was reasonable assurance of decommissioning funding and, in the Exelon case, that the new owners were financially qualified. NRC acknowledged that it did not appropriately document some of these evaluations. However, NRC asserted that, by reviewing other, unspecified, sources of financial information and information on the appropriate state's non-bypassable charges requirements, it was able to obtain reasonable assurance of decommissioning funding and financial qualifications. We disagree, for reasons that go beyond the lack of review documentation. Specifically, NRC's staff could not, in response to our requests, identify the specific sources upon which they relied, but did not document, for other information. Furthermore, we independently reviewed the state laws on non-bypassable charges for decommissioning funding that NRC's staff had referred us to and found that, while these laws provided for utilities to collect these charges, the statutes were silent on the procedures for depositing the charges collected into the plants' decommissioning funds. These collection and transfer procedures were left to appropriate state public utility commissions and, in many cases, had not been determined

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<sup>7</sup> NRC's four performance goals are to maintain safety, increase public confidence, reduce unnecessary regulatory burden, and enhance the effectiveness and efficiency of its activities and decisions.

when NRC conducted its license transfer reviews. Nevertheless, NRC did not require the prospective new plant owners to make binding commitments with affiliated utilities or other enforceable statements of assurance that the non-bypassable charges collected by these utilities from their electricity customers would be transferred to the appropriate decommissioning fund for the new owners' plants.

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# Chapter 3: Regulatory Policies Under Consideration May Affect Decommissioning Costs and Nuclear Waste Policies

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Varying radiation cleanup standards, the possibility that NRC will approve alternative decommissioning methods, and incomplete historical plant contamination data confound a licensee's ability to estimate future decommissioning costs. Varying radiation cleanup standards create uncertainty because plants decommissioned to NRC's radiation cleanup standards may also have to meet more stringent EPA or state standards, thus increasing the costs of decommissioning. Alternative decommissioning methods under consideration for approval would add uncertainty because no reliable data exist on their overall costs; they could reduce short-term decommissioning costs but add considerably to long-term costs. Moreover, implementing these methods would raise significant technical and policy issues pertaining to the management and disposal of radioactive wastes. Furthermore, the lack of complete historical information regarding plant contamination can translate into an unexpected increase in site cleanup costs late in the decommissioning process.

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## Varying Cleanup Standards Create Cost Uncertainties

To terminate an operating license and to release a site for unrestricted use, an NRC licensee must decommission its plant so that the residual radiation remaining at the site after decommissioning has been reduced to levels that meet NRC's standard.<sup>1</sup> However, meeting NRC's radiation cleanup standard may not signal the end of the decommissioning costs, because either EPA or the host state could require additional cleanup activity to meet more stringent standards.

While NRC regulates the decommissioning of commercial nuclear facilities, EPA issues general standards for radiation protection and administers CERCLA, which governs the cleanup of contaminated facilities.<sup>2</sup> NRC and EPA have historically disagreed on how restrictive U.S. radiation protection standards should be, and in 1997, EPA's Administrator told NRC's Chairman that NRC's radiation cleanup standard should be tightened to 15 millirems per year. The Administrator also called for adding a separate standard limiting the concentration of radiation in

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<sup>1</sup> Under regulations issued by NRC in 1997, decommissioned sites that are decontaminated to residual radiation levels of 25-millirems or less may be released for unrestricted future uses. Decommissioned sites with elevated residual radiation levels of up to 500-millirems may only be released for restricted use, with safeguards and institutional controls to prevent public exposure.

<sup>2</sup> NRC's regulatory authority derives from the Atomic Energy Act, while EPA's derives from Presidential Reorganization Plan No. 3 of 1970 and CERCLA.

groundwater to 4-millirems per year.<sup>3</sup> These limits would be consistent with EPA's standards for cleanup at Superfund sites. If NRC did not agree, the Administrator said, EPA would have to reconsider its policy of exempting the sites of facilities regulated by NRC from EPA's National Priorities List of Superfund sites. Such action could subject NRC-decommissioned and released sites to a second evaluation under EPA's Superfund standards. EPA could conduct these subsequent evaluations under its own authority or when asked to do so by other stakeholders. It has provided guidance to its regional offices on how to proceed in such instances. However, the agency believes that the vast majority of decommissioned nuclear power plants will meet Superfund protection standards and is not actively looking for NRC sites to evaluate. Nevertheless, failure to pass a Superfund evaluation could mean significant additional cleanup costs.

NRC, however, shows no sign of changing its standards. NRC disagrees with EPA's preferences and questions EPA's technical basis for proposing the extra groundwater protection. Differences in agency missions, legislative mandates, and regulatory strategies contribute to this disagreement, which, despite resolution efforts spanning a number of years, remains essentially unresolved.<sup>4</sup>

According to the NRC Chairman, the disagreement over acceptable radiation standards is eroding public confidence and is negatively affecting efforts to assure the public that decommissioning can be accomplished in a manner that protects public health, safety, and the environment. In fact, in part because of the uncertainty over the scientific basis supporting radiation protection standards and the dispute between EPA and NRC, several states have established, or are in the process of establishing, their own radiation protection standards. Because most of these proposed or

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<sup>3</sup> EPA does not actually express radiation protection standards in millirems but uses a system of "slope factors" to assign risk limits to individual chemical and radioactive contaminant types alike. These limits equate to a risk threshold of 1 in 1,000,000 that an individual will develop cancer in a lifetime or, with regard to radiation, roughly to a 15-millirem-a-year all-pathway radiation dose limit and a separate four-millirem-a-year dose limit for groundwater.

<sup>4</sup> *Radiation Standards: Scientific Basis Inconclusive, and EPA and NRC Disagreement Continues* (GAO/RCED-00-152, June 30, 2000); *Nuclear Regulation: Better Oversight Needed to Ensure Accumulation of Funds to Decommission Nuclear Power Plants* (GAO/RCED-99-75, May 3, 1999); and *Aging Nuclear Power Plants: Managing Plant Life and Decommissioning* (U.S. Congress, Office of Technology Assessment, OTA-E-575, Sept. 1993).

