

GAO

Report to the Chairman, Environment,
Energy, and Natural Resources
Subcommittee, Committee on
Government Operations, House of
Representatives

June 1993

RADIOACTIVE WASTE

EPA Standards Delayed by Low Priority and Coordination Problems



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**Resources, Community, and
Economic Development Division**

B-252509

June 3, 1993

The Honorable Mike Synar
Chairman, Environment, Energy, and
Natural Resources Subcommittee
Committee on Government Operations
House of Representatives

Dear Mr. Chairman:

The management and disposal of radioactive waste have long been focal points of national concern. Radioactive waste results from various processes, such as the production of nuclear weapons and civilian nuclear power. The Environmental Protection Agency (EPA) is authorized to issue standards to protect the general environment from radiation. The Department of Energy (DOE) and the Nuclear Regulatory Commission (NRC) are authorized to establish standards for radiation contained inside nuclear facilities. DOE establishes standards for weapons plants and energy research and development facilities, while NRC establishes standards for commercial facilities.

This report responds to your request for information on the status of EPA's development of radiation protection standards. We agreed to (1) examine the length of time taken for EPA to issue four sets of standards on high-level waste, low-level waste, the protection of groundwater at inactive uranium-processing sites, and residual radiation; (2) examine the factors that have had an impact on the time taken for EPA to issue these standards; and (3) provide information on the activities of EPA's radiation laboratories, specifically those activities related to the development of radiation protection standards.

Results in Brief

EPA's Office of Radiation and Indoor Air¹ has experienced lengthy delays in developing standards governing various aspects of radioactive waste management, including standards for high-level waste, low-level waste, inactive uranium-processing sites, and residual radiation. EPA's timely development of radiation protection standards is important. For example, DOE and the Department of Defense (DOD) have informed both EPA and the Congress of the need for residual radiation standards so that they (DOE and

¹In October 1992, EPA's Office of Radiation Programs was renamed the Office of Radiation and Indoor Air. In this report, references to activities undertaken and information provided by the Office of Radiation and Indoor Air include those and that of its predecessor.

DOD) can clean up contaminated sites. Until such standards are developed, cleanups will vary in degree.

EPA announced the need for the four above sets of standards between December 1976 and June 1984, but as of March 1993, had not successfully issued any of the four. Although EPA issued standards for inactive uranium-processing sites and high-level waste in 1983 and 1985, respectively, courts later remanded provisions in both sets of standards. In March 1993, EPA's Director of the Office of Radiation and Indoor Air said that EPA plans to issue high-level waste standards by June 1993 but has not yet established a specific date for issuing standards for inactive uranium-processing sites.

EPA's low priority for developing radiation standards and the ensuing limited allocation of resources to the Office of Radiation and Indoor Air have contributed to EPA's delays in issuing radiation standards. EPA's Science Advisory Board has ranked radiation (from sources other than indoor radon) as a low environmental risk and a medium cancer risk but did not provide an overall ranking of its risk to human health. In addition, EPA officials have stated that, because resources are limited throughout the agency, EPA devotes most of its resources to other activities that are congressionally or judicially mandated. While EPA's Office of Radiation and Indoor Air has assumed increased responsibility for developing radiation standards during the past 15 years, its funding, adjusted for inflation, decreased by about 18 percent, and its staffing declined by about 41 percent from October 1977 to September 1992.

Attempts to coordinate the development of standards and resolve the concerns of other federal agencies, such as DOE, NRC, and the Office of Management and Budget (OMB), have also delayed EPA from completing radiation protection standards. At times, DOE and NRC have had different opinions on the content of EPA's proposed standards. Settling these disagreements has been very time-consuming and has required that EPA perform additional work to support its position. Although EPA has taken steps to improve its coordination with DOE and NRC, OMB has raised additional concerns once the standards were submitted for review. Delays in completing groundwater protection standards for inactive uranium-processing sites are primarily associated with OMB's concerns that EPA has not adequately demonstrated the costs and benefits of the standards as well as alternatives for addressing groundwater contamination at the sites.

EPA's radiation laboratories do not play a major role in the standards development process because it is not part of their primary mission. Instead, the laboratories perform a variety of other activities, such as monitoring environmental radiation levels, testing the accuracy of radon detection equipment, and responding to nuclear emergencies.

Background

Radioactive waste results from governmental and commercial use of nuclear fuel and material. While some radioactive waste is safe to handle, other types are intensely "hot", in both temperature and radioactivity. Some waste decays so that its radioactivity diminishes to very low levels, in a matter of days or weeks, while other types continue to present a radiological hazard for thousands of years.

Radioactive Waste Categories

Major categories of radioactive waste include spent nuclear fuel, such as uranium and plutonium, from nuclear reactors; high-level waste; transuranic waste; low-level waste; and uranium mill tailings from mined uranium.

- Spent nuclear fuel, which consists of fuel rods that have been permanently withdrawn from a nuclear reactor, is the most radioactive type of civilian nuclear waste.
- High-level waste is highly radioactive material that remains after spent fuel has been reprocessed. During reprocessing, most of the uranium and plutonium are usually removed for reuse.
- Transuranic waste, which includes items contaminated with man-made radioactive elements having atomic numbers higher than uranium, is generated almost exclusively as a result of DOE's nuclear weapons production.
- Low-level waste includes radioactive waste not classified as spent fuel, high-level waste, transuranic waste, or "by-product" material, such as uranium mill tailings. Some types of low-level waste, such as waste generated during nuclear reactor operations, can be more radioactive than some types of high-level waste.
- Uranium mill tailings are sand-like residues remaining from the processing of uranium ore. Most tailings have very low radioactivity, but extremely large volumes can pose a cumulative hazard, particularly from radon emissions or groundwater contamination.

DOE estimates that, through 1989, the volume of spent nuclear fuel, high-level waste, transuranic waste, and low-level waste totaled 4.6 million

cubic meters. By volume, low-level waste makes up more than 85 percent of all U.S. radioactive waste. Most of the remaining 15 percent is high-level and transuranic waste, with spent fuel accounting for less than 2 tenths of 1 percent. In terms of the total amounts of radioactivity, however, spent fuel accounts for nearly 95 percent of the radioactivity contained in the 4.6 million cubic meters. Low-level waste accounts for less than 1 tenth of 1 percent.

Regulatory Responsibilities

When the President created EPA by Reorganization Plan No. 3 in 1970, it was thought that an independent agency would give greater attention to the importance of setting standards and guidance for protecting health and the environment from radiation hazards. More specifically, the Reorganization Plan transferred to EPA certain radiation authorities from the Atomic Energy Act of 1954, as amended. One authority was that of making recommendations to the President concerning guidance to appropriate federal regulatory agencies for the formulation of radiation standards. A second radiation authority given to EPA was that it establish generally applicable environmental standards for the protection of the environment from radiation and radioactive materials. EPA was not authorized to set standards for radiation contained inside nuclear facilities. These standards are established and implemented by DOE and NRC. DOE establishes standards for weapons plants and energy research and development facilities, while NRC establishes standards for commercial facilities.

