

GAO

Report to the Ranking Minority Member,
Committee on Governmental Affairs,
U.S. Senate

April 1995

NUCLEAR REGULATION

Slow Progress In Identifying and Cleaning Up NRC's Licensees' Contaminated Sites





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

Resources, Community, and
Economic Development Division

B-260200

April 24, 1995

The Honorable John Glenn
Ranking Minority Member
Committee on Governmental Affairs
United States Senate

Dear Senator Glenn:

For years, the Nuclear Regulatory Commission (NRC) and its predecessor, the Atomic Energy Commission, paid little attention to how licensees using radioactive materials were decommissioning (cleaning up) their sites after terminating research, manufacturing, and other operations. Some sites lingered for years, often decades, before cleanup was initiated, and at sites where cleanup was attempted, it was often performed improperly, leaving harmful levels of radiation. In response to your concern about the effectiveness of NRC's decommissioning program, this report addresses NRC's progress in (1) identifying all former materials licensees' sites that require additional cleanup and (2) ensuring that sites in NRC's Site Decommissioning Management Plan—those facing difficult and/or prolonged decommissioning—are cleaned up in a timely manner. In addition, this report discusses factors that impede the timely cleanup of sites.

Results in Brief

NRC has not yet completed its ongoing review to identify sites requiring additional cleanup. Through December 1994, an NRC contractor had reviewed about 29,000 (about 75 percent) of an estimated 38,500 terminated licenses. Thus far, NRC has identified 22 sites that exceed its guidelines for radioactive contamination and therefore require further cleanup. Documentation for another 895 terminated licenses was inadequate to determine whether the sites meet NRC's guidelines. Consequently, as of March 15, 1995, NRC was in the process of obtaining additional information about the nature and extent of the contamination resulting from these licenses. The total number of sites that could require additional cleanup will not be known until NRC obtains this information and completes its review of the remaining 9,500 terminated licenses. NRC expects that the contractor's review will be completed in 1996. However, according to NRC, it will take several additional years to review the contractor's work and conduct inspections that may be needed to assess the contamination at the sites.

Although most sites with NRC-licensed operations do not experience difficult or lengthy cleanups, cleaning up other sites is highly complex and time-consuming for a variety of reasons, including technical problems related to the disposal of large amounts of radioactive waste. In 1990, NRC established the Site Decommissioning Management Plan to help ensure the timely cleanup of sites facing difficult and/or prolonged cleanups. Despite NRC's increased efforts, however, little progress had been made in cleaning up these sites. NRC had estimated that with increased regulatory attention, the decommissioning of 11 of the 52 Decommissioning Plan sites that NRC had identified through 1993 would be completed by April 1994. However, only three sites were cleaned up by that time. Progress in cleaning up most Decommissioning Plan sites is behind schedule.

A variety of factors has delayed and even halted cleanups at Decommissioning Plan sites. For example, at 14 sites large volumes of thorium waste cannot be disposed of on-site without an exemption from NRC's requirements, and disposal elsewhere may not be feasible because of the high cost and limited availability of off-site disposal facilities. Litigation, coordination, and negotiations between affected parties also have delayed cleanups at many sites. Finally, lengthy time frames for NRC's review and approval of key decommissioning documents have contributed to delays at nine of the sites. According to NRC officials, delays in cleaning up Decommissioning Plan sites increase the likelihood, over the long term, of human exposure to radiation through the further release and spread of contamination into the environment. NRC officials and representatives of the owners of the contaminated sites told us that the sites do not pose any imminent health or safety risk because steps have been taken to limit the public's access to the contaminated areas. However, eight sites have already experienced groundwater contamination, and as delays continue, more sites could experience similar problems.

This report contains no recommendations.

Background

NRC issues licenses under the Atomic Energy Act of 1954, as amended, to individuals and entities such as hospitals, research and fuel cycle facilities, and manufacturers that use radioactive materials. The license—termed a “materials license”—permits the licensee to possess, use, and/or transfer radioactive materials under controlled conditions intended to limit the public's exposure to harmful radiation. According to NRC's August 1994 annual report, NRC regulates about 6,850 active licenses. Over 38,000

licenses have been terminated for sites previously involved in activities related to radioactive materials.¹

NRC terminates about 350 materials licenses annually. According to NRC, the majority of the licensed operations cause little or no contamination. As a result, most site cleanups are routine and generally take less than 4 years to complete. Cleanups at other NRC-licensed sites, however, are highly complex, and many have been under way for an extended period of time—over 20 years in one case.

At the conclusion of the licensees' operations, NRC currently requires them to decontaminate their facilities, including land, buildings, and equipment, to a level that would allow the site to be used safely for any purpose in the future (unrestricted use). This process is known as "decommissioning." Decommissioning generally involves many steps. Among other steps, (1) the licensee must develop a site characterization plan documenting the extent and location of contamination, (2) NRC must review and approve the licensee's plan for decommissioning the site, (3) the licensee must remediate the site and prepare a final site survey documenting the results, and (4) NRC must conduct a survey to confirm that the site has been adequately cleaned up before terminating the license.

NRC Does Not Yet Know the Number of Sites Requiring Additional Cleanup

In our 1989 review of NRC's decommissioning procedures and criteria, we found that NRC had improperly terminated licenses at two of the eight sites we reviewed.² The two sites were released for unrestricted use despite the presence of radioactive contamination in excess of NRC's decommissioning guidelines. Radioactive contamination at one site was 3 to 320 times higher than the guidelines allow; at the other site, contamination was 2 to 4 times higher than NRC allows. Because of inadequate information, we were unable to determine whether similar problems existed at the other six sites. During congressional deliberations on this topic in August 1989, NRC agreed to (1) review documentation on materials licenses terminated between 1965 and 1985 to assess whether past operations had been properly cleaned up and, if not, (2) identify sites requiring additional cleanup.

¹NRC regulates licenses in the following 21 states: Alaska, Connecticut, Delaware, Hawaii, Idaho, Indiana, Massachusetts, Michigan, Minnesota, Missouri, Montana, New Jersey, Ohio, Oklahoma, Pennsylvania, South Dakota, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming. With the exception of licenses for fuel cycle facilities, licenses in the remaining 29 states—about 15,000 licenses—are regulated by the respective state, under agreement with NRC. This report primarily addresses issues related to the cleanup of sites in NRC-regulated states.