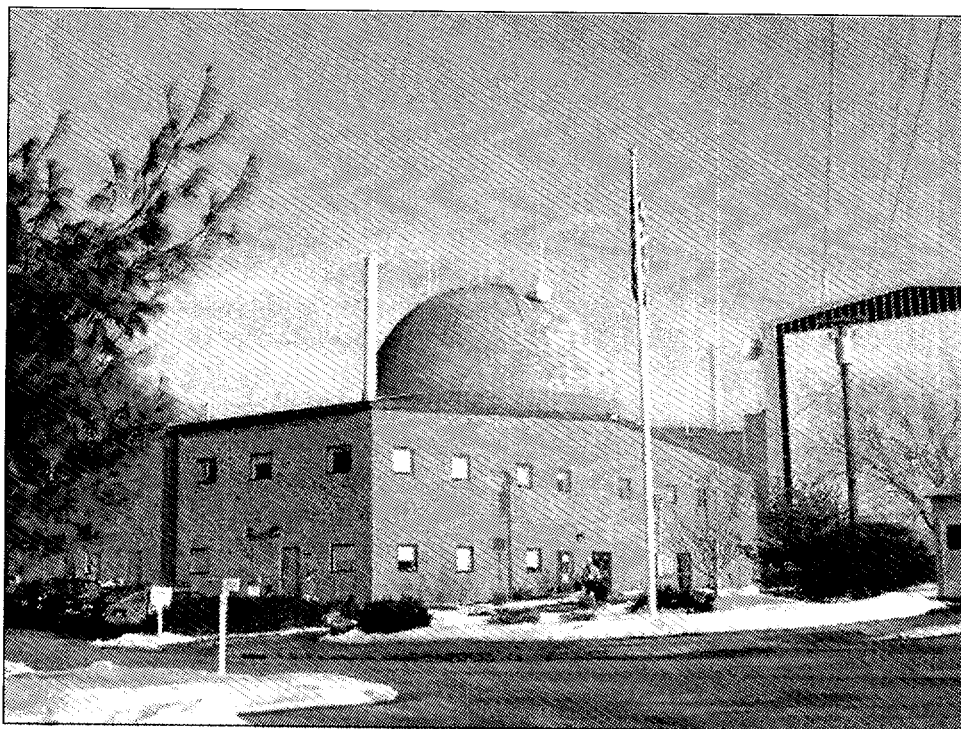
existing state standards are more stringent than either EPA's or NRC's standards, implementation of the states' standards could increase decommissioning costs.

For example, in April 2000, the state of Maine imposed a standard limiting the total effective annual dose from residual contamination at the Maine Yankee nuclear plant site to 10 millirems, with a separate 4-millirem dose standard for groundwater—which is below the dose allowed under either NRC's standard or EPA's preferred standard. Maine Yankee officials estimated that it would cost between \$25 million and \$30 million to ship and dispose of the waste materials that must be disposed of to meet the state's more restrictive standard.

Similarly, Massachusetts has set its own total effective annual dose equivalent standard of 10-millirem for decommissioned sites and New York has set a soil cleanup standard of 10-millirem for radioactive materials. New Jersey has set a 15-millirem residual radiation exposure standard, and the state of Connecticut is presently developing its own cleanup standards for commercial nuclear facilities. According to a state environmental department official, the new standard has not yet been officially approved, but will be the approximate equivalent of a 19-millirem dose limit, with a requirement to further reduce dose if it proves economically and environmentally feasible to do so. According to officials of the state and the Connecticut Yankee Power Company, the utility and the state are working together to ensure that the company will comply with the state's new standard, when issued, as well as NRC's and EPA's standards, in the decommissioning of the company's Haddam Neck nuclear power plant.

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Figure 3: The Decommissioning Connecticut Yankee Haddam Neck Plant



Source: GAO.

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### Alternative Decommissioning Methods May Marginally Decrease Costs but Raise Significant Technical and Policy Issues

NRC is considering whether to authorize licensees to leave more radioactively-contaminated material at their plant sites when decommissioning nuclear power plants by either (1) reducing contaminated concrete to rubble and then burying the rubble on site or (2) removing the most radioactive plant wastes and entombing the residual radioactive materials inside the thick, reinforced concrete containment structure of retired plants. The rubblization and entombment methods could, if approved and implemented, decrease off-site waste disposal costs during the decommissioning of plants. However, short-term cost savings for some sites could be more than offset over the long-term because institutional control measures will be needed to prevent public access.

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### Short-Term Cost Savings Could Be Offset Over Time

According to the NRC Chairman, the low-level radioactive waste program in the United States is not working and the potential exists for the decommissioning process to be hampered at many sites unless alternative disposal options are pursued. States, the nuclear industry, and others have

voiced similar concerns. Therefore, within the limits of its regulatory authority, NRC is considering decommissioning methods such as rubblization and entombment that would allow the permanent burial or encasement of radioactive waste at nuclear plant sites.

NRC believes that it is technically possible to approve a license termination plan that includes rubblization, as long as the total effective annual dose of radiation that a person living at the site would receive did not exceed the Commission's standards. Rubblization will be technically possible, NRC believes, as long as licensees are able to successfully address related issues, such as access to, and digging at, the sites where rubblization has occurred and the potential for reuse of extracted materials that are contaminated with radioactive elements.

Rubblization represents a departure from NRC's past licensing practice, which emphasized shipping low-level radioactive wastes from decommissioning sites to disposal facilities. Although NRC has estimated that rubblization could save a licensee from \$10 million to \$16 million in waste disposal costs during decommissioning, its Advisory Committee on Nuclear Waste has concluded that technical factors, such as the depth of radioactive contamination and the volume of rubblized waste, could significantly diminish the potential cost savings. The Advisory Committee also believes that evaluating radioactive material content and doses from rubblization, both at the site and in local groundwater, may prove difficult and expensive. The Committee has cautioned that estimates of cost savings from rubblization could be offset if extensive decontamination, sampling, and analyses are needed. Therefore, the Committee has recommended that NRC establish a test case for study to identify possible problems and solutions related to rubblization.

In April 1997, NRC's commissioners also requested NRC staff to revisit the entombment method of decommissioning, the use of which the commission had discouraged a decade earlier, to determine whether that method serves as a viable alternative to completely dismantling nuclear plants. The Commission added that, if the staff concluded that entombment is not a viable decommissioning method, the staff should describe the technical requirements and regulatory actions necessary for entombment to become viable, including the resources involved, potential decommissioning cost savings, and vulnerabilities.

NRC had considered entombment as a decommissioning method in 1988 but generally opposed its use because, among other things, (1) the method would require expenditures for maintenance, security, and other long-term



institutional controls for at least 100 years that would about equal dismantlement costs and (2) regulatory changes occurring during the long entombment period might require additional costly decommissioning activity before entombed sites could be released for unrestricted use in the future. NRC determined that entombment would be acceptable only on a case-by-case basis when a licensee could demonstrate that (1) immediate or delayed dismantlement of its nuclear facility was infeasible, (2) radioactive decay would allow unrestricted release of a site in about 100 years, and (3) access to waste disposal facilities was not available. No licensee at any additional power reactors undergoing decommissioning has since proposed the entombment option.

On May 4, 1998, NRC's staff notified the Commission that, on the basis of its preliminary assessment of work performed for NRC by the Department of Energy's Pacific Northwest National Laboratory, consideration of entombment as a viable decommissioning method had merit. The Laboratory had estimated and compared decommissioning costs, radioactive waste disposal requirements, estimated radiation doses to persons, and institutional control requirements for the two decommissioning methods approved in 1988—immediate dismantlement and dismantlement after storage of 50 years or more—with two entombment variations. These entombment methods are immediate entombment of radioactive plant materials in the containment building and the storage of radioactive plant materials in the containment structure for over 100 years, followed by entombment.

Subsequently, on July 19, 1999, NRC's staff affirmed that entombment could be safe and viable, depending on specific site situations. NRC's staff said that entombment, when properly performed, should have little effect on health, safety, and the environment. In addition, the staff noted that the entombment of radioactive wastes within the containment building of a retired nuclear power plant could significantly reduce off-site waste disposal requirements and related costs—although cost reductions would be offset, to some degree, by the cost of maintaining and monitoring the entombed facility for 100 to 300 years.