Since 1970, EPA's radiation protection authority has been supplemented by other legislation. The Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), as amended, required that EPA promulgate general standards for inactive uranium mill tailings sites by October 1982. The Nuclear Waste Policy Act of 1982 required EPA to promulgate by January 1984 generally applicable standards to protect the general environment from off-site releases from radioactive material in nuclear waste repositories. The Waste Isolation Pilot Plant Land Withdrawal Act of 1992 requires EPA to issue final disposal standards for spent nuclear fuel, high-level waste, and transuranic radioactive waste by April 1993.² The Energy Policy Act of 1992 requires EPA, in consultation with the National Academy of Sciences, to promulgate by December 1994 separate standards to protect the public from releases of high-level waste stored or disposed of at the Yucca Mountain, Nevada, repository site.

²All three waste categories are included in one set of standards, which are referred to as the "high-level waste" standards.

EPA has cited its general authority under the Atomic Energy Act to develop some standards, such as those for the management, storage, and disposal of low-level waste. Although legislation specifically requiring EPA to promulgate residual radiation standards for cleanups at radiologically contaminated sites has not been enacted, EPA has begun developing standards and guidance for these cleanups under the general authority of the Atomic Energy Act.

Executive Order 12291, issued in 1981, requires that OMB review proposed regulations of executive agencies. The executive order authorizes OMB to, among other things, (1) determine whether proposed regulations, such as EPA's standards, duplicate, overlap, or conflict with existing or proposed rules of other federal agencies and (2) require appropriate interagency consultation to minimize or eliminate duplication, overlap, or conflict. The executive order also requires that the potential benefits of every agency rulemaking must outweigh the costs, and to the extent allowed by law, that agencies must choose the alternative involving the least net cost. An agency must refrain from publishing a final rule in the Federal Register until it responds to OMB's concerns and incorporates OMB's views in the rulemaking file. According to OMB officials, if an agency is dissatisfied with OMB's review, the agency may elevate its concerns to a higher level in OMB, to a higher level in the executive branch, and ultimately to the President.

EPA's timely development of radiation protection standards is important. For example, as of July 1992, DOE had spent about \$1.3 billion in developing the Waste Isolation Pilot Plant—a facility for the disposal of transuranic waste. However, DOE will be unable to complete its test program at the facility to determine the facility's suitability for permanently disposing of waste until EPA promulgates disposal standards for transuranic waste. In addition, DOE and DOD have informed both EPA and the Congress of the need for residual radiation standards so that they (DOE and DOD) can clean up contaminated sites. These standards are needed to determine when sites no longer require regulatory control and can be released for unrestricted use. Until EPA develops such standards, cleanups will vary in degree.

Delays in Developing Major Radiation Standards

EPA has spent several years in developing the four sets of standards we examined—high-level waste, low-level waste, inactive uranium-processing sites, and residual radiation standards—but none had been successfully issued as of March 1993. While the standards for inactive uranium-processing sites and high-level waste were issued in 1983 and

1985, respectively, courts later remanded provisions in both sets of standards to EPA. As shown in table 1, EPA and/or the Congress announced the need to develop these standards as early as December 1976.

Table 1: Dates When EPA And/or the Congress Announced the Need for Radiation Standards

Standards	Date
High-level waste standards	Dec. 1976 ^a
Groundwater protection standards for inactive uranium-processing sites	Nov. 1978 ^b
Low-level waste standards	Aug. 1983
Residual radiation standards	June 1984 ^c

^aAlthough EPA issued its final rule in September 1985, a federal court remanded the standards in July 1987 after ruling that portions of the standards were defective. In September 1987, the court reinstated part of the standards.

^bIn November 1978, the Congress enacted UMTRCA, which required EPA to issue general standards for uranium mill tailings at both active and inactive uranium-processing sites. Although EPA promulgated final standards for inactive uranium-processing sites in January 1983, a federal court remanded the groundwater provisions in the standards to EPA in September 1985.

^cIn June 1984, EPA assembled an interagency work group to address criteria for the cleanup of residual radioactivity but had not decided whether to issue the criteria in the form of standards or guidance.

Only One of Four Standards Is Near Completion

Only one of the four sets of standards appears to be nearing completion—the high-level waste disposal standards. OMB returned the draft proposed high-level waste standards to EPA in January 1993, and they were published in the Federal Register for public comment in February 1993. The Waste Isolation Pilot Plant Land Withdrawal Act required EPA to issue final standards by April 1993. In March 1993, the Director of EPA’s Office of Radiation and Indoor Air stated that the standards should be issued by June 1993.

The remaining three sets of standards—the low-level waste standards, the groundwater protection standards for inactive uranium-processing sites, and the residual radiation standards—are in various stages of development. OMB suspended its review of EPA’s draft proposed low-level waste standards in January 1990, pending an EPA review of concerns raised by DOE and NRC. On January 15, 1993, OMB returned EPA’s draft final groundwater protection standards for inactive uranium-processing sites to EPA for reconsideration. In March 1993, the Director of EPA’s Office of Radiation and Indoor Air said that EPA plans to discuss the standards with OMB before deciding what further action should be taken. EPA has not yet drafted cleanup standards for residual radiation. Appendixes I through IV

contain detailed information about delays associated with EPA's promulgation of each of the four sets of radiation protection standards.

Factors Delaying Radiation Standards' Development

Factors that have contributed to EPA's delays in promulgating the four sets of standards include their low priority and unsuccessful attempts to resolve conflicts and coordinate with other executive agencies, particularly DOE, NRC, and OMB.

Low Priority Has Delayed Standards' Development

Delays in developing and completing management, disposal, and cleanup standards have resulted, in part, because EPA perceives radiation protection as having a lower priority than other EPA activities. Consequently, EPA's Office of Radiation and Indoor Air has not received the necessary resources to promulgate final standards in a more timely manner. EPA's Science Advisory Board has ranked radiation (from sources other than indoor radon) as a low risk to natural ecology and welfare. The Board's September 1990 report, which assessed and compared different environmental risks, ranked radiation below other problems such as habitat alteration, stratospheric ozone depletion, global climate change, herbicides/pesticides, and airborne toxics.³ Although the report ranked radiation as a medium cancer risk, it provided no overall ranking of the risk of radiation to human health.