²Nuclear Regulation: NRC's Decommissioning Procedures and Criteria Need to Be Strengthened (GAO/RCED-89-119, May 26, 1989).

NRC initiated the review in September 1990 and subsequently expanded it to include all terminated licenses. According to NRC, contractors had examined documentation on about 29,000 (about 75 percent) of an estimated 38,500 terminated licenses through December 1994. NRC has determined that 22 of the 29,000 licenses involved sites that exceed radioactive guidelines for unrestricted use and, consequently, require additional cleanup.³ Documentation on another 895 of the former licenses was inadequate to determine whether the sites meet NRC's guidelines.⁴ As a result, as of March 15, 1995, NRC was in the process of obtaining additional information about the 895 terminated licenses using, among other things, the personal knowledge of cognizant NRC staff, site visits, and states' and former licensees' records of the affected sites.

NRC does not expect that a large number of former sites will require additional cleanup, although the total number of these sites will not be known for several years. According to NRC, the contractor will complete its review of the remaining 9,500 terminated licenses in 1996. However, NRC officials told us that it will take several more years to review the contractor's work and conduct any site inspections that may be needed to assess contamination resulting from these licenses.

Little Progress Has Been Made in Cleaning Up Sites Under the Site Decommissioning Management Plan

In March 1990, NRC established a program—termed the Site Decommissioning Management Plan (SDMP)—to help ensure the timely cleanup of sites facing difficult and/or prolonged decommissioning. NRC originally identified 40 sites for increased oversight, guidance, and assistance to help ensure their timely cleanup. The sites, known as SDMP sites, were selected on the basis of the personal experience of the NRC regional and headquarters staff considered most knowledgeable of and familiar with sites facing problematic cleanups. NRC staff included sites within the SDMP program if they met one or more of the following criteria:

- A licensee's financial ability or willingness to perform the cleanup was questionable, or other problems existed.
- The site contained large amounts of contaminated soil, unused settling ponds, or buried waste that could be difficult to dispose of.

³The sites are located in California, Colorado, Connecticut, Michigan, Ohio, Oklahoma, Pennsylvania, Texas, Utah, and West Virginia.

⁴This number includes 494 licensees that NRC authorized to possess or use radioactive materials in sealed containers. According to NRC, sealed sources are not a high priority for further examination because, in its view, these sources are not likely to result in site contamination. However, some of these sealed sources are over 30 years old, and their condition is unknown.

- The site contained unused facilities that had been contaminated for a long time.
- The license had previously been terminated, but residual contamination at the site still exceeded NRC's guidelines for unrestricted use.
- Groundwater at the site was contaminated, or potentially contaminated, by radioactive waste.

By 1992, 2 years after the SDMP program was initiated, eight new sites had been added to the program, and only one site had been cleaned up and removed from the program.⁵ Dissatisfied with the slow pace of cleanups at the SDMP sites, NRC's management directed its staff to accelerate those cleanups. As a result, in April 1992 NRC developed an action plan that, among other things, (1) summarized NRC's existing guidance and criteria for site cleanups, (2) established time frames for major decommissioning milestones, and (3) described the process that NRC would use to establish schedules for timely site cleanups.

According to NRC officials, the 1992 action plan represented NRC's first attempt to explain and formalize its cleanup process. Before the 1992 plan, NRC officials said, the decommissioning process was operated on an ad hoc basis. Site owners lacked clear guidance about NRC's decommissioning requirements, and NRC staff were unclear about how they could best fulfill their decommissioning responsibilities.

Since issuing the 1992 action plan, NRC has taken additional action to clarify its requirements for decommissioning. In July 1993, NRC issued new regulations that required licensees and others who use or possess radioactive materials to prepare and maintain adequate documentation on activities that could affect decommissioning at their sites. Furthermore, in July 1994 NRC issued regulations that established time frames for completing decommissioning activities. Under the regulations, licensees are required to complete decommissioning within about 50 to 62 months. The new regulations primarily affect the timeliness of decommissioning future sites. For example, many SDMP sites have encountered delays resulting from inadequate information about past operations. Because little can be done to reconstruct this information, the new requirement for adequate recordkeeping will not apply to these sites. In addition, according to NRC officials, because many SDMP sites face extenuating circumstances that necessitate longer cleanups, they may need to be exempted from the decommissioning time frames.

⁵Two additional sites were removed from the SDMP program for other reasons. Responsibility for cleaning up one of the sites was transferred to the State of Illinois, and NRC determined that the other site's cleanup did not require priority regulatory attention.

To date, NRC's efforts have not resulted in the timely cleanup of existing SDMP sites. In fact, little progress has been made. Since 1990, the number of sites in the SDMP program has fluctuated between 40 and 57.⁶ In 1993, NRC projected that a total of 11 SDMP sites would be cleaned up by April 1994 and, consequently, removed from the SDMP program. However, only three sites were cleaned up and removed from the SDMP program during that period.⁷

Furthermore, interim progress toward the final cleanup at most of the 50 sites in the SDMP program in November 1994, is also behind schedule. According to NRC officials, since April 1993 NRC has, among other things, reviewed numerous (1) plans for decommissioning SDMP sites and (2) reports on the status of decommissioning activities at the sites. According to NRC, these efforts represent substantial progress in remediating SDMP sites. While progress is being made at some SDMP sites, our comparison of NRC's October 1993 and November 1994 projections for completing interim decommissioning activities found that only two sites had completed their planned activities on schedule. Decommissioning activities at 31 sites were projected to exceed their milestones by 2 to 42 months, and 17 of the 31 sites were expected to exceed their milestones by 12 months or more. We could not determine whether activities at the remaining 17 sites were on schedule because of changes in the scope of decommissioning activities between October 1993 and November 1994.

According to NRC's records, most of the 50 SDMP sites in the program in November 1994 have large amounts of contaminated soil—up to 10 million cubic feet. The contamination resulted from a variety of operations, such as nuclear fuel research, chemical manufacturing, uranium processing, and landfill disposal activities. (App. I provides additional information about the sites, including the location and a description of the contamination present at each of the sites.)