The NRC staff's decision that entombment might reduce decommissioning costs is questionable. For instance, both plants that have already been decommissioned and plants in the process of decommissioning using the immediate decontamination and dismantlement option report higher costs than the figure used for this option in the Pacific Northwest National Laboratory analysis on which NRC's staff based its views. Furthermore, the minimum amounts required for this option (as determined by NRC's

own generic formula) are significantly greater than the figure used in the laboratory's analysis. The laboratory's analysis also showed that neither immediate nor delayed entombment offer significant projected cost savings unless one assumed that entombment would lead to a reduction in long-term site security and insurance costs. Moreover, the laboratory's analysis showed that, even when reduced security and insurance costs are assumed, placing a retired plant in storage for approximately 50 years and then dismantling the plant is the least costly decommissioning method.

The laboratory also used a 130-year institutional control period in its analysis of the entombment method of decommissioning. NRC, however, has stated that if radioactive wastes entombed in a former nuclear plant include long-lived waste varieties, then the necessary period of institutional control could be extended to 300 years. In such a case, the cost for the additional 170 years of monitoring and surveillance needed could make both entombment options significantly more costly than the immediate dismantling of a plant and off-site disposal of its radioactive wastes.

Also, although the laboratory's analysis did not include entombment of Greater-Than-Class-C (GTCC) waste, NRC is considering the possibility of authorizing licensees to entomb GTCC waste rather than disposing of it in a geologic repository. Current regulations specify that GTCC waste is not generally acceptable for near-surface disposal without special processing and design and the case-by-case approval of NRC. GTCC waste from decommissioning a nuclear power plant is essentially comprised of radioactive internal reactor parts, which, while less radioactive than high-level waste such as spent fuel, remain radioactive for many thousands of years. However, including GTCC within the entombment structure would extend the required period of institutional control and its associated expense to thousands of years. Furthermore, regardless of the time period in which institutional controls would be required, a licensee would need to establish a funding mechanism to provide sufficient financial assurance that essential institutional controls would be carried out for the required time period. In contrast to immediately dismantling a plant and removing essentially all radioactive materials from the plant site, entombment would essentially make a former plant site a restricted storage or disposal facility for low-level radioactive waste for more than 100 years, which could hamper commercial reuse or resale of the site for the entombment period.

Finally, questions remain regarding the financial provisions for remediation in the event of a failure at an entombed site. According to NRC's staff, "very expensive remedies" could be required if an

entombment configuration proved unable to adequately isolate radioactive contaminants over the 100-year or longer time period needed for radioactive decay. Given the length of time involved, states are concerned that they will have to pay remediation costs should an entombment fail.

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Technical Issues Surround  
Alternative  
Decommissioning Methods

Aside from questionable cost benefits, rubblization and entombment raise a number of technical issues. For instance, NRC does not intend to require that sites where rubblized radioactive materials would be buried have protection equivalent to off-site disposal facilities for low-level radioactive waste. Disposal facilities for commercial low-level radioactive waste, which are licensed and regulated by NRC or by a state (under agreement with NRC), must be designed, constructed, and operated according to NRC's regulations (or compatible regulations issued by the host state). In addition, to obtain a license to build and operate a disposal facility, the prospective licensee must characterize the facility site and analyze how the facility will perform for thousands of years. However, according to NRC, a rubblized site is not comparable to a low-level radioactive waste disposal facility because

- the quantity, forms, and range of radioactive waste types buried at a nuclear plant site would be less,
- rubblization is a decommissioning action subject to the license termination rule rather than a radioactive waste disposal action subject to the licensing provisions of 10 CFR Part 61, and
- NRC's regulations for disposing of low-level radioactive waste apply only to facilities that dispose of waste from other sites and sources and not to sites where contaminated materials are to be rubblized and buried on-site.

Nevertheless, 10 CFR Part 61 does not differentiate between what does or does not qualify as a low-level waste disposal action or facility on the basis of the quantity, forms, or range of the low-level radioactive waste to be buried. Furthermore, NRC's view that rubblization does not constitute the creation of a low-level radioactive waste disposal site is not shared by EPA and at least three agreement states. When the Maine Yankee Power Company was considering rubblization as the decommissioning method for the Maine Yankee nuclear power plant, the state of Maine and EPA expressed concern that burying low-level radioactive waste at the plant site would be tantamount to creating an unlicensed low-level radioactive waste disposal facility. In fact, Maine's attorney general found that a strict application of Maine state law would have classified rubblization of the plant as such. Such classification would have, in turn, required state legislature and voter approval, licensing by NRC or the state, and eventual

state ownership of the plant site. Furthermore, when NRC sent a draft entombment rulemaking plan, an Advance Notice of Proposed Rulemaking (ANPR), and the PNNL entombment assessment to agreement states for comment on March 7, 2001, two out of the three agreement states that commented responded negatively.

New York, for example, opposed any new rulemaking that would allow low-level or GTCC waste to be entombed at reactor sites in the state. The state also contended that such an action would be contrary to the intent of the Nuclear Waste Policy Act and would adversely impact the financial viability of existing or planned low-level radioactive waste disposal facilities and state compacts. The state pointed out that data presented in the PNNL assessment (as discussed above) indicated that long term storage followed by dismantlement was preferable to entombment.

The state of Illinois also found entombment to be problematic as a decommissioning method, urged that NRC prohibit that approach, and said it would resist its implementation. The state found entombment to be inconsistent with the waste management policy established by Congress through the Low-Level Radioactive Waste Policy Act as amended. Regarding NRC's position that entombment is a decommissioning rather than a disposal action, the state said:

"It is beneath the NRC to engage in the semantical charade of denominating long-term isolation of reactor waste as anything other than disposal. The Agreement States' authority to license disposal of LLRW at reactor sites includes authority over entombment of LLRW. Any attempt by the NRC to repeal Agreement State authority under the pretext of merely licensing the decommissioning of commercial nuclear power reactors is virtually guaranteed to be vehemently [opposed] by Agreement States. If it is the NRC's objective to assert permanent federal control and responsibility over reactor sites, using those sites as a multitude of sacrifice areas throughout the United States, IDNS submits that NRC should make its proposal to Congress for a full and vigorous national debate."

Water intrusion is also a major concern for rubblized or entombed sites, and the fact that most nuclear power plants are situated in shallow water table or flood plain locations may limit the viability of these options. Furthermore, should NRC decide to allow GTCC waste in an entombment, integrity of the concrete configuration would have to be assured for many thousands of years. However, experts cannot guarantee or predict the integrity of concrete after 500 years.

Other technical concerns about rubblization include the potential for buried concrete to leach from rubblized sites, adversely affecting local

water quality; the propriety of diluting contaminated material by mixing the material with non-contaminated materials; and, how to demonstrate that the estimated radiation dose at a rubble site has been reduced to a level “as low as reasonably achievable,” as required by NRC.<sup>5</sup> As with any proposed decommissioning method, the licensee would have to address any relevant issues in the License Termination Plan, as well as demonstrate compliance with the License Termination Rule and requirements for the reduction of resulting residual radiation to levels that are as low as reasonably achievable. NRC is in the process of updating its generic environmental impact statement on radiological criteria for terminating nuclear facility licenses. The update will address, among other things, rubbleization as a decommissioning method and may include issues such as the acceptability of mixing or diluting contaminated material, the environmental effects of leaving contaminated concrete at decommissioned sites, and the potential effects of widespread use of the rubbleization method because of economic considerations. NRC intends to require an environmental review for each site that proposes rubbleization. The new generic statement should be useful to NRC in reviewing the environmental effects of license termination plans based on rubbleization.