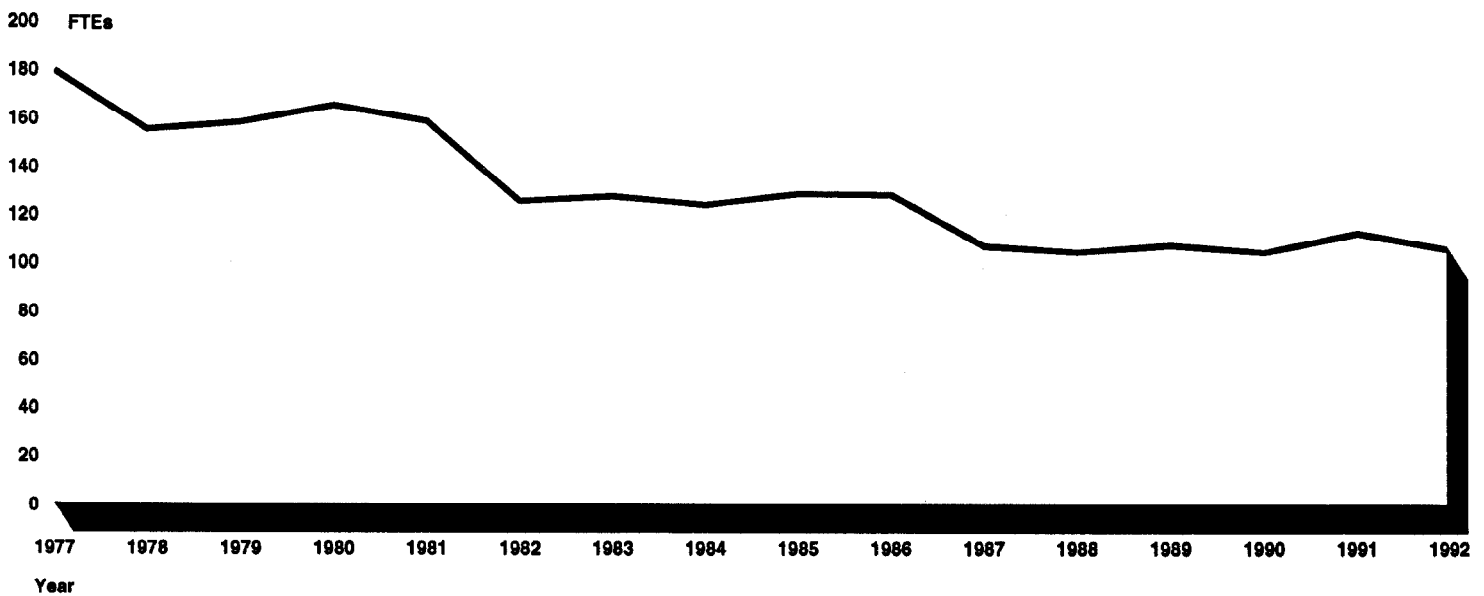
Officials in the Office of Radiation and Indoor Air said that because resources are limited throughout the agency, EPA devotes most of its resources to other activities having congressional or judicial mandates, such as the Clean Air Act. While the Director of EPA's Office of Radiation and Indoor Air acknowledged that having mandates does not ensure that EPA will issue standards in a timely manner, she stated that the lack of such mandates almost guarantees that EPA will be unable to do so.

Developing radiation standards is a resource-intensive process because EPA's standards must be adequately supported in order to withstand challenges by other federal agencies, interest groups, and the public at large. Even the revision of standards remanded by a federal court, such as the high-level waste standards, may require additional study because more data are available than existed when the standards were first developed. Despite EPA's increased radioactive waste management responsibilities, the Office of Radiation and Indoor Air's budget from October 1977 to September 1992 decreased about 18 percent once inflation is considered.

³Reducing Risk: Setting Priorities and Strategies for Environmental Protection, EPA Science Advisory Board (EPA/SAB-EC-90-021, Sept. 1990).

Likewise, as shown in figure 1, the number of full time equivalents (FTE) allocated to the Office decreased by about 41 percent, with 179 FTES allocated in 1977 and 105 allocated in 1992.⁴

Figure 1: FTEs Allocated to the Office of Radiation and Indoor Air, Fiscal Years 1977-92



Source: EPA's Office of Air and Radiation.

The increase in responsibilities, without additional resources, has delayed EPA's development of radiation standards. After the high-level waste disposal standards were issued in 1985, most of the staff who worked on the standards were reassigned to other activities, such as work on the low-level waste standards. When a federal court remanded the standards in 1987, adequate staffing could not be obtained until the Congress appropriated additional money for the project in 1989. Furthermore, because limited staff were available, they were sometimes reassigned to work on standards that were considered to have a higher priority. This situation still exists. For example, a Section Chief in EPA's Criteria and Standards Division stated that, as of April 1993, he had no staff to work on

⁴This analysis of funding and staffing excludes the Office of Radiation and Indoor Air's radon and indoor air programs.

standards for the management, storage, and disposal of low-level waste because they had been directed to work on the high-level waste standards. Resource constraints have also prevented EPA from developing residual radiation standards or guidance for cleaning up radiologically contaminated sites even though other federal agencies, such as DOE, have stated that cleanup criteria are needed.

Efforts to Resolve Concerns Have Contributed to Delays

Efforts by EPA to coordinate its standards development and resolve the concerns of other federal agencies and OMB have contributed to delays in promulgating radiation protection standards. For example, prior to submitting the high-level waste standards to OMB for review in December 1992, EPA circulated three "working" drafts of revised high-level waste standards to other agencies for comment between June 1989 and April 1991. In addition, the Electric Power Research Institute, with EPA's support, sponsored a workshop attended by DOE, NRC, and other concerned parties in September 1991 to address issues that the attendees had raised about the proposed standards. The Institute held a second workshop in February 1992 to obtain further convergence of viewpoints on unresolved issues, and EPA circulated a fourth draft of its proposed standards for comment. Largely because of numerous comments received on the proposed standards, in April 1992 EPA requested that its Science Advisory Board review the scientific basis underlying EPA's regulatory release limits for radioactive gases. In July 1992, EPA and DOE jointly requested the National Academy of Sciences to conduct a separate review of issues based on comments that DOE agreed to provide to EPA.

OMB Requires Interagency Consultation

According to the Director of EPA's Criteria and Standards Division, EPA tries to obtain concurrence from NRC and DOE before submitting rules to OMB for review. He said that, otherwise, OMB will not move the rules forward for final promulgation. OMB cited the need for further interagency consultation as a reason for suspending its review of two of the four sets of EPA radiation protection standards we examined.⁵ In July 1988, EPA submitted its draft proposed low-level waste standards to OMB for review. In November 1988, EPA and NRC staff began meeting to resolve their differences regarding several issues raised by NRC. The two agencies reached an impasse in January 1989 and agreed to draft a joint letter to OMB outlining each agency's concerns and positions. In March 1989, OMB suspended its review of the draft proposed standards, pending receipt of the letter. But instead of sending a joint letter, in April 1989 EPA submitted a revised draft preamble and draft proposed standards to OMB and stated

⁵As of January 1993, EPA had submitted only three of the four sets of standards to OMB for review.

that it (EPA) had adequately responded to NRC's concerns. However, NRC continued to express concerns about the standards, and DOE informed OMB that it also had concerns. In January 1990, OMB again suspended its review of the proposed low-level waste standards, pending an EPA analysis of benefits and costs as well as of alternatives to the standards, and a review of legal and procedural issues raised by NRC and DOE.

EPA's promulgation of groundwater protection standards for inactive uranium-processing sites has also been delayed, in part, because of coordination issues with OMB, DOE, and NRC. EPA began developing these standards after a federal court in September 1985 remanded the groundwater protection provisions contained in EPA's 1983 standards for the cleanup and disposal of mill tailings at inactive processing sites. The court directed EPA to include general groundwater protection standards comparable to those that EPA had established for active uranium-processing sites. According to an OMB official, EPA submitted new draft proposed standards to OMB for review in July 1987, and OMB completed its review the following month. After publishing the proposed standards in the *Federal Register* and receiving public comments, EPA revised the standards and resubmitted them to OMB in final form in March 1989, 6 years after EPA issued its 1983 standards on mill tailings.