Potential Impacts of Cleanup Delays

According to NRC officials, delays in cleaning up SDMP sites increase the likelihood, over the long term, for human exposure to radiation through the further release and spread of contamination into the environment. However, NRC officials and representatives of the contaminated SDMP sites told us that the sites do not pose any imminent health or safety risk

⁶According to SDMP program officials, up to 12 other sites meet NRC's criteria for inclusion in the program. However, the sites have not been included in the program because acceptable progress is being made toward cleanup.

⁷Two other sites were cleaned up in June and July 1994.

because controls exist to limit the public's access to contaminated areas. For example, they said fences and posted danger signs have been erected around contaminated property and buildings. In addition, they said the public has little reason to access areas that are obviously contaminated. However, we found that the extent of contamination is not always obvious. Figures 1 and 2 illustrate how a radioactively contaminated site appeared in 1976 and in 1994. Although the site appears to be cleaner in the 1994 photograph, it is not. The barrels of chemical and radioactive waste obvious in the 1976 photograph are still there but, over time, have been covered by top soil. And although most people probably have no reason to access property contaminated with radioactive waste, the representative for this SDMP site told us that hunters sometimes enter the property despite fences and signs alerting them to the danger.

Figure 1: An SDMP Site in 1976



Figure 2: The Same SDMP Site in 1994



Delays in cleaning up contaminated sites can also result in more difficult cleanups. For example, over time, radioactive materials can seep into the water table beneath a site and contaminate the groundwater both on and off the site. Eight SDMP sites have already contaminated the groundwater, and according to a contractor performing NRC's review of formerly licensed sites, about 1 percent of the former sites (nearly 400) may need to be examined for groundwater contamination. The spread of radioactive waste through soil and water also results in more costly cleanups, a factor that can have a great impact on an owner's ability and willingness to pay for site cleanups. Finally, according to NRC, continued cleanup delays erode the public's confidence in NRC's ability to protect the public from adverse health and safety consequences.

Many Factors Impede the Timely Cleanup of SDMP Sites

A variety of factors have delayed and even halted cleanups at the SDMP sites. For example, at 14 SDMP sites, large volumes of thorium waste cannot be disposed of on-site without an exemption from NRC's existing requirements, and disposal elsewhere may not be practical or feasible because of the high cost and limited availability of off-site disposal facilities. Litigation, coordination, and negotiations between affected

parties also have delayed cleanups at many SDMP sites. Finally, lengthy time frames for NRC's review and approval of key decommissioning documents have contributed to cleanup delays at nine SDMP sites.

Many SDMP Sites Face Difficulties in Meeting Regulatory Disposal Requirements

NRC permits site owners to bury contaminated waste on-site if radiation levels can be reduced to a point that permits the site to be used for unrestricted purposes. If NRC's guidelines for decommissioning cannot be met through on-site burial, owners may have to remove the waste and transfer it to a facility licensed to accept low-level radioactive waste. However, neither disposal option is viable for many SDMP sites contaminated with large quantities of radioactive waste. Many SDMP sites cannot meet NRC's guidelines for on-site disposal, yet off-site disposal may not be feasible or practical because of the limited availability of waste facilities and the high cost of off-site disposal.

According to NRC, 30 SDMP sites are contaminated with large amounts of radioactive waste. Fourteen of these sites are contaminated with thorium. Over time, thorium decays to thallium, a radioactive isotope which emits gamma rays that can penetrate and harm the body. In the past, NRC allowed licensees to bury large quantities of thorium, subject to restrictions on the future use of the sites. NRC eliminated this disposal option in 1992. Because of the nature and large quantities of thorium at the 14 sites, radiation doses at the sites would exceed NRC's guidelines for unrestricted use if the waste were buried. According to NRC, it is too early to tell whether the other 16 sites with large volumes of radioactive waste can meet NRC's guidelines for on-site disposal because efforts to characterize the sites are still under way.

Off-site disposal of large amounts of radioactive waste also may not be feasible. Specifically, only one facility in Utah is currently available to accept large volumes of waste from existing SDMP sites; however, it cannot accept materials that exceed the specified concentration levels established for various radioactive materials.⁸ According to NRC, access to waste disposal facilities will continue to be a problem and could even get worse over the next 5 to 10 years until state-sponsored facilities are available to accept the waste. And even when these facilities are available, the manager of the SDMP program acknowledged that it is uncertain whether

⁸Two other facilities are located in South Carolina and Washington; however, neither facility can currently accept waste from existing SDMP sites. The South Carolina facility accepts waste from 8 states in the Southeast, and the facility in Washington accepts waste from 11 states in the Northwest and Rocky Mountain regions. None of the SDMP sites are located within these regions.

the facilities will accept the quantities of contaminated materials present at some SDMP sites.

Off-site disposal also may not be practical because of the costs involved. For example, the owner of one site contaminated with thorium estimated that on-site disposal would cost less than \$2 million, compared to between \$135 million and \$467 million to dispose of the same waste off-site. In another case, an SDMP site representative estimated that on-site disposal of his site's waste would cost between \$1 million and \$6 million, compared to over \$100 million for off-site disposal. According to NRC officials, the high cost of off-site disposal is an important consideration because it raises concern about the ability and willingness of owners to pay the costs of decommissioning sites. For example, as a result of the high cost of off-site disposal, owners of one site have threatened to declare bankruptcy if required to transfer their waste off-site.⁹ When decommissioning costs exceed an owner's financial capability, according to NRC officials, NRC has no other recourse but to turn the site over to the Environmental Protection Agency for cleanup under the Superfund program.

NRC is taking action to provide additional disposal options for sites with radioactive contamination. In August 1994, NRC solicited views from interested parties on the appropriateness of revising its existing regulations to allow site owners to retain private ownership of their contaminated properties for a 100-year period, subject to land-use restrictions. Comments on NRC's proposal were overwhelmingly negative. As a result, according to the NRC official responsible for handling comments on the proposal, NRC staff do not intend to pursue this regulatory change.

NRC has also proposed a regulation to replace its existing decommissioning guidelines. If adopted, the regulation would permit site owners to exceed regulatory limits for radioactive contamination in certain cases, subject to restrictions on the future use of their properties. According to NRC, a number of significant issues will need to be resolved before this regulatory change can be adopted. Issues include (1) the amount of radiation that will be allowed at the sites, (2) whether existing SDMP sites should be held to

⁹NRC requires its licensees to set aside funds for the subsequent decommissioning of their sites. However, in this case the owner was required to set aside only \$750,000—compared to \$1.75 million, the minimum estimated cost of decommissioning the site. Fourteen SDMP sites do not have any money set aside for decommissioning primarily because the sites' activities were unlicensed or the owners' licenses were terminated before NRC could secure the funding. In June 1994, NRC proposed revisions to its existing regulations to help ensure that funding for decommissioning will be adequate in the future.

new requirements, and (3) the conditions and time frames for returning sites to unrestricted use.