NRC staff recognized in reaching their favorable conclusions on the viability of entombment in 1999, that statutory, regulatory, technical, and implementation issues, such as the appropriateness of relying on intruder barriers over a 1,000-year period, required further development. For example, the usefulness of the entombment decommissioning method could be limited by concerns over the reliability of long-term institutional controls. Such concerns are indirectly addressed in a recent National Academy of Sciences report on the long-term management of DOE’s nuclear sites.<sup>6</sup> Many of the weaknesses addressed in the Academy’s report may apply to the restricted release of NRC-licensed sites as well. For example, according to the Academy:

The viability over time of land use restrictions is likely to be especially questionable in cases where contamination levels are not high enough to prohibit all public access but not

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<sup>5</sup> NRC’s “As-Low-As-Reasonably-Achievable (ALARA)” policy essentially requires licensees to reduce residual radiation at decommissioning below the level required for unrestricted release as long as it is economically and environmentally feasible to do so.

<sup>6</sup> *Long-Term Institutional Management of U.S. Department of Energy Legacy Waste Sites* (National Research Council, Committee on the Remediation of Buried and Tank Wastes, International Standard Book Number 0-309-07186-0, Copyright 2000, National Academy Press).

low enough to permit unrestricted use. Often the real issue is not **whether** use restrictions will eventually fail, but when and what the **consequences** will be when they do. [Emphasis in original.]

EPA has also questioned the reliability of long-term institutional controls, stating that among other things, long-term governmental controls may not be enforced effectively because of political and fiscal constraints on a state or local government's exercise of its police power.

NRC's Chairman has acknowledged that the need for long-term institutional controls is a significant weakness in decommissioning methods, such as entombment, in that states or other governmental agencies may not be willing to accept the responsibility for such controls. And, according to NRC's staff, the viability of entombment as a decommissioning method hinges, in part, on the Commission's decision on whether barriers to intrusion in the absence of institutional controls would effectively keep exposure to affected persons beneath the Commission's dose limits.

The reliability of institutional controls over entombments that include GTCC waste would be even more questionable because of the extremely long post-closure monitoring and surveillance timeframes that would be required. In fact, in its August 1988 generic environmental impact statement on decommissioning nuclear facilities, NRC's staff concluded that the entombment method with GTCC waste included in the encasement was not viable because the security of the site could not be assured for thousands of years. In 1998, NRC also said that analyses would be required to demonstrate that a proposed entombment was unlikely to fail over the proposed entombment period. Such a requirement would be difficult to meet if GTCC waste were stored in the entombment because, experts say, projections on the integrity of concrete after 500 years are speculative. Finally, NRC's staff has determined that the Low-Level Radioactive Waste Policy Amendments Act of 1985 and NRC's regulations essentially require that the disposal of GTCC waste be licensed and that GTCC waste be placed in a geologic repository.<sup>7</sup>

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<sup>7</sup> During a NRC entombment workshop held in December 1999, DOE panel members stated that entombing GTCC waste in a reactor containment building is possible under existing legislation and that such an alternative was preferable to disposing of this type of waste in a geologic repository. The Low-Level Radioactive Waste Policy Act makes DOE responsible for disposing of commercially generated GTCC wastes.

Over the 100 to 300 year entombment period, early license termination and potential property ownership changes could also complicate the issue of financial responsibility for the entombment failure and subsequent responses. States are concerned that they may be obligated to pay the potential remediation costs if they have to assume oversight responsibility for an entombment after NRC has terminated a plant's operating license. For this reason, state representatives have said that, at least until experience with entombment has been acquired, NRC should continue to maintain some type of licensing responsibility at entombment sites. Such a step, however, would be contrary to NRC's goal of terminating licenses upon plant entombment.

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Alternative  
Decommissioning Methods  
Potentially Conflict With  
National Policy

On-site burial of rubblized low-level radioactive waste or the entombment of these wastes on-site may conflict with national policy on management and disposal of these wastes. The Low-Level Radioactive Waste Policy Act of 1980, as amended in 1985, established as federal policy that commercial low-level radioactive waste—except for GTCC waste—can be most safely and effectively managed by states on a regional basis. Through the act, the Congress encouraged states to form regional compacts to meet their collective disposal needs, minimize the number of new disposal sites, and more equitably distribute the responsibility for the management of low-level radioactive wastes among the states.

To encourage the formation of such regional compacts, congressionally approved compacts are allowed to prohibit the disposal of wastes generated outside their respective regions. To date, 44 states have entered into 10 compacts. However, despite some 20 years of effort and the expenditure of about \$600 million, no new regional disposal facilities have been provided as a result of the act, and no state or compact is currently trying to identify a site for a disposal facility.<sup>8</sup>

Commercial generators of low-level radioactive waste, including licensees that are, or soon will be, decommissioning their nuclear power plants, currently have access to off-site disposal facilities for this waste. Of the three currently operating disposal facilities for commercial low-level radioactive waste, the Barnwell, South Carolina facility is both available to

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<sup>8</sup> For a fuller discussion of states' implementation of the Low-Level Radioactive Waste Policy Act, see *Low-Level Radioactive Wastes: States Are Not Developing Disposal Facilities* (GAO/RCED-99-238, Sept. 17, 1999).

generators in all states and licensed to accept all classes of waste for which states must provide disposal. However, whether such access will continue, and at what cost, is uncertain. Access to the Barnwell facility is to be phased out for most generators by mid-2008. Another facility—Envirocare of Utah—which is located west of Salt Lake City, Utah, is available to generators in all states outside the Northwest Interstate Compact region but is licensed to accept only the least radioactive class of such wastes. In July 2001, the operator of this facility obtained a license amendment from the state of Utah to dispose of the more radioactive classes of low-level radioactive waste. However, the facility must also obtain the approval of the state's governor and legislature for such disposal. The company has announced that, at this time, it will not pursue such approvals because of controversy over an unrelated proposal to develop a storage facility for spent fuel from commercial nuclear power plants.

Unless Envirocare obtains the required governmental approvals in Utah and expands its existing disposal facility, and absent any new initiative by a compact of states to develop other disposal capacity, by mid-2008 waste generators in 36 states, Puerto Rico and the District of Columbia, will have no access to a disposal facility for wastes that are not already approved for disposal at the Envirocare facility.

The potential lack of access to disposal facilities prompted NRC and the nuclear industry to explore the rubblization and entombment decommissioning methods. Concerns have been voiced, however, that rubblization and/or entombment could adversely affect disposal costs and/or the profitability and economic well-being of the existing disposal facilities, while making it economically infeasible for a compact to develop new disposal facilities. Thus, the two decommissioning methods appear to run counter to the existing national policy of encouraging states to manage disposal of low-level radioactive wastes on a regional basis.