OMB suspended its review of groundwater provisions on two separate occasions, citing, among other things, the need for EPA to resolve DOE's and NRC's concerns and to demonstrate that the benefits of the standards bear a reasonable relationship to the costs. While DOE has informed OMB that EPA's May 1991 version of the revised standards is acceptable, as of March 1993 EPA had not fully resolved NRC's and OMB's concerns. On January 15, 1993, OMB returned the standards to EPA for reconsideration. OMB cited four reasons for returning the standards. Three of the reasons pertain to OMB's concern that EPA had not adequately demonstrated the cost and benefits of the standards as well as alternatives for addressing groundwater contamination from inactive uranium-processing sites. The fourth reason cited by OMB was EPA's inability to resolve NRC's concern that EPA was usurping some of NRC's authority.

EPA previously attempted to respond to each of these concerns. However, EPA and OMB have had a fundamental disagreement regarding whether DOE should clean up contaminated groundwater not currently being used. OMB informed EPA that the limited extent of potential exposure at some sites suggests that EPA's standards should include alternatives to cleaning up the groundwater, such as a provision for alternative drinking water supplies or

the installation of water treatment devices. According to OMB, these alternatives are likely to provide equal or greater protection of human health at far less cost. However, EPA has stated that the usage of the groundwater in these areas will likely increase as the population increases. EPA asserts that the costs of cleaning up contaminated groundwater should be borne as part of the disposal and cleanup program, as the Congress directed, and not passed on to future users of groundwater.

Efforts to Improve Coordination With Other Agencies

EPA has taken some steps to improve its coordination with NRC and DOE. In March 1992, EPA and NRC signed a memorandum of understanding to establish a basic framework for resolving issues of concern to both agencies that relate to the regulation of radioactive materials. The Director of EPA's Office of Radiation and Indoor Air stated that she is very pleased with the two agencies' progress in implementing the memorandum and the development of priorities for addressing various standards-related issues. To facilitate coordination with DOE, EPA officials said that, over the last year, EPA has initiated meetings between its Deputy Administrator for Air and Water and DOE's Assistant Secretaries for Environmental Restoration and Waste Management and for Environment, Safety and Health, as well as the Director of the Office of Civilian Radioactive Waste Management.

Interagency Committee Not Used to Coordinate Standards

EPA has not relied on the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) to coordinate its proposed radiation protection standards with other agencies. Established in 1984 by the Office of Science and Technology Policy,⁶ CIRRPC has as two of its purposes facilitating the coordination of federal radiation policy among agencies and advising on the formulation of broad radiation policy. However, CIRRPC's charter states that the establishment of CIRRPC in no way changes or diminishes the statutory authority or responsibility of any agency or department. CIRRPC comprises 18 member agencies, including DOE, NRC, and EPA, that have policy and/or scientific roles in the regulation and/or use of radiation.

EPA's Criteria and Standards Division Director told us that EPA prefers to work directly with other federal agencies. In addition, the Director of EPA's Office of Radiation and Indoor Air said that she had questions about CIRRPC's objectivity because technical support to facilitate CIRRPC's operation is provided through a DOE contract and DOE contributes more

⁶The Office of Science and Technology Policy was established within the Executive Office of the President in 1976 to advise the President of scientific and technological considerations involved in areas of national concern.

funding for contractor support than other member agencies.⁷ CIRRPC's review of EPA's proposed drinking water regulations has also led EPA to conclude that EPA should not rely on CIRRPC as a means of coordination. According to the Criteria and Standards Division Director, CIRRPC officials had informed an EPA official that EPA would be allowed to attend all meetings during the course of the review, and this did not occur. CIRRPC's Executive Committee Chairman, however, explained that EPA was excluded from certain phases of the review process because of concern that other member agencies might be reluctant to comment on EPA's proposed standards if EPA were present.

EPA Laboratories Have Limited Role in Standards' Development

According to the Director of the Office of Radiation and Indoor Air, EPA's two radiation laboratories have not been given significant responsibility for the development of standards because it is not part of their primary mission. The laboratories' principal mission, which dates to the laboratories' establishment under the Public Health Service, is to conduct environmental monitoring, radiochemical analyses, and emergency preparedness and response functions. The laboratories' monitoring and analytical capabilities, however, are used in support of regulatory development.

The Director said the laboratories have often supported regulatory development because of their monitoring and analytical capabilities. For example, the laboratories' analytical and field measurement capabilities were used to develop background information supporting the emission standards for radionuclides, included in the National Emissions Standards for Hazardous Air Pollutants, promulgated under section 112 of the Clean Air Act. The laboratories have also used their computer expertise in the development of model-based standards promulgated by EPA, such as the high-level waste standards. In addition, information collected by the laboratories concerning the levels of electromagnetic fields in a variety of environmental situations may contribute to the development of guidance on exposure to those fields.

The majority of the laboratories' effort is devoted to supporting the monitoring and analytical functions. Programs that are currently supported through the operations of the two laboratories involve, among other things, testing the accuracy of radon detection devices; providing analytical support to surveys of radon concentrations in homes, schools, and other public buildings; conducting radiochemical analyses of

⁷Funding for the DOE contract is provided by CIRRPC's member agencies.

environmental media and performing site assessments at Superfund sites where radiation contamination is known or suspected; and refining cleanup technologies for sites where cleanup or restoration is required. These efforts are in addition to the laboratories' traditional functions, such as operating a national monitoring system to determine radiation levels in air, precipitation, groundwater, milk, and soil; responding to emergencies at sites where radioactive materials are present; and performing analyses of radioactive materials in unique situations.

Conclusions

EPA's efforts to promulgate radiation protection standards have been delayed, in part, because radiation protection is perceived by EPA as having a lower priority than other agency activities and has, therefore, received limited resources. While resource constraints have negatively affected EPA's ability to promulgate standards in a timely manner, we recognize that resources are limited throughout the entire agency. However, we also recognize that, in the absence of congressional or judicial mandates and additional resources, EPA is not likely to promulgate radiation protection standards in a timely fashion, which could negatively affect the cleanup of facilities and radioactive waste disposal.

EPA has also experienced delays in developing proposed standards and moving them through OMB's review process because of the need to coordinate the development of standards and address the concerns of DOE, NRC, and OMB. Although EPA has recently taken steps to improve coordination with DOE and NRC, OMB has raised additional concerns once standards were submitted for review. EPA's proposed groundwater protection standards for inactive uranium-processing sites are currently being delayed primarily by OMB's concerns. EPA has been unable to resolve these concerns for over 3 years, and the two parties have a fundamental disagreement regarding whether contaminated groundwater not currently being used should be cleaned up. The Congress mandated that these standards be completed in 1982. Although this deadline lapsed over 10 years ago and the standards are being repromulgated following a 1985 court remand, we believe that the Congress, in setting the deadline, intended that the standards be issued expeditiously.