Finally, NRC is studying on-site disposal issues at four SDMP sites contaminated with large volumes of thorium. When completed, NRC officials said, the studies may be used to evaluate the appropriateness of on-site disposal at other sites contaminated with large volumes of thorium. NRC expects the studies will take at least 2 years to complete.

Litigation, Coordination, and Negotiations Have Delayed Many SDMP Site Cleanups

Litigation, coordination, and negotiations between affected parties also have delayed cleanups at many SDMP sites. According to NRC, for example, litigation has delayed cleanups at six SDMP sites, including one case that has been unresolved for more than 5 years. Litigation has occurred for a variety of reasons. For example, owners of one SDMP site—a sewage treatment facility—have filed a lawsuit against the owners of another SDMP site involved in the manufacturing of medical equipment. According to the owners of the sewage facility, discharges of radioactive waste in the manufacturer’s sewage lines have contaminated the sewage facility. According to NRC, outside parties, such as environmental groups, have also filed lawsuits to stop or impede cleanups at SDMP sites because of environmental and health concerns. Finally, owners of SDMP sites who are embroiled in disputes about NRC’s decommissioning policies and regulations have filed lawsuits against NRC.

In addition to litigation, nearly half of the SDMP sites face management and disposal issues that must be coordinated with other federal and state agencies that have jurisdiction over specific aspects of cleanups. In some cases, coordination requirements are perfunctory and have little impact on timely site cleanups. However, in other cases, particularly when states’ requirements differed from those imposed by NRC, substantial delays have occurred. For example, under state regulations the radioactive waste at one SDMP site in Ohio also must be treated as solid waste. As a result, even though the site can meet NRC’s requirements for on-site burial, delays have occurred because of the state’s concerns about whether the company’s proposed disposal cell (waste receptacle) complies with the state’s requirements for the disposal of solid waste. Coordination on this issue has already contributed to cleanup delays of about 3 years, and additional delays will occur until the issue is resolved.

Finally, negotiations between current and previous site owners about who is responsible for cleaning up SDMP sites have resulted in delays. For

example, at one SDMP site negotiations between the former licensee and the current site owner to determine which one is the responsible party delayed cleanup by at least 2 years; negotiations between parties at another site delayed cleanup by about 6 months. According to the manager of the SDMP program, NRC expects that most future SDMP sites will be identified from NRC's ongoing review of past cleanups at sites with terminated materials licenses. Consequently, negotiations about who is responsible for site cleanups will likely become a larger issue in the future.

Lengthy Time Frames for NRC's Review of Key Decommissioning Documents Have Resulted in Delays

NRC's lengthy time frames for reviewing and approving key decommissioning documents, such as site decommissioning plans, also have contributed to cleanup delays at many SDMP sites. For example, according to NRC documentation, excessive time frames for reviewing and approving documents submitted by SDMP site owners contributed to delays of between 6 months and 22 months at nine sites during 1993. Representatives of owners at 10 of the 14 SDMP sites we contacted also identified concerns about the timeliness of NRC's reviews. Specifically, they said that NRC's reviews were "rarely" or "not usually" timely. For example, one representative said that inaction on his site's application for a materials license was significantly delaying cleanup at the site.¹⁰ In November 1994, NRC estimated that the license would be approved in July 1995—2 years after the owner submitted the application. Decommissioning activities cannot begin at the site until the license is approved.

According to NRC, lengthy time frames for reviewing and approving decommissioning documents are the result of a variety of factors, including the availability of staff to perform the reviews. Several SDMP site representatives agreed that NRC staffing, particularly staff turnover, is a problem. For example, one site owner said that during a 4-year period, he had to educate three NRC staff who, at various times, were responsible for overseeing the cleanup of the site, thereby delaying the cleanup. In addition, we found that NRC does not assign staff to work exclusively on the SDMP program or ensure that priorities are set consistently for SDMP's cleanup activities. Instead, the responsibility for overseeing SDMP sites within NRC has been divided between many headquarters and regional organizations with varying missions and priorities that, according to NRC, often have taken precedence over SDMP's program activities.

¹⁰Contamination at some of the SDMP sites resulted from unlicensed and unauthorized activities. This case involves an unlicensed landfill that became contaminated by shipments from outside sources. Now that the site has radioactive waste, NRC has required the owner to obtain a license before cleaning up the site.

According to NRC, it has acted to improve the timeliness of its document reviews. For example, because of a recent reorganization within NRC, additional staff are now available to perform the reviews. Furthermore, between October 1994 and December 1994, NRC tested a system for tracking and assigning staff resources to the reviews. Although NRC is currently reviewing the test's results, early indications are that the system is more costly than can be justified. As a result, NRC officials said that they will probably need to pursue other methods for managing staff resources for SDMP activities.

Conclusions

NRC's efforts to provide increased assistance to sites facing difficult and lengthy cleanups, while laudable, are unlikely to resolve the numerous and complex issues encountered at existing SDMP sites. Many SDMP site cleanups have been delayed by issues involving litigation, coordination, and negotiation between affected parties, which are issues largely beyond NRC's control. In addition, in the short term, little can be done to resolve the pressing problems experienced by sites that cannot meet current decommissioning guidelines for on-site disposal without an exemption from NRC's existing requirements. The limited availability and high cost of off-site waste disposal facilities may be addressed when state-sponsored facilities are available to accept the waste. However, even when these facilities become available, it is unclear whether they will be able to accept the types and quantities of contaminated waste present at a large number of SDMP sites.

NRC is exploring additional disposal options for sites that cannot meet its existing requirements. While additional disposal options may facilitate decommissioning at many SDMP sites, a wide variety of difficult issues will need to be thoroughly addressed before any regulatory change can be adopted. For example, because sites would be allowed to have greater concentrations of radioactive contamination than currently permitted, issues about the possibility of future waste migration will need to be resolved to ensure that additional sites do not experience migration problems. NRC will also need to ensure that controls at the sites will be adequate over the long term to safeguard the public from greater exposure to radiation.