Moreover, the rubblization and/or entombment decommissioning methods may also contravene some state-compact agreement provisions. As discussed earlier, for example, if rubblization of the Maine Yankee plant had occurred, the state could have determined that the rubblized site was a disposal facility for low-level radioactive waste. In such a case, according to Maine's attorney general, the state could have been in violation of the Texas Low-Level Radioactive Waste Disposal Compact, of which Maine is a member, because the compact terms make Texas—not Maine—responsible for developing the compact's disposal capacity for low-level radioactive waste generated within Maine, Texas, and Vermont.



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## Site Contamination Can Go Undetected Until Late in Cleanup Process

Site characterization is an essential step in the decommissioning process,<sup>9</sup> but NRC does not stipulate when site characterization must be done. The sole time constraint is that a site-characterization must accompany NRC licensee's license termination plan and that the license termination plan must be submitted to NRC at least 2 years before the requested termination date of the license. If site characterization work does not begin until the latter stages of decommissioning and survey work uncovers unexpected contamination, instances can occur where the balance remaining in the decommissioning trust fund may not be enough to cover the unplanned additional cleanup work required.

NRC requires licensees to document occurrences and locations of spills, leaks, and other events that may occur at the plant and result in site contamination. This documentation, combined with the institutional knowledge of plant employees, provides the basis for a plant's historical site assessment and characterization plans. Historical site assessment and characterization are essential to ensure and demonstrate that all impacted areas at the site have been identified and cleaned up to meet the appropriate dose level required for license termination.

In cases where nuclear power plants were operating before NRC imposed record keeping requirements for burials, spills, and so forth, or if required record-keeping was less than meticulous, the institutional knowledge of plant employees becomes an invaluable tool for disclosing incidents and locating where contamination might be present. However, once a plant announces its plans to decommission, employees are often let go or leave to take other jobs, diminishing the institutional knowledge. In situations where plants close and are placed in safe storage for a number of years before final decommissioning work begins, institutional knowledge may be all but lost. As a result, although surveys take place throughout the decommissioning process, some instances of contamination may not be discovered until comprehensive site characterization work begins.

For instance, one small nuclear plant—Saxton in Pennsylvania—was built on the site of an old steam generating plant. The nuclear reactor was purposely built on this site to utilize an existing turbine and associated equipment from the steam plant. The nuclear reactor was shut down in

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<sup>9</sup> Site characterization entails radiological surveys of site grounds and facilities to insure that residual radiation at the site is in compliance with the appropriate NRC-prescribed dose limits for license termination and site release.

1972. In 1975 the steam plant was demolished and the basement was backfilled with demolition debris. The nuclear facility was maintained in a monitored condition, and full-scale decommissioning work did not begin until May 1998, 26 years after the plant was permanently shut down.

After initial site characterization and submission of the License Termination Plan in early 1999, unexpected additional contamination was discovered that required complete removal of all concrete in the containment structure and excavation, characterization, and remediation of the old steam plant basement. The estimated cost for this work exceeded the balance remaining in the decommissioning trust fund, forcing the owners to pay for it out of their general operating funds.

An NRC official told us that the plant owners are committed to doing a quality decommissioning job and that many of the problems found have been identified as a result of their diligence in approaching the decommissioning task. Nevertheless, historical site assessment efforts might have been easier to perform and more input from plant employees might have been obtained had initial site characterization work begun closer to plant shutdown and unexpected contamination problems been discovered sooner. Because the licensee was initially able to collect decommissioning costs from the ratepayers after the plant shut down, ratepayer contributions to the decommissioning fund might have been increased, or decontamination and dismantlement could have been delayed to allow for decommissioning fund investment income to grow to meet additional decommissioning costs before the principal was spent.

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## Conclusions

The actual cost incurred to decommission a nuclear power plant site is affected by many factors, some of which lie beyond a licensee's control. One of these factors is uncertainty over the application of radiation protection standards. Though NRC's licensees accumulate funds to decommission their plants to NRC's standard, once the time to decommission a plant arrives, a licensee may find that it must also meet a more stringent EPA or state standard at higher than anticipated cost. Another factor is whether, in the future, licensees will have access to affordable disposal capacity for the low-level radioactive waste generated in the decommissioning process. Licensees' and NRC's interest in rubblization and entombment, as alternative approaches for decommissioning, attempts to address this uncertainty, but in turn raises equally important technical and policy issues pertaining to on- and off-site disposal of low-level radioactive wastes and the proliferation of radioactive waste disposal sites around the country. Also, the potential

short-term cost savings from these methods may be more than offset if safeguards and institutional controls are required to ensure the safety of rubblized or entombed sites over the longer term. And the principal advantage of rubblization and entombment appears to be the disposal of radioactive waste at nuclear plant sites, which may not comport with current federal policy encouraging states, by means of congressionally-approved compacts, to be responsible for this function. Leaving low-level radioactive wastes buried or entombed at nuclear plant sites would make it more difficult for the existing low-level radioactive waste disposal program to succeed economically, thereby undermining the objectives of the Low-Level Radioactive Waste Policy Act, as amended.

There is, however, a way to alleviate some cost uncertainty in the decommissioning process without major technical and policy ramifications. Licensees could conduct historical site assessments/characterization surveys soon after the decision is made to permanently cease operations. Such early characterization would minimize the chances of the discovery of contamination problems late in the decommissioning process, when most or all of the funds have been spent. It would also provide licensees more time to adjust the accumulation of decommissioning funds accordingly.

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## Recommendations for Executive Action

We recommend that the Chairman, NRC, in the Commission's ongoing consideration of modifications to radiological criteria for terminating licenses and alternative decommissioning approaches, address

- how the burial or entombment of low-level radioactive waste at nuclear plant sites, leading to a potentially large number of contaminated sites scattered around the country, affects the federal policy under the Low-Level Radioactive Waste Policy Act to manage radioactive waste on a regional basis; and
- concerns about whether these decommissioning approaches are technically compatible with provisions of the Low-Level Radioactive Waste Policy Act, the interstate compact agreements that implement the act, and NRC's technical regulations on licensing disposal facilities for low-level radioactive waste.

To reduce the likelihood that site contamination will go undetected until late in the cleanup process, we recommend that the Chairman, NRC, require licensees to survey their plant sites for radiation immediately following the announcement of intentions to permanently cease

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operations, rather than allowing them to wait until 2 years before decommissioning is supposed to be complete.

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## Agency Comments and Our Response

NRC stated that it intends to consider our recommendations, as they pertain to the entombment alternative, during its ongoing rulemaking proceeding on that option. NRC added that it will obtain input from stakeholders on addressing the technical and policy concerns associated with the entombment decommissioning approach.

NRC disagreed with our recommendations as they pertain to rubbleization. The burial of radioactive rubble at the site of a former nuclear plant, NRC said, would be subject to its license termination rules and not its regulations governing the development and operation of facilities for disposing of low-level radioactive wastes. We, however, like EPA and the State of Maine, find it difficult to discern why radioactive material buried on-site—material that has traditionally been shipped to disposal facilities designed and regulated for such purpose—does not merit the same protection as material sent to a low-level waste disposal site.