Recommendation

We recommend that, in the case of the groundwater protection standards for inactive uranium-processing sites, where EPA and OMB program officials have been unable to resolve fundamental disagreements in a timely manner and where the Congress has expressed its intention for

expeditious issuance, the Administrator, EPA, meet with the Director, OMB, to resolve these differences.

Agency Comments

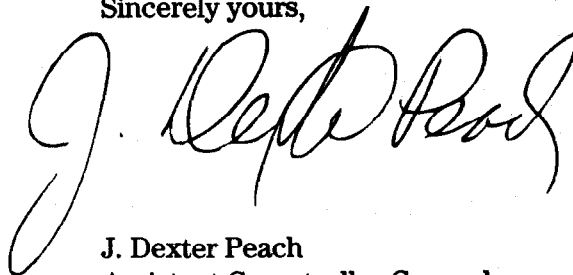
We discussed the facts in this report with the Director and Deputy Director of EPA's Office of Radiation and Indoor Air. We also obtained comments from officials in NRC's Office of Nuclear Material Safety and Safeguards and Office of Nuclear Regulatory Research; DOE's Office of Environment, Safety and Health; OMB's Office of Information and Regulatory Affairs; and the Director of CIRRPC's Executive Committee, on excerpts of the report that were relevant to their respective organizations. The officials generally concurred with the information presented and provided technical corrections and clarifying information, which have been incorporated in the report as appropriate. However, as requested, we did not obtain written agency comments on a draft of this report.

We conducted our review from March 1992 through February 1993 in accordance with generally accepted government auditing standards. Appendix V contains more information on our objectives, scope, and methodology.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will provide copies to the Secretary of Energy; Administrator, EPA; Chairman, NRC; and Director, OMB. We will make copies available to others on request.

This work was performed under the direction of Richard L. Hembra, Director, Environmental Protection Issues, who can be reached on (202) 512-6111 if you or your staff have any questions. Major contributors to this report are listed in appendix VI.

Sincerely yours,

A handwritten signature in black ink, appearing to read "J. Dexter Peach". The signature is written in a cursive style with a large initial "J" and a long, sweeping underline.

J. Dexter Peach
Assistant Comptroller General

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Abbreviations

CIRRPC	Committee on Interagency Radiation Research and Policy Coordination
DOD	Department of Defense
DOE	Department of Energy
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
FTE	full time equivalent
GAO	General Accounting Office
NAS	National Academy of Sciences
NRC	Nuclear Regulatory Commission
NRDC	Nuclear Resources Defense Council
OMB	Office of Management and Budget
SAB	Science Advisory Board
UMTRCA	Uranium Mill Tailings Radiation Control Act
WIPP	Waste Isolation Pilot Plant

Chronology of High-Level Waste Standards

Since the late 1970s, the Environmental Protection Agency (EPA) has been engaged in setting standards to protect people and the environment from the potential hazards associated with the long-term disposal of spent nuclear fuel, high-level wastes, and transuranic nuclear wastes.¹ In September 1985, pursuant to its legislative authority and responsibilities under (1) the Atomic Energy Act of 1954, as amended, (2) the Executive Branch's Reorganization Plan No. 3 of 1970, and (3) the Nuclear Waste Policy Act of 1982, as amended, EPA issued generally applicable environmental standards to regulate the management and storage of spent fuel, high-level wastes, and transuranic wastes (hereafter referred to as the "high-level waste standards"). In March 1986, EPA's high-level waste standards were challenged in a petition filed by environmental groups and several states in the U.S. Court of Appeals for the First Circuit. In 1987, the court remanded parts of the standards to EPA because of deficiencies in the promulgation of the standards' provisions to protect (1) people outside of a disposal facility from receiving harmful radiation doses and (2) groundwater in the vicinity of a facility from contamination.

Following the 1987 court decision, EPA has been working to revise its high-level waste standards. Before EPA could complete its proposed regulatory changes, the Congress, in October 1992, enacted legislation that amended EPA's standard-setting authority. The legislation reinstated all but two parts of the original disposal regulations; set a 6-month deadline for EPA to issue final high-level waste disposal regulations; and required that EPA develop and issue, by the end of 1994, separate radiation protection standards for one of two nuclear waste disposal sites that the Department of Energy (DOE) is presently investigating.

Background

It is essential to properly manage and dispose of spent nuclear fuel and high-level wastes because of the inherent hazard posed by the large amounts of radioactivity that they contain. Although transuranic wastes are contaminated with smaller amounts of radioactivity than spent fuel or other high-level waste, they contain long-lived and highly-toxic radioactive materials, such as plutonium and americium, thus warranting their isolation from people and the environment for thousands of years. Prolonged human exposure to any of these radiation sources could result

¹Three principal forms of nuclear waste are spent nuclear fuel, the result of the fissioning of fuel in nuclear reactors for military and commercial purposes; high-level radioactive waste, the result of the reprocessing of spent nuclear fuel to recover unfissioned uranium or plutonium; and transuranic wastes, generally items such as tools, rags, and equipment which have become contaminated with man-made radioactive elements having atomic numbers higher than uranium, from processes associated with the production of nuclear weapons.

in an increase in the risk of adverse health effects, including cancer, birth defects, and developmental defects. At high doses over short periods, radiation can cause skin damage, cataracts, acute sickness, and even death.

Spent nuclear fuel is generated primarily from commercial nuclear power plant operations and is temporarily stored in pools of water or in steel or concrete containers, called dry casks. Currently, more than 20,000 metric tons of such fuel is stored on the premises of more than 60 nuclear power plants across the country, and by the year 2000, an estimated 40,000 metric tons will have been produced. An equivalent of about 9,500 metric tons of high-level radioactive waste is being stored at DOE facilities in Washington State, South Carolina, Idaho, and at the Nuclear Fuel Services Plant in New York. Transuranic wastes—currently about 1.97 million cubic meters in volume—have been generated by DOE and its predecessor agencies² since the 1940s, and are primarily stored in 55-gallon drums and metal boxes, or are buried in the soil at DOE facilities in Colorado, Idaho, Nevada, New Mexico, Ohio, South Carolina, Tennessee, and Washington State.

DOE is the lead federal agency responsible for disposing of spent fuel, high-level waste, and transuranic waste. The principal waste-related activities of DOE and its predecessors have been directed toward the siting and construction of underground repositories for permanent waste disposal and surface facilities for waste storage. The Nuclear Regulatory Commission (NRC) is responsible for licensing long-term storage and disposal facilities for spent fuel for the nation's commercial waste activities. NRC has developed procedures for licensing such facilities in 10 C.F.R. parts 60 and 72. With one exception, however, the Congress specifically exempted DOE's defense-waste-related activities from licensing requirements. The exception is that disposal of DOE's high-level waste is to be licensed and regulated by NRC.