Decommissioning issues are likely to become even more problematic as the magnitude of NRC's decommissioning effort grows. NRC's ongoing review of terminated licenses already has identified 22 sites requiring additional cleanup. Another 895 licenses require additional review to

determine if the sites require further cleanup. More sites are likely to be identified as NRC completes its review of the remaining 9,500 licenses.

Agency Comments and Our Evaluation

On March 15, 1995, we met with NRC officials, including the Deputy Executive Director for Nuclear Materials Safety, Safeguards and Operations Support, and the Director of the Office of Nuclear Material Safety and Safeguards to discuss and clarify NRC's written comments on a draft of our report. (NRC's written comments are included as app. II.) NRC officials agreed that little progress has been made in removing sites from the SDMP program—the ultimate objective of the program. However, they cited several actions by NRC that they believe will contribute to the eventual cleanup of SDMP sites. We have included details on these actions, as appropriate, in the body of this report. We have also clarified and updated information in our draft report on the basis of NRC's comments.

NRC officials stressed that SDMP sites, such as the one illustrated in this report, do not represent an immediate hazard to infrequent intruders. While all SDMP sites exceed NRC's guidelines for unrestricted use, they said that an individual's risk of exposure to radiation would occur only if controls at the sites broke down and people took up residence or worked at the sites without adequate precautions. Furthermore, they said that covering barrels of contaminated waste with soil, as was done at the site discussed in this report, helps reduce the overall hazard.

We agree that health consequences related to an individual's exposure to radiation are considered a long-term—not an immediate—risk, provided that an individual's exposure is controlled and limited. However, we do not fully agree with NRC's comments about the site discussed in our report. As demonstrated in our report, controls can and do break down. Furthermore, we believe that it is too early to assess the health risk associated with this site. The site, which was used as a landfill, has not yet been characterized to determine the extent and nature of contamination. In addition, records are incomplete or nonexistent about the (1) sources of contamination, (2) adequacy of efforts to cover the contaminated waste, and (3) frequency and duration of any intruder's access to the property.

Scope and Methodology

To assess NRC's progress in identifying former materials licensees' sites that require additional cleanup, we interviewed contractor officials performing the work and the NRC manager responsible for overseeing the

review. We also examined documentation related to the project, including the contract governing the scope of the work.

To assess progress in cleaning up the high-priority SDMP sites and to identify major factors contributing to decommissioning delays in the 21 states in which nuclear materials are regulated by NRC, we interviewed the manager of the SDMP program and other cognizant headquarters and regional NRC officials, including 48 project managers in three NRC divisions (Low-Level Waste Management and Decommissioning, Fuel Cycle Safety and Safeguards, and Industrial and Medical Nuclear Safety) responsible for providing increased oversight, guidance, and assistance to SDMP sites during 1993. We also contacted owners or their representatives at 14 SDMP sites to obtain their views about the effectiveness of the SDMP program. The sites represent a cross-section of SDMP sites facing difficult decommissioning issues. In addition, we reviewed NRC's documentation of the origin, intent, and goals of the SDMP program, including NRC's site selection criteria, the 1992 action plan, annual status reports on the program, and memorandums and policy papers about possible changes in NRC's decommissioning regulations and policies. Finally, we visited five sites in Michigan, Oklahoma, and Ohio to observe the extent of contamination at some SDMP sites. We conducted our work between May 1993 and March 1995 in accordance with generally accepted government auditing standards.

As agreed with your office, we plan no further distribution of this report until 15 days from the date of this letter. At that time, we will send copies to appropriate congressional committees, the Chairman of NRC, and other interested parties. We will also make copies available to others upon request.

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

Sincerely yours,



Victor S. Rezendes Director, Energy and Science Issues

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Abbreviations

GAO	General Accounting Office
NRC	Nuclear Regulatory Commission
SDMP	Site Decommissioning Management Plan

List of 50 Sites in the SDMP Program in November 1994

Name	Location	Description of contamination
AAR Manufacturing	Livonia, MI	Thorium contamination in facility
Advanced Medical Systems, Inc.	Cleveland, OH	Cobalt-60 in building and sewer line
Aluminum Company of America (ALCOA)	Cleveland, OH	Thorium, depleted uranium in buildings and soil; possible thorium burial site
Anne Arundel County/Curtis Bay	Baltimore, MD	Thorium in wood, concrete, and soil
(Department of the) Army	Aberdeen Proving Ground, MD	Depleted uranium in soil
Babcock and Wilcox	Apollo, PA	Uranium contamination in soil
Babcock and Wilcox	Parks Township, PA	Uranium and thorium burial site
BP Chemicals, America, Inc.	Lima, OH	Depleted uranium in ponds and soil; ponds also contain hazardous wastes
Cabot Corp.	Boyertown, PA	Uranium and thorium contaminated slag
Cabot Corp.	Reading, PA	Uranium and thorium contamination in building and slag
Cabot Corp.	Revere, PA	Uranium and thorium contaminated slag and soil
Chemetron Corp., Bert Avenue	Newburgh Heights, OH	Depleted uranium in soil and waste
Chemetron Corp., Harvard Avenue	Newburgh Heights, OH	Depleted uranium in soil and waste
Clevite Corporation	Cleveland, OH	Uranium in buildings
Dow Chemical Co.	Bay City, MI Midland, MI	Thorium in slag and soil
Elkem Metals, Inc.	Marietta, OH	Thorium in buildings
Engelhard Corp.	Plainville, MA	Uranium in soil and buildings
Fansteel, Inc.	Muskogee, OK	Thorium and uranium in soil and settling ponds
Frome Investment Co.	Detroit, MI	Thorium burial site
Hartley and Hartley Landfill	Bay County, MI	Thorium and hazardous wastes in landfill
Heritage Minerals	Lakehurst, NJ	Thorium in sand
Horizons, Inc.	Cleveland, OH	Thorium in buildings
Kaiser Aluminum	Tulsa, OK	Thorium contamination in ponds and ground
Kerr-McGee, Cimarron Plant	Crescent, OK	Uranium in buildings, soil, settling ponds
Kerr-McGee, Cushing Plant	Cushing, OK	Thorium and uranium contamination
Lake City Army Ammunition Plant	Independence, MO	Depleted uranium in soil and sand
Magnesium Elektron, Inc.	Flemington, NJ	Uranium and thorium in sludge
Minnesota Mining and Manufacturing Co.	Pine County, MN	Uranium and thorium burial sites
Molycorp, Inc.	Washington, PA	Thorium in soil and slag
Molycorp, Inc.	York, PA	Thorium in soil
Northeast Ohio Regional Sewer District Southerly Plant	Cleveland, OH	Cobalt-60 in sewage sludge and ash