NRC also disagreed with our recommendation to require earlier characterization of sites where plants are to be decommissioned because earlier characterization, in its view, will not add significant value to the decommissioning process. We disagree. There is always the chance that contamination exists at a plant site that has not been documented. Although there is no guarantee that early historical site assessment and characterization work would identify all such instances, the chances of doing so would be enhanced by the availability of plant employees knowledgeable about past plant operations and site conditions. Delaying this work until essentially the end of the decommissioning process—after many employees who are familiar with a plant's operational history are gone—decreases the available institutional knowledge. Such delay also limits the ability of the licensee to acquire more decommissioning funds if necessary to cover increased decontamination expenses.

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# Chapter 4: New Accounting Standard Improves Financial Reporting but Cannot Ensure Adequate Decommissioning Funding

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Recent changes to financial reporting standards for asset retirement obligations, established by the Financial Accounting Standards Board in June 2001, will require owners of nuclear power plants, among other affected industries, to report estimated decommissioning costs as liabilities in their financial statements. When implemented, the new standard will improve consistency in plant owners' reporting of these costs, which previous accounting practices allowed to be reported in a variety of ways. However, as an accounting standard it cannot guarantee that licensees have the funds available for decommissioning.

The estimation of decommissioning costs for nuclear regulatory purposes is an uncertain process, influenced by such matters as applicable cleanup standards and the selection of a decommissioning method. Moreover, liability amounts that companies owning nuclear power plants disclose in their financial statements may differ from the amounts determined under NRC's regulatory requirements. The new accounting standard, for example, will require public utilities and electricity generating companies to measure the liability of decommissioning costs using the "fair value" method.<sup>1</sup> In contrast, NRC requires licensees to estimate the cost of decommissioning their plants using a generic formula that takes into account the electrical output of the plants and derives from technical analysis of previous decommissioning activities. Alternatively, NRC allows licensees to base decommissioning costs on site-specific cost estimates if these estimates exceed the amounts calculated under the minimum funding requirements prescribed by NRC.

Finally, the new accounting standard cannot ensure that funds will be available at the time of decommissioning. Accounting standards are concerned with how financial events and obligations are reported; they do not ensure that resources will be available to pay for future needs, including decommissioning costs.

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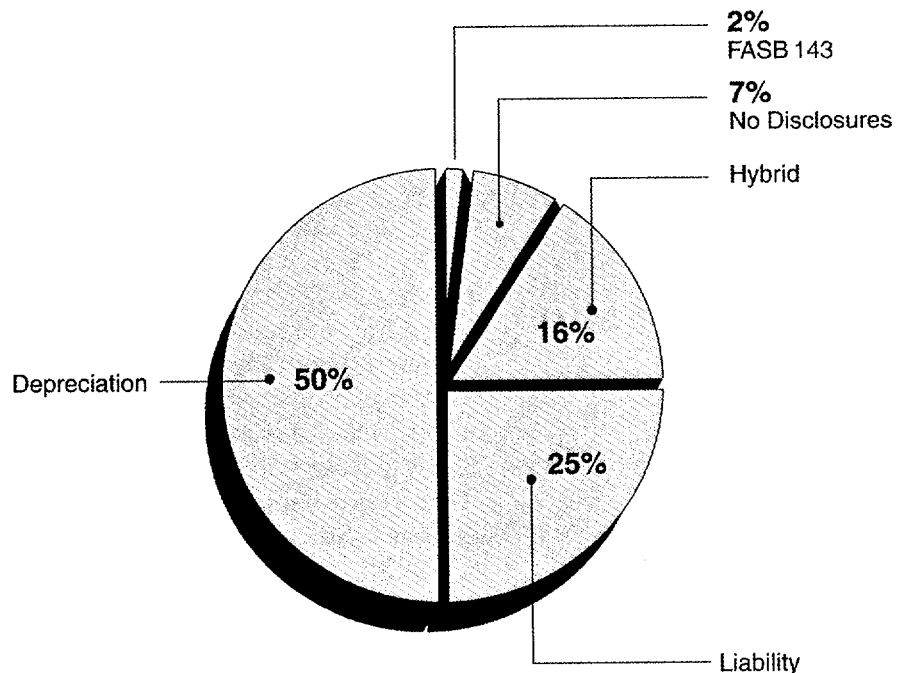
<sup>1</sup> Fair value is the amount that an entity would be required to pay in an active market to settle the asset retirement obligation in a current transaction in circumstances other than a forced or liquidation settlement.

## New Accounting Standard Will Improve Consistency of Reporting

Utility companies have used a variety of methods to report estimated costs of decommissioning nuclear power plants. Implementation of the new standard in mid-2002 will improve consistency in plant owners' reporting of these costs.

On the basis of our review of the 1999 annual financial reports of 55 utility companies, we determined that about 75 percent of the companies have used one of two methods—the depreciation method or the liability method—to account for their decommissioning costs. The remaining companies used either a hybrid method (16 percent); or the method included in the new accounting standard (2 percent). (See fig. 4.) We were unable to determine the method used by 7 percent of the utility companies because of insufficient disclosures in the financial statements.

**Figure 4: Methods Currently Used to Account for Decommissioning Costs**



Source: GAO analysis.

Utility companies most frequently accounted for nuclear decommissioning costs as a component of depreciation expense. Using this method, an expense is reported each year for a portion of the amounts collected from customers in utility rates; however, instead of recording a liability, the reported amount for the plant asset is reduced by the amount of the

expense. This method could ultimately result in a negative book value for the plant asset.

Using the liability method, an expense is reported each year for a portion of the amounts collected from customers in utility rates, with an equal amount added to a liability. The “bottom-line” (net income), as well as net assets, remains the same under both methods.

A comparison of the depreciation and liability methods to the new accounting standard shows that only the new standard requires the total estimated liability to be reported at plant startup, as well as a corresponding plant asset. (See table 3.)

**Table 3: Comparison of Methods to Report Decommissioning Liability**

Reporting approach	Depreciation method	Liability method	New standard
Full liability reported at inception	No	No	Yes
Liability gradually reported in an increasing amount	No	Yes	No
Plant asset cost amount includes the estimated decommissioning liability	No	No	Yes

Source: GAO analysis.

In February 2000, the Financial Accounting Standards Board (FASB) issued for comment an exposure draft entitled Accounting for Obligations Associated with the Retirement of Long-Lived Assets, which discussed nuclear plant decommissioning, among other types of asset retirement obligations. After obtaining and considering public comments, in June 2001 the Board unanimously voted to issue the standard in final form, effective for fiscal years beginning after June 15, 2002. Under this new standard (Statement of Financial Accounting Standards No. 143, Accounting for Asset Retirement Obligations), the fair value of the decommissioning costs is capitalized as part of the cost of the nuclear plant and an equal amount is recorded as a liability on the balance sheet.

In addition to requiring utility companies to recognize the full estimated cost of decommissioning at plant start-up, the new accounting standard also requires additional disclosures to investors, including:

- a general description of the plant retirement obligation (the liability);
- the fair value of assets, if any, dedicated to satisfy the liability; and
- an explanation of any significant changes in the liability.