DOE is investigating the suitability of two sites for permanent waste disposal in geologic repositories. Pursuant to the Nuclear Waste Policy Act, as amended, DOE is studying a site at Yucca Mountain, Nevada—about 100 miles northwest of Las Vegas—as the nation's first prospective repository for the disposal of commercial spent fuel and high-level waste. The Yucca Mountain project, financed by a congressionally imposed fee on nuclear-generated electricity, has cost the electric utilities (through DOE) about \$1.2 billion through fiscal year 1992. In addition, after DOE spent

²DOE's predecessor agencies were the Atomic Energy Commission and the Energy Research and Development Administration.

several years in searching for a permanent disposal site for its defense waste, in 1979 the Congress authorized DOE to build a research and development facility in southeastern New Mexico to demonstrate the safe disposal of such waste.³ DOE began constructing a deep geologic repository near Carlsbad, New Mexico, called the Waste Isolation Pilot Plant (WIPP). DOE has completed construction of the surface and underground facilities at WIPP and has excavated about 15 of 100 acres of planned underground storage area. As of July 1992, DOE had spent about \$1.3 billion on WIPP-related activities. If WIPP is eventually determined to be suitable for permanent waste disposal, DOE plans to store a total volume of 6.2 million cubic feet of transuranic waste in the facility. DOE cannot permanently dispose of waste at WIPP until it demonstrates that the facility complies with environmental standards promulgated by EPA.

EPA's Development of High-Level Waste Standards

In October 1976, President Ford announced new steps to ensure that the nation has facilities for the long-term management of nuclear wastes from commercial nuclear power plants. On the basis of findings of an interagency task force commissioned by the President, it was determined that the most practical method for disposing of high-level waste was to store it in geologic repositories deep underground. Among the many steps to be taken, the President directed EPA to issue general standards governing releases of radioactive materials into the environment above the levels normally emitted by naturally occurring radioactive sources.

In December 1976, EPA announced its intent to develop standards for high-level waste to protect the public health and general environment (41 Fed. Reg. 53,363).

One of EPA's initial responses to the presidential directive was to hold a series of public workshops during 1977 and 1978 so that it could understand the public's concerns and technical issues associated with radioactive waste disposal. Following these workshops, EPA decided that it would develop federal guidance for the disposal of all types of radioactive waste. On November 15, 1978, it proposed "Criteria for Radioactive Wastes" (43 Fed. Reg. 53,262). However, on March 19, 1981, after reviewing the public comments, EPA withdrew the proposed criteria (46 Fed. Reg. 17,567). EPA decided that the many different types of radioactive wastes made the issuance of generic disposal guidance too difficult. That same year, DOE issued a comprehensive Environmental Impact Statement

³The legislation authorizing the facility was the Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980 (P.L. 96-164).

affirming the Reagan administration's focus on high-level nuclear waste disposal using geologic repositories (46 Fed. Reg. 26,677).

On December 29, 1982, EPA published in the Federal Register (47 Fed. Reg. 58,196) a proposed rulemaking for high-level waste disposal standards titled "Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes" (40 C.F.R. part 191). EPA requested that public comments be provided by May 2, 1983. These standards were to apply to high-level waste, spent fuel, and transuranic waste facilities designed and constructed by DOE and those licensed by NRC.

In January 1983, at EPA's request, the agency's Science Advisory Board (SAB) appointed a 13-member subcommittee to review the proposed high-level waste disposal standards. From January 18 to September 21, 1983, SAB held nine public meetings in its review of the proposed standards.

Soon after EPA proposed its high-level waste standards, the Congress enacted legislation that established definitive federal responsibilities and policies for the disposal of high-level nuclear waste and spent fuel. The Nuclear Waste Policy Act of 1982—signed into law on January 7, 1983 (P.L. 97-425)—mandated that within 1 year of the signing of the act, EPA was to publish "generally applicable" environmental protection standards for off-site releases of radioactive material within repositories. The act also assigned key responsibilities to DOE and NRC. DOE was to screen potential repository sites, investigate candidate sites selected by the President, and recommend to the President that specific sites for the first and second repositories be selected.⁴ DOE was also to design, construct, and operate the first repository. NRC was to issue technical requirements and criteria for use in approving or disapproving any DOE applications for a license to construct and operate nuclear waste repositories. To obtain a license from NRC, DOE was to demonstrate that it complied with NRC's regulations. Finally, the act stipulated that NRC's regulations were not to be "inconsistent" with EPA's standards.

In May 1983, EPA held two meetings to obtain public comments on its proposed high-level waste disposal standards. Upon expiration of the original comment period, EPA held open a second comment period until

⁴The Congress subsequently amended the Nuclear Waste Policy Act (P.L. 100-203, Dec. 22, 1987), which among other things, (1) mandated that DOE limit its investigation to only one candidate site—Yucca Mountain—for the first repository and (2) prohibited DOE from conducting any site-specific activities related to the second repository.

June 20, 1983, in order to obtain further public comment on several topics that generated additional questions. More than 200 comment letters were received during the comment periods, and 13 oral statements were made at the meetings (47 Fed. Reg. 23,666).

On February 17, 1984, SAB transmitted its final report to EPA. The report contained 46 findings and recommendations for specific improvements in EPA's technical analyses accompanying the proposed standards and in the standards themselves. On May 8, 1984, EPA sought public comment in the Federal Register on SAB's report (49 Fed. Reg. 19,604). After evaluating that report and the public comments, EPA agreed with 34 of the report's findings and partially agreed with 2 others. EPA made changes to its proposed standards and/or the supporting technical analyses accompanying the standards on the basis of 31 SAB findings. (EPA determined that five of SAB's findings did not require any further action on its part.)

EPA's Issuance of High-Level Waste Standards

On February 8, 1985, the Natural Resources Defense Council (NRDC) and four other environmental groups sued EPA for failing to promulgate high-level waste standards by January 7, 1984, the statutory deadline in the Nuclear Waste Policy Act. EPA and the five plaintiffs settled the case through a negotiated consent order, whereby EPA agreed to promulgate final standards on or before August 15, 1985.

To meet the terms of the consent order, EPA released final high-level waste standards under 40 C.F.R. part 191 on August 15, 1985. These standards were published in the Federal Register on September 19, 1985 (50 Fed. Reg. 38,066).

EPA's final high-level waste standards consisted of two parts—Subpart A, which set limits on radiation exposures to members of the public from the management and storage of high-level waste prior to disposal, and Subpart B, which regulated the waste disposal phase and established several different requirements. The primary standards for disposal—long-term containment requirements—regulated the cumulative releases of radioactive materials from a repository to the environment for 10,000 years once the repository has been permanently closed. Subpart B also established requirements to protect (1) individuals in the areas surrounding a repository from receiving harmful radiation doses and (2) groundwater from radioactive contamination for 1,000 years. Finally, EPA established a qualitative set of assurance requirements—additional

protection measures and guidance—to provide confidence that its long-term containment requirements would be met.

EPA's containment requirements were a departure from other federal radiation protection measures and thus generated much debate during the draft standards' development and coordination. This happened because EPA required the implementing agency to not only estimate releases of radioactive materials to the environment and compare them with EPA-established numerical limits, but also to predict the probability of the radioactive releases occurring and the consequences of such releases over 10,000 years.⁵ NRC and DOE had initially raised concerns about the feasibility of implementing these requirements because of the inherent uncertainty in making statistically valid predictions far into the future. However, DOE and NRC eventually agreed that the standards probably could be implemented after EPA added language to the standards that did not require absolute proof of compliance but instead provided a test of "reasonable expectation" of compliance.