(continued)

**Appendix I
List of 50 Sites in the SDMP Program in
November 1994**

Name	Location	Description of contamination
Nuclear Metals, Inc.	Concord, MA	Depleted uranium in holding basin, soil, and groundwater
Permagrain Products, Inc.	Media, PA	Strontium-90 in building and equipment
Pesses Co.	Pulaski, PA	Thorium in metal scrap and soil; hazardous and mixed waste also present
RMI Titanium Co.	Ashtabula, OH	Uranium in building and soil; uranium and trichloroethylene in groundwater
RTI, Inc.	Rockaway, NJ	Cobalt-60 in soil and burial sites
Safety Light Corp.	Bloomsburg, PA	Radium-226, strontium-90, and cesium-137 in soil and groundwater and tritium in groundwater
Schott Glass Technologies, Inc.	Duryea, PA	Thoriated glass and refractory tile containing small amounts of uranium and thorium in landfill
Sequoyah Fuels Corp.	Gore, OK	Uranium in soil and groundwater
Shieldalloy Metallurgical Corp.	Cambridge, OH	Thorium, uranium, and radium in slag
Shieldalloy Metallurgical Corp.	Newfield, NJ	Thorium, uranium, and radium in slag and soil
Texas Instruments, Inc.	Attleboro, MA	Uranium in soil
UNC Recovery Systems	Wood River Junction, RI	Strontium-90 in groundwater
United Technologies/Pratt & Whitney	Middletown, CT	Cesium-137 and cobalt-60 contamination
Watertown Arsenal/Mall	Watertown, MA	Uranium contamination in buildings and soil
Watertown GSA	Boston, MA	Uranium in soil
West Lake Landfill	Bridgeton, St. Louis County, MO	Radium-226, uranium, and thorium in landfill
Westinghouse Electric Corporation	Madison, PA	Radioactive waste in buildings and waste retention basins; strontium-90 in soil and groundwater
Whittaker Corp.	Greenville, PA	Thorium and uranium in slag
Wyman-Gordon Co.	North Grafton, MA	Thorium in burial sites

Comments From the Nuclear Regulatory Commission



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

March 8, 1995

Victor S. Rezendes
Director, Energy and Science Issues
Resources, Community, and Economic Development Division
United States General Accounting Office
Washington, D.C. 20548

Dear Mr. Rezendes:

Enclosed, per your February 15, 1995 request, are the NRC comments on the draft proposed report entitled Nuclear Regulation: Slow Progress in Identifying and Cleaning Up NRC's Licensees' Contaminated Sites (GAO/RCED-95-95).


James L. Blaha
Assistant for Operations, OEDO

Enclosure:
As stated

cc: Philip Olson

**Appendix II
Comments From the Nuclear Regulatory
Commission**

Comments on Draft GAO Report, "Nuclear Regulation: Slow
Progress in Identifying and Cleaning Up NRC's
Licensees' Contaminated Sites"

1. General

The SDMP program involves the resolution of several policy issues as well as site remediation activities. The GAO report should describe the substantial rulemaking efforts that have been completed and are in progress to address several of the principal policy issues that have impeded site remediation. As a result of the Synar hearing in 1989, NRC initiated major rulemakings to establish requirements for decommissioning timeliness, financial assurance, radiological criteria, and recordkeeping. In July 1994, NRC promulgated a final rule on decommissioning timeliness. In July 1993, NRC promulgated a final rule on decommissioning recordkeeping. In August 1994, NRC initiated a series of public workshops in an enhanced participatory rulemaking, and, in August 1994, published a proposed rule on radiological criteria for decommissioning. This rule is scheduled to be promulgated as a final rule in July 1995. In 1994, NRC proposed revisions to the financial assurance requirements for decommissioning to enhance confidence that sufficient resources will be available to decommission contaminated sites.

2. General

The GAO appears to use the completion of decommissioning, and the removal of a site from the SDMP list, as the only measure of progress. The GAO report should also use as a measure of progress the NRC activities related to the intermediate steps that must be completed before a site can be removed from the SDMP list. NUREG-1444, "Site Decommissioning Management Plan," Section 4.3, discusses the intermediate completions up to April 1993. Since April 1993, NRC staff has completed reviews of 10 site characterization plans, 6 site characterization reports, 9 decommissioning plans, and 4 termination survey reports. In addition, 5 confirmatory surveys were conducted and 3 sites have been removed from the SDMP list. Also, 2 characterization plans, 3 characterization reports, and 3 decommissioning plans are currently under review by NRC staff. We consider that these activities represent substantial progress in remediating SDMP sites.

3. General

While all the SDMP sites have contamination that exceeds our guidelines for unrestricted use, there are no sites that represent an immediate threat to public health and safety. The GAO report should be strengthened by clarifying that the existing contamination at most of the SDMP sites poses a long-term risk to the public health and environment. These risks would only be realized if the access controls and other measures currently in place at the sites broke down and people took up residence or worked on the sites without adequate controls. Short-term hazards at the sites are very limited or non-existent.

Attachment

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4. General

The GAO report should recognize the initiatives that the NRC staff has taken to improve public access to information about the contaminated sites and to inform and involve the public and other stakeholders in the decommissioning process. These initiatives include holding periodic public meetings, coordinating decommissioning actions with other Federal, State, and local authorities, noticing licensing actions, developing Environmental Impact Statements, establishing local public document rooms, and making a wide range of information available to the public.

5. General

The text and conclusions of the report recognize that many of the causes of the delays in remediation are outside of NRC's control. A principal cause of the delays has been limited access to low-level waste disposal facilities. Since the closure of the Barnwell low-level waste disposal facility to out of compact generators in June 1994, access to disposal facilities is even more limited than during most of the period covered by the GAO report. These difficulties are expected to continue or worsen over the next 5 to 10 years unless access to disposal facilities improves.