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## New Accounting Standard Does Not Ensure Adequate Funding for Decommissioning Costs

The new accounting standard will not ensure that owners of nuclear power plants accumulate adequate funding for decommissioning costs. The Financial Accounting Standards Board is responsible for establishing standards of financial reporting, but not for ensuring that funding for liabilities reported under those standards will be available. The latter responsibility remains with NRC as a part of its regulation of nuclear power under the Atomic Energy Act of 1954, as amended, and other legislation.

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## Agency Comments

NRC stated that it neither supports nor opposes the new accounting standard. NRC added that the accounting standard and NRC's biennial financial reporting requirements were developed by distinct organizations for different purposes. Finally, NRC said it understands that the purpose of the Financial Accounting Standards Board's standard is to ensure the consistency of financial reporting. The standard is not, NRC added, meant to duplicate NRC's responsibility of assuring the availability of adequate decommissioning funds.



# Appendix I: Comments From the Nuclear Regulatory Commission



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

November 2, 2001

Ms. Gary L. Jones, Director  
Natural Resources and Environment  
United States General Accounting Office  
Washington, D.C. 20548

Dear Ms. Jones:

I am responding to your October 1, 2001 request that the U.S. Nuclear Regulatory Commission (NRC) provide comments on the draft General Accounting Office (GAO) report to the Honorable Edward J. Markey, House of Representatives, entitled "Nuclear Regulation - NRC's Assurances of Decommissioning Funding During Utility Restructuring Could be Improved."

The NRC provided the GAO with comments on the statement of facts associated with this report during an exit meeting with GAO staff on September 7, 2001. We are pleased that GAO incorporated many of the NRC's comments from the exit meeting in the October 1, 2001, draft report. GAO determined that most restructuring license transfers have maintained or enhanced assurance of decommissioning funding, and GAO also has provided constructive comments regarding documentation of the financial considerations associated with power reactor license transfer requests.

However, we continue to be concerned that GAO has not fully represented certain aspects of the NRC's license transfer review process, nor entirely considered the various processes associated with the decommissioning of a power reactor facility. The enclosed comments are intended to provide a more comprehensive perspective related to the conclusions and recommendations contained in GAO's draft report.

Sincerely,

A handwritten signature in dark ink, appearing to read "William D. Travers".

William D. Travers  
Executive Director for Operations

Enclosures: As stated

NRC COMMENTS ON DRAFT GENERAL ACCOUNTING OFFICE (GAO) REPORT TO THE  
HONORABLE EDWARD J. MARKEY, HOUSE OF REPRESENTATIVES, "NUCLEAR  
REGULATION - NRC'S ASSURANCES OF DECOMMISSIONING FUNDING DURING UTILITY  
RESTRUCTURING COULD BE IMPROVED"

1. GAO begins Chapter 2 of the draft report by stating (p. 20) that "for most of the requests that NRC reviewed to transfer licenses for one or more plants, the level of assurance that the plants' decommissioning funds will be adequate has been maintained or enhanced." However, GAO then cites two specific license transfer reviews that caused it concern, and GAO concludes Chapter 2 by stating (p. 33) that "NRC's inconsistent review and documentation of license transfer requests creates the appearance of different requirements for different owners or different types of transfers." Based on this conclusion, GAO recommends that NRC revise its standard review plan (NUREG-1577, Revision 1, "Standard Review Plan on Power Reactor Licensee Financial Qualifications and Decommissioning Funding Assurance," hereinafter referred to as the SRP) and related controls for reviewing license transfers to include a checklist for NRC staff to follow.

NRC conducted two separate detailed financial reviews. The cited reviews concerned the corporate reorganization of Public Service Electric and Gas Company (PSEG) and the formation of Exelon Corporation (Exelon) through a merger between Unicom and PECO Energy Company.

NRC believes that the actual decommissioning fund assurance (DFA) reviews associated with the PSEG and Exelon license transfers were adequate and that reasonable assurance of decommissioning funding was ascertained. In accordance

NRC staff verified that adequate decommissioning funding would be maintained by reviewing other sources of financial information in addition to the application materials, including publicly available information concerning the appropriate State's non-bypassable charge requirements. In the PSEG review, NRC specifically documented a detailed and thorough evaluation of applicable State law pertaining to DFA, which, in conjunction with NRC license conditions required by the PSEG order, provides reasonable assurance of decommissioning funding for PSEG's plants. NRC staff also followed the SRP guidance regarding adequate review of applicable State legislation pertaining to DFA in the Exelon review to ensure conformance with applicable NRC regulations and to obtain reasonable assurance of decommissioning funding. NRC, however, agrees with GAO that the DFA aspect of the Exelon review was not appropriately documented.

With respect to financial qualifications reviews, GAO concludes (p. 30-31) that NRC's review of Exelon's financial qualifications for operating a large fleet of nuclear reactors was not complete and not conducted in accordance with the SRP guidance. Again, the NRC believes that this conclusion is a reflection of a lack of documentation, rather than any substantive deficiency in the actual review. NRC staff followed the SRP guidance by evaluating the appropriate information needed to obtain reasonable assurance of Exelon's financial qualifications to own and operate its reactors safely. NRC acknowledges, however, that some of the factors associated with the Exelon review were not appropriately documented, such as the NRC staff's finding that certain changes in financial projections would not have had a material effect on NRC's determination of Exelon's financial qualifications.

Regarding GAO's recommendation for developing a license transfer review checklist (p. 33), NRC does not believe that a checklist will greatly enhance the effectiveness of license transfer reviews because many of the reviews that have been performed over the last few years have been very complex and, in many aspects, unique. GAO's assessments of the PSEG and Exelon reviews appear to be based largely on the lack of adequate documentation supporting the decision-making logic provided in the SRP. Therefore, NRC believes that appropriate documentation of the logic supporting each license transfer review will help to further demonstrate the adequacy and effectiveness of each review. The NRC will seek to ensure proper documentation is maintained to address GAO's concern of the appearance of different requirements.

2. In Chapter 3 of the draft report, GAO concludes (p. 50) that the proposed alternative approaches for decommissioning (i.e., entombment and rubbleization) raise equally important policy and technical issues. GAO also recommends (p. 50) that NRC require site radiation surveys to be performed immediately after a licensee announces its intention to permanently cease operations to minimize the chances of the discovery of contamination problems late in the decommissioning process.

NRC agrees that the issues raised in the draft report are important. Although NRC has previously identified DECON and SAFSTOR as the preferred alternatives, NRC is evaluating whether ENTOMB, under certain circumstances, may be an allowable alternative. NRC intends, during the ongoing entombment rulemaking effort documented in SECY-01-0099, to consider GAO's recommendation and obtain stakeholder input for addressing the technical and policy concerns associated with the

entombment alternative approach. Regarding rubbleization, NRC considers the rubbleization process to be subject to the license termination rules of 10 CFR Parts 20, and 50, instead of the low-level waste requirements of 10 CFR Part 61 because the intent is not to create a low-level waste disposal site.