High-Level Waste Standards Overturned Following Legal Challenge

In March 1986, environmental groups, including NRDC, and several states filed petitions for judicial review of EPA's high-level waste standards. The petitions, which were consolidated in the U.S. Court of Appeals for the First Circuit in Boston, alleged, among other things, that EPA had (1) issued individual and groundwater protection standards that violated sections of the Safe Drinking Water Act, (2) not given the public ample notice and opportunity to comment on its groundwater protection requirements, and (3) inadequately supported a 1,000-year compliance time frame for the standards' individual protection requirements. On July 17, 1987, the First Circuit Court issued its ruling concerning EPA's standards.⁶ The court remanded the entire set of standards even though all but the two sections of Subpart B were either unchallenged or upheld. With respect to the Subpart B requirements relating to individual protection, the court required that EPA give (1) further consideration to their interrelationship with the Safe Drinking Water Act and (2) an explanation of the 1,000-year time frame for these requirements. The court also remanded the groundwater protection requirements for further notice and comment procedures.

⁵Because of this feature, members of the scientific and technical community often refer to the containment requirements as "probabilistic" standards.

⁶Natural Resources Defense Council v. United States Environmental Protection Agency, 824 F.2d 1258 (1st Cir. 1987)

The Department of Justice, on behalf of EPA, filed a motion in August 1987 asking for reinstatement of all sections of EPA's high-level waste standards except for the two sections which the court had found to be defective. The court ruled in September 1987 that Subpart A of the standards be reinstated, but left the entirety of Subpart B in remand. EPA testified before the Subcommittee on Energy and the Environment, House Committee on Interior and Insular Affairs, on December 8, 1987, that it would take approximately 2 years for EPA to comply with the terms of the court's remand.

EPA's Efforts to Revise High-Level Waste Standards

On June 2, 1989, EPA developed for comment and discussion an internal "working draft" of proposed revisions to its standards for high-level nuclear waste. It was circulated to interested parties outside the agency. EPA testified on June 12, 1989, before the Environment, Energy, and Natural Resources Subcommittee, House Committee on Government Operations, that it had planned to repropose high-level waste standards by the end of 1989 and issue final standards by September 1991.

NRC staff and the NRC Commissioners met in a November 1989 public meeting to discuss the NRC staff's past and present concerns about implementing EPA's high-level waste standards at a future repository-licensing hearing. One of the key issues discussed was the unique probabilistic nature of EPA's long-term containment requirements and the potential technical and procedural problems that these standards may pose if NRC were called upon to license a DOE repository.⁷

On January 31, 1990, EPA circulated for discussion and comment a second "working draft" of proposed revisions to its high-level waste standards. The following month, EPA's project leader responsible for drafting the original high-level waste standards unexpectedly died. According to EPA Office of Radiation and Indoor Air officials, this was a significant setback to EPA because of the project leader's extensive technical background concerning the standards. EPA had to reassign other staff in the Office of Radiation Programs to complete the project. On April 3, 1990, EPA testified before the Senate Committee on Energy and Natural Resources that it planned to repropose high-level waste standards in late 1990 and issue final standards by mid-1992.

⁷Our report *Nuclear Waste: Quarterly Report as of December 31, 1989* (GAO/RCED-90-130, Apr. 30, 1990) focused on concerns that the NRC staff had raised in the November 1989 meeting. The report also discussed longstanding concerns about EPA's containment standards raised by NRC's external advisory group on nuclear waste disposal matters, the Advisory Committee on Nuclear Waste.

The National Academy of Sciences (NAS) Board of Radioactive Waste Management, National Research Council, issued a report in July 1990 titled Rethinking High-Level Waste Disposal. The Board criticized the current federal approach to developing a geologic repository as inflexible with respect to both schedule and technical specifications. For example, the Board questioned the scientific soundness of a regulatory approach using geologic and analytical information to predict, with a high degree of certainty, the long-term performance of a repository. The Board recommended that an alternative, more flexible approach be adopted—one that would require significant changes in existing program management, laws, and regulations, including high-level waste disposal regulations.

On the basis of the theme of its July 1990 report, NAS sponsored a symposium in September 1990 to examine U.S. and international efforts to license a radioactive waste repository. Symposium participants once again raised concerns about whether DOE could feasibly demonstrate compliance with EPA's proposed high-level waste containment standards at an NRC licensing hearing. Also, some of the participants maintained that EPA's standards were far more stringent than necessary to protect the environment and public health. Finally, conference participants suggested that EPA, DOE, NRC, and other interested stakeholders in the high-level waste standards explore the feasibility of a negotiated rulemaking as a means of resolving outstanding differences.

In a letter dated September 28, 1990, the Chairman of the United States Nuclear Waste Technical Review Board⁸ encouraged both NRC and EPA to pursue a negotiated rulemaking approach to both its high-level waste standards and NRC's repository-licensing regulations and offered the Board's assistance in this matter.

At NAS' and the Nuclear Waste Technical Review Board's suggestion, EPA's Deputy Assistant Administrator in December 1990 directed EPA's Regulatory Negotiation Branch to determine the feasibility of a negotiated rulemaking regarding its high-level waste standards. EPA hired its negotiation support contractor, the Conservation Foundation, to conduct preliminary interviews with NRC, DOE, and other prospective parties in May 1991. EPA said that if the prospects for such a rulemaking were promising, it would complete the negotiation process and issue a proposed rule. Conversely, if the prospects were not promising, EPA would seek

⁸The Nuclear Waste Technical Review Board is an independent group created by the Congress in 1987 to review the scientific and technical validity of DOE's civilian high-level nuclear waste program.

alternative—but less timely—means of addressing specific issues affecting the rulemaking, such as holding technical workshops.

EPA testified on April 16, 1991, before a hearing by the Subcommittee on Energy and the Environment, House Committee on Interior and Insular Affairs, that it planned to propose revised high-level waste disposal standards in 1992 and anticipated issuing a final rule in 1993. On April 25, 1991, EPA circulated a third “working draft” of its high-level waste standards. In addition, EPA circulated for comment along with the working draft, an NRC proposal recommending an alternative method of implementing the standard’s probabilistic containment requirements to make them more compatible with NRC’s repository-licensing regulations.

EPA’s negotiation support contractor issued a report on July 9, 1991, concerning its findings on the feasibility of a negotiated rulemaking for EPA’s high-level waste standards. After preliminary interviews with DOE, NRC, and other prospective parties, the contractor advised EPA against continuing further with such a rulemaking because of the limited receptivity to the idea outside of EPA; EPA shortly thereafter abandoned this initiative.

With EPA’s support, the Electric Power Research Institute (EPRI)⁹ sponsored a technical workshop in September 1991 as a forum for scientific and technical review of the original high-level waste standard (issued in 1985) and EPA’s third working draft. Material prepared as a result of the workshop was forwarded to EPA for its consideration in making further revisions to the standards.