6. Results in Brief, Last Para., p. 1

To update and clarify the information on formerly terminated licenses, this section of the report should be revised to read: "...Through September 1994, an NRC contractor had reviewed about 27,500 of an estimated 38,500 terminated licenses (about 71 percent). Thus far, NRC has identified 22 sites that exceed radioactive contamination criteria and therefore require further clean-up. NRC also determined that documentation for about 550 other licenses was inadequate to determine whether the sites meet regulatory standards. By December 1994, about 150 of these licenses were subsequently eliminated from concern upon additional review. NRC is in the process of obtaining additional information about contamination at the remaining sites. The total number of sites that could require additional clean-up will not be known until NRC obtains this information and completes its review of the remaining 11,000 terminated licenses, although NRC expects this number to be small based on experience to date. NRC expects the contractor review to be completed in 1996."

The GAO report should indicate that in response to recommendations in GAO's 1989 review, NRC Chairman Carr made commitments to Congress to review sites terminated since 1965 to ensure that the sites were adequately decontaminated. NRC's contractor has completed the initial review, comprising about 17,000 licenses terminated between 1965 and 1985. This review identified approximately 322 licenses requiring additional inquiry. NRC's Regional Offices have completed most of their followup evaluations and site visits for these 322 licenses. This effort largely fulfills NRC commitments to GAO and Congress.

NRC subsequently expanded the review, on its own initiative, to include all terminated licenses, both those terminated before 1965 and those terminated

Now on pp. 1 and 2.

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after 1985. The 11,000 licenses indicated in the GAO report as remaining to be reviewed are part of this additional initiative.

7. Results in Brief, 1st Full Para., p. 2

The GAO report indicates that 11 of 52 sites would be cleaned up by April 1994. NRC review of all previous SDMP reports indicates that 7 sites were scheduled to be removed from the list by April 1994. Five have been removed from the SDMP list. We are unable to confirm the commitments to remove 11 sites from the SDMP list that is referred to in the report.

8. Results in Brief, 2nd Full Para., 2nd Sent., p. 2

Suggest revising to read: "...thorium waste cannot be disposed of onsite in accordance with existing requirements without exemptions, and disposal ..."

9. Results in Brief, Last Sentence, p. 3

The statement is made that as delays continue, more sites are likely to experience groundwater contamination. We consider that this overstates the problem. Other than the sites NRC has already identified with groundwater contamination, few additional sites would be expected to have caused or are causing significant groundwater contamination. Due to the differing chemical and physical properties of the contamination at different sites, groundwater contamination is "possible" but should not be characterized as being "likely." We recommend changing the statement to read: "... as delays continue, it is possible that a few sites could experience similar problems."

10. 2nd Para., 1st Sent., p. 4

Suggest revising to read: "At the conclusion of operations, NRC currently requires licensees ..." Note that the proposed rule on radiological criteria for decommissioning would allow restricted use limits in certain conditions. Depending on the final resolution of public comments, the final rule may include restricted use limits.

11. 3rd Para., 1st Sent., p. 4

Suggest revising to read: "Clean-up for SDMP sites involves many steps." Note that this paragraph is not completely accurate for all of our licensees. For example, NRC regulations allow certain licensees, whose decommissioning programs involve already approved procedures, to begin decommissioning without submitting decommissioning plans.

12. 1st Para., 2nd Sent., p. 5

Note that NRC has not promulgated radiological criteria for decommissioning in its regulations. However, NRC does have guidance for decommissioning criteria that is not in regulations. Suggest using "decommissioning guidelines" rather than "regulatory standards" in this sentence and throughout the report.

Now on p. 2.

Now on p. 3.

Now on p. 3.

Now on p. 3.

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Now on p. 4.

13. 2nd Para., 2nd and 3rd Sent., p. 5

It is stated that NRC officials cannot estimate when the review of terminated licenses will be completed. Suggest deleting the second and third sentences and adding: "NRC expects the contractor review to be completed in 1996." NRC staff review of the results of the contractor review and any needed site inspections will be completed over the next several years, as resources allow.

Now on p. 4.

14. 1st Para., p. 6

Revise to read: "The total number of former sites that could require additional clean-up will not be known until NRC completes its review. However, as of December 31, 1994, NRC had identified 22 sites that exceed radioactive contamination standards for unrestricted use and, consequently, require additional clean-up. According to NRC officials, documentation for about 550 licenses was inadequate to determine whether the sites meet regulatory standards. As of December 1994, about 150 of these licenses were subsequently eliminated from concern upon further review. As a result, NRC is in the process of obtaining additional information about the remaining approximately 400 terminated licenses identified to date using, among other things, the personal knowledge of cognizant NRC staff, site visits, and State and former licensee records. NRC expects that, based on experience to date, only a small number of sites will require remediation."

Now on p. 4.

15. Footnote 3, p. 6

As an update to reflect the changes in comments 6 and 14, add Colorado and West Virginia to the list of States.

Now on p. 6.

16. 2nd Full Para., 2nd Sent., p. 8

It is stated that little progress has been made in cleaning up most of the problematic sites. Due to the complex nature of SDMP sites, progress should not be measured solely by removals from the SDMP list, but should reflect the effort expended on the necessary intermediate actions (e.g., reviews of characterization plans, characterization reports, remediation plans, final survey reports, and confirmatory survey reports) that have been completed. We suggest that the intermediate review completions be addressed to more accurately reflect progress. Note that Section 4.3 of NUREG-1444 discusses the major SDMP activity completions during the period up to April 1993. Since April 1993, NRC staff has completed reviews of 10 site characterization plans, 6 site characterization reports, 9 decommissioning plans, and 4 termination survey reports. In addition, 5 confirmatory surveys were conducted and 3 sites have been removed from the SDMP list. Completion of these activities represent substantial progress in remediating SDMP sites.

Now on pp. 6 and 7.

17. 2nd Full Para., p. 9 and 1st Para., p. 10

The discussion implies that there is an immediate health and safety danger to individuals who ignore the posted hazard signs and enter contaminated areas. For SDMP sites having outdoor contamination, the radioactivity exposure

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levels are low enough that infrequent intruders, like hunters, even though they ignore posted hazard signs, will not receive doses that place them in immediate danger. In the example that is given, it is stated that drums of contamination have been covered by soil. As an interim measure, covering the drums with soil would actually reduce exposure levels to intruders, make it more difficult to intentionally or unintentionally remove the contamination from the site, and reduce the overall hazard. The SDMP sites do not represent an immediate threat to public health and safety with the controls currently in effect.