NRC believes that GAO's site survey recommendation would not add significant value to current decommissioning practices. Under current regulations, a licensee may begin substantial decommissioning activities, such as removing and dismantling various facility systems and structures, prior to site characterization. An immediate site characterization survey performed prior to these decommissioning activities, as recommended by GAO, would not necessarily identify all potential areas of radioactive contamination because there may be sources of radioactivity that cannot be identified or adequately assessed until many of the facility systems and structures are dismantled and removed. Therefore, GAO's recommendation may not necessarily be cost effective, because additional site characterization surveys may need to be performed in order to thoroughly understand the contamination remaining after the removal and dismantlement of facility systems and structures.

3. In Chapter 4, GAO (p. 53-54) states that the new accounting standard set forth in June 2001 by the Financial Accounting Standards Board (FASB) will improve the consistency of reporting estimated decommissioning costs in financial statements, but will not ensure that licensees will have adequate funds for decommissioning. The NRC neither supports nor opposes the new FASB standard. The NRC notes that, at one point, it intended to adopt the FASB standard for reporting decommissioning costs as a way to

obtain additional information on the status of decommissioning funds, but that the FASB standard was delayed for several years. In September 1999, the NRC promulgated additional reporting requirements for the status of decommissioning funding, obviating NRC's need for the new FASB standard. The new FASB standard and the NRC's decommissioning funding status reports were developed by two distinct organizations for different purposes. The NRC agrees with GAO's statement that NRC, not FASB, is responsible for ensuring that NRC licensees will have adequate funds for decommissioning, and understands that the purpose of the FASB standard is to ensure the consistency of financial reporting and is not meant to provide a means of assuring the availability of adequate decommissioning funds.

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# Appendix II: GAO Contact and Staff Acknowledgments

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## GAO Contact

Dwayne E. Weigel (202) 512-6876

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## Acknowledgments

In addition, Michael J. Rahl, Carolyn K. McGowan, John Fretwell, Peggy Smith, Cynthia Norris, Doreen S. Feldman, and Barbara Timmerman made key contributions to this report.

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# Related GAO Products

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*Radiation Standards: Scientific Basis Inconclusive, and EPA and NRC Disagreement Continues* (GAO/RCED-00-152, June 30, 2000).

*Low-Level Radioactive Wastes: States Are Not Developing Disposal Facilities* (GAO/RCED-99-238, Sept. 17, 1999).

*Nuclear Regulation: Better Oversight Needed to Ensure Accumulation of Funds to Decommission Nuclear Power Plants* (GAO/RCED-99-75, May 3, 1999).



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General Accounting Office  
Washington, DC 20548

The Honorable Mitchell E. Daniels, Jr.  
Director  
Office of Management and Budget  
Washington, DC 20503

**SAMPLE LETTER TO CONGRESS FORWARDING NRC RESPONSE  
TO FINAL GAO REPORT**

The Honorable Joseph I. Lieberman, Chairman  
Committee on Governmental Affairs  
United States Senate  
Washington, DC 20510

Dear Mr. Chairman:

In accordance with the statutory obligation to respond to recommendations by the General Accounting Office (GAO) within 60 days of receipt, we hereby submit our responses to the recommendations made by the GAO in its report entitled "Nuclear Regulation - Action Needed to Control Radioactive Contamination at Sewage Treatment Plants." Specific responses to the GAO recommendations are presented in the enclosure.

The reconcentration cases noted in the GAO report occurred under regulations that have now been revised, with the objective of precluding recurrence of such cases. Although we have taken steps to prevent future reconcentration problems by changing the rules for releases to sanitary sewers, we will continue to work with the Environmental Protection Agency (EPA) to ensure a coordinated regulatory review effort concerning sewage treatment with respect to radioactive material.

Sincerely,

(Chairman's Name)

Enclosure:  
Responses to GAO Recommendations

cc: Senator Fred Thompson

IDENTICAL LETTERS TO THOSE ON ATTACHED LIST

## GAO RECOMMENDATIONS AND NRC RESPONSES

The General Accounting Office (GAO), in its report "Nuclear Regulation - Action Needed to Control Radioactive Contamination at Sewage Treatment Plants," made specific recommendations for responding to sewer contamination by NRC-licensed radioactive materials. These recommendations, and the U. S. Nuclear Regulatory Commission's responses to them, are provided below.

### Recommendation 1:

Determine the extent to which radioactive contamination of sewage sludge, ash, and related byproducts is occurring.

### NRC Response:

We agree and note that our evaluation is continuing of the extent to which radioactive contamination of sewage sludge, ash, and related byproducts is occurring. Initial results of NRC inspections and research analysis conducted in the mid- to late-1980s indicated that the problem was limited to only a few treatment plants that served licensees engaged in certain well-defined activities. As a result, NRC regulations (10 CFR Part 20) were revised in 1991 to prohibit the discharge of liquids containing insoluble radioactive waste materials that tended to settle out of the sewage water.

In addition to the changes to our regulations, in 1993 we initiated additional studies to understand the complexities of radioactive material reconcentration, such as the possible effects of implementation of state-of-the-art sewage treatment technologies on materials that, under traditional treatment methods, did not reconcentrate.

In addition to our efforts, the Environmental Protection Agency (EPA) will conduct a second National Sewage Sludge Survey (NSSS), in 1996 or 1997, in cooperation with the Association of Metropolitan Sewage Agencies (AMSA). AMSA represents agencies which provide sewage treatment services to over half of the population of this country. Radionuclides will be included during this second survey. To assist in EPA/AMSA's selection of sites for the survey, we will provide EPA with a list of licensees that have the potential to discharge into sewer systems.

NRC has also published an Advanced Notice of Proposed Rulemaking, in the Federal Register, in February 1994, to solicit information, comments, and suggestions in the area of sewer disposal of radioactive materials. Future actions in this area, including changes in the regulations, will depend, to some

extent, on the nature of the responses received which are being analyzed. We intend to exchange information and views on this matter with EPA in an effort to coordinate future rulemaking efforts.

Recommendation 2:

Directly notify the treatment plants that receive discharges from NRC's and the Agreement States' licensees of the potential for radioactive contamination, because of radioactive materials concentration, and of the possibility that they may need to test or monitor their sludge for radioactive content.

NRC Response:

We will take steps to notify State officials of the potential for contamination of sewer treatment plants. While we do not believe that such notification is needed to protect public health and safety, State officials will then be in a position to disseminate this information further if they believe that to be appropriate.

Recommendation 3:

Establish acceptable limits, for radioactivity in sludge, ash, and related by-products, that should not be exceeded, to ensure the health and safety of treatment workers and the public.

NRC Response:

NRC agrees that it is important to have acceptable limits for radioactive materials in sludge, ash, and related by-products. We will continue to work with EPA and sewerage consortiums to develop a national approach to this issue and assure the protection of the public health and safety.

NRC has already taken efforts to solicit comments on policy issues associated with the release of radioactive materials to sanitary sewers (see 59 FR 9146). In addition, rulemaking efforts are now ongoing to evaluate the question of generally applicable release limits for slightly radioactive material (i.e., contaminated sludge and ash that are continuously produced and which may have cumulative dose effects when regularly placed in landfills). These efforts include the use of computer models to evaluate the possible pathways of migration of contaminants in the environment. We also intend to address the possible uses of the slightly contaminated sludge and ash in commercial products such as fertilizers and the dose effects of these uses.