On October 23, 1991, the NRC staff provided comments to EPA on its third working draft, and on December 5, 1991, DOE provided comments. Both agencies recommended that EPA make further modifications to its standards. NRC noted on the one hand that EPA had made much progress in addressing NRC’s concerns about EPA’s earlier working drafts, but it urged EPA to reexamine the stringency of its standards (particularly the 10,000-year containment requirements) in light of other health and safety risks experienced by society and the risk levels on which federal rulemakers based other health and safety standards.

On the other hand, DOE’s comments were highly critical, and DOE called upon EPA to make substantial changes and provide additional justifications

⁹EPRI is funded by the nation’s electric utilities to perform research and development on issues affecting electrical power generation.

to make its standards "technically defensible and implementable." For example, DOE took exception to EPA's methodology for setting the standards' limits for the release of the radioactive gas, carbon-14, into the environment from a geologic repository. According to DOE, EPA's derivation of its containment requirements was flawed because EPA did not adequately consider various ways in which radioactive materials can be released into the environment through different geological formations, particularly for arid repository sites such as Yucca Mountain. Moreover, EPA's proposed carbon-14 release limits would force DOE at Yucca Mountain to adopt extremely expensive measures to comply with the standards, without a significant increase in protection to public health and safety. DOE and EPA met on December 20, 1991, and in January 1992 to discuss DOE's comments, and DOE offered to provide EPA with additional documentation in developing a basis for revisions to EPA's standards.

In February 1992, EPRI held a second workshop, seeking a further convergence of viewpoints to address unresolved issues associated with EPA's high-level waste standards. At the workshop, the issue of EPA's methodology for arriving at its carbon-14 release limits resurfaced. Also, EPA circulated to workshop members a fourth working draft of the proposed high-level waste standards, which it referred to as a "Draft Federal Register Notice." The working draft proposed additional changes to the draft standards, largely on the basis of comments received on EPA's third working draft and at the October 1991 EPRI workshop.

EPA announced at the February workshop that it had planned to send a draft notice of proposed rulemaking on the high-level waste standards to the Office of Management and Budget (OMB) by the spring of 1992. EPA also acknowledged that it had accepted DOE's proposal to provide additional information supporting DOE's suggested approaches to seven technical issues affecting the high-level waste standard. To meet EPA's schedule, DOE estimated that it would submit this material to EPA in about 2 months, but DOE did not finish the effort until August 1992.

On April 20, 1992, largely due to numerous comments that it had received, EPA requested that its SAB review the scientific basis underlying EPA's containment-standard release limits for carbon-14 radioactive gases expected to be released from a repository. The SAB Radiation Advisory Committee agreed to study the carbon-14 issue and appointed a special subcommittee to conduct the review. The SAB subcommittee held its first of a series of meetings in June 1992. SAB's final report was anticipated to be released in January 1993. EPA announced at the June meeting that it would

probably defer sending OMB a draft proposed rulemaking on its high-level waste standard until it had an opportunity to review and evaluate SAB's findings and recommendations.

In July 1992, EPA and DOE jointly requested that the NAS Board of Radioactive Waste Management do a technical review of the documents provided by DOE to EPA to support DOE's proposed alternatives to EPA's draft standards. EPA asked that the Board complete its review of the DOE documentation within about 6 weeks. The Board subsequently agreed to review five of the seven DOE issues within EPA's proposed time constraints.¹⁰ On August 12, 1992, DOE issued its final report to EPA on its suggested alternatives for improving EPA's high-level waste standards. In a letter accompanying the report, DOE stated that EPA's standards were "fundamentally flawed" and that DOE's suggested approaches, if adopted, would only make the standards "nominally workable."

In August and September 1992, the SAB subcommittee held its second and third meetings on EPA's high-level waste standard carbon-14 release limits and developed a draft consensus position. Also, in September, the NAS Board of Radioactive Waste Management sponsored a workshop to elicit views from various interests on the five DOE technical issues that the Board agreed to study.

New Legislation Affects High-Level Waste Standards' Development

In October 1992, the Congress enacted, and the President signed, legislation that modified EPA's authority to set standards for high-level nuclear waste and changed the applicability of 40 C.F.R. part 191. First, the Energy Policy Act of 1992 (P.L. 102-486), signed on October 24, 1992, required that EPA, in consultation with NAS, promulgate separate nuclear waste disposal standards for DOE's Yucca Mountain site. Second, the Waste Isolation Pilot Plant Land Withdrawal Act (P.L. 102-579), signed on October 30, 1992, reinstated 40 C.F.R. part 191, except for the two parts of Subpart B that the First Circuit Court had found defectively promulgated, and directed that EPA issue final regulations within 6 months of the act's passage.

The WIPP Land Withdrawal and Energy Policy acts have important implications concerning EPA's standard-setting authority. Under the WIPP Land Withdrawal Act, the regulations contained in 40 C.F.R. part 191

¹⁰The seven issues DOE raised included the carbon-14 issue. However, because EPA's SAB was already reviewing this issue, NAS refrained from studying it at that time. NAS also decided not to review NRC's alternative approach to implementing EPA's containment requirements because it believed that this matter was more of an EPA policy choice than a scientific and technical matter.

remain "generally applicable" nuclear waste disposal standards for any disposal sites other than those to be characterized (investigated) under provisions of the Nuclear Waste Policy Act. As such, 40 C.F.R. part 191 regulations still apply to DOE's WIPP facility and will apply to other possible disposal technologies that DOE is investigating.¹¹ However, under the WIPP Land Withdrawal Act, the regulations will not apply to future commercial spent fuel repository sites if the Congress permits characterization of sites in addition to Yucca Mountain. Also, the Energy Act mandates an unprecedented role for NAS—by December 31, 1993, the Academy is to study and recommend to EPA reasonable environmental standards at Yucca Mountain. Finally, the law requires that within 1 year from the time when it receives the Academy's report, EPA is to issue final standards "based on" and "consistent with" the Academy's findings and recommendations.

In early December 1992, EPA received a final report from NAS addressing five of DOE's technical concerns related to EPA's 40 C.F.R. part 191 draft standards. However, EPA did not revise its standards as a result of the report. The recent WIPP legislative amendments reinstated all but the groundwater and individual protection requirements of the original 40 C.F.R. part 191 standards. EPA only proposed to revise these two sections of its draft standards. An EPA official explained that only one of the five issues that NAS reviewed pertained to EPA's individual and groundwater protection requirements, and NAS concluded that DOE did not provide convincing evidence to support its concern on that issue. On December 30, 1992, EPA sent OMB a draft of proposed revisions to 40 C.F.R. part 191 for preliminary clearance. On January 13, 1993, OMB cleared the proposed revisions so they could be published in the Federal Register for comment. EPA published the proposed rulemaking in the February 10, 1993, Federal Register (58 Fed. Reg. 7924) and scheduled public hearings on February 23-25, 1993. EPA officials stated that the standards should be issued by June 1993.

As of February 23, 1993, EPA was awaiting a final report by SAB on the carbon-14 issue. According to the EPA Director, Office of Radiation and Indoor Air, EPA did not address the carbon-14 gaseous release issue before sending OMB the draft standards for review. This was because (1) the existing carbon-14 release standard is reinstated under the new WIPP legislation; (2