Now on p. 8.

18. 1st Para., 3rd Sent., p. 12

It is stated that groundwater may be contaminated at nearly 400 former sites. Neither the NRC nor NRC's contractor on review of the formerly terminated licenses knows of any basis for this statement. As stated in comment 9, NRC does not expect significant groundwater contamination at many of these sites. Nevertheless, the potential for groundwater contamination will be evaluated as part of the review of the formerly terminated licenses.

Now on p. 8.

19. 2nd Para., 2nd Sent., p. 12

Suggest revising to read: "... large volumes of thorium waste cannot be disposed of on-site under existing regulations without an exemption..." to more accurately reflect current requirements and NRC's consideration of exemption requests.

Now on p. 9.

20. 2nd Para., 2nd Sent., p. 13

The statement that thorium is a "potentially dangerous radioactive material" overstates the hazard of thorium, and implies that an immediate threat to public health and safety exists. Thorium is a naturally occurring nuclide that is ubiquitous in nature. In fact, most of the difficult SDMP thorium sites involve contamination from metal extraction from natural ores. While the thorium concentrations in these materials exceed unrestricted use criteria, it is incorrect to imply that an immediate threat to public health and safety exists at SDMP sites. We suggest deleting the phrase, "potentially dangerous radioactive material."

Now on p. 9.

21. 2nd Para., 4th and 5th Sent., p. 13

NRC's regulations did not authorize disposal of thorium wastes subject to future restrictions. The 1981 Branch Technical Position on "Disposal or Onsite Storage of Thorium or Uranium Wastes From Past Operations" included reliance on land use restrictions under Options 3 and 4. In the 1992 Action Plan for SDMP sites (57 FR 13389), NRC explicitly eliminated the restricted use options to ensure consistency with the 1988 rule that established general requirements for decommissioning.

Now on p. 10.

22. 1st Partial Para., Last Sent., p. 15

The GAO report should also refer to the financial assurance requirements in place in NRC regulations. These regulations require certain licenses to

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provide financial assurance for decommissioning to ensure that funds will be available for decommissioning even in the event that licensees go out of business.

Now on pp. 10 and 11.

23. Last Para., p. 15

This discussion should note that NRC's proposed rule on radiological criteria for decommissioning proposes restricted use options for privately owned land under certain conditions.

Now on p. 13.

24. 1st Full Para., p. 19

As noted in the report, NRC has developed a pilot project management data base system to increase the efficiency and effectiveness of NRC staff reviews of decommissioning projects. The system used the Harvard Project Manager software. NRC pilot tested the application of the data base during October-December 1994 for a limited number of SDMP projects managed in the Low-Level Waste and Decommissioning Projects Branch. Although NRC is currently reviewing the results of the test, early indications are that continued application of the Harvard Project Manager system would require more resources than can be justified.

Now on p. 13.

25. 1st Full Para., 1st Sent., p. 20

The report concludes that exempting licensees from unrestricted use provisions is unlikely to provide a solution for many SDMP sites. However, the basis for this conclusion is unclear and inconsistent with current policy developments. In the proposed rule on radiological criteria for decommissioning (August 1994), NRC proposed allowing for restricted use options in limited cases. The proposed rulemaking also recognized that the rule may not be applicable to some contaminated sites, where decommissioning is more similar to a waste disposal operation than a conventional decommissioning in which most of the radioactive material is removed from the site (59 FR 43217, Columns 1-3). NRC is developing Environmental Impact Statements (EISs) for the Shieldalloy Metallurgical Corporation sites in Cambridge, Ohio, and Newfield, New Jersey, the Sequoyah Fuels Site near Gore, Oklahoma, and the Parks Township Shallow Land Disposal Area near Leechburg, Pennsylvania. These EISs will analyze the technical, legal, environmental, and financial issues related to various restricted use alternatives. The information to be developed in these EISs will provide information for evaluating other sites with large volumes of thorium contamination.

Now on pp. 13 and 14.

26. 1st Partial Para., p. 21

Revise to read: "... already has identified 22 sites requiring additional clean-up and over 400 former sites ..."

27. General

The GAO report uses the term "SDMP Director" in several places. We suggest that the specific title of the person referred to be used, since "SDMP Director" is not a specific position title.

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The GAO report uses the term "clean-up" throughout the report. However, it is used in several ways that can be misunderstood. For example, "clean-up" is used to mean removed from the SDMP list. It is also used to mean remediation. Note that the UNC Recovery Systems site in Rhode Island has completed remediation activities, but must wait for completion of administrative actions involving the State to be removed from the SDMP list. Also Babcock & Wilcox has completed remediation activities at the site in Apollo, Pennsylvania, but must await completion of a year-long groundwater monitoring program before it can be removed from the SDMP list. We suggest that more appropriate and consistent terms be used when referring to either remediation or removal of a site from the SDMP list.

28. Appendix I

Descriptions of the sites in Appendix I should be revised as follows to provide a more accurate description of the type of contamination:

Advanced Medical Systems	Cobalt-60 in building and sewer line
Babcock & Wilcox, Parks Township	Uranium and thorium burial site
Cabot Corp., Reading	Uranium and thorium contamination in building and slag
Cabot Corp., Revere	Uranium and thorium contaminated slag and soil
Nuclear Metals	Depleted uranium in holding basin, soil, and groundwater
Schott Glass	Thoriated glass and refractory tile containing small amounts of uranium and thorium in landfill
UNC Recovery Systems	Strontium-90 in groundwater
Watertown Arsenal/Mall	Uranium contamination in buildings and soil
Westinghouse	Radioactive waste in buildings and waste retention basins; strontium-90 in soil and groundwater

Major Contributors to This Report

Resources,
Community, and
Economic
Development
Division, Washington,
D.C.

Bernice Steinhardt, Associate Director
Gene Aloise, Assistant Director
Philip A. Olson, Assignment Manager
Kathleen Turner, Adviser

Office of General
Counsel

Mindi G. Weisenbloom, Senior Attorney

Chicago/Detroit Field
Office

Anthony A. Krukowski, Regional Management Representative
Odell W. Bailey, Jr., Evaluator-in-Charge
Joanna C. Allen, Evaluator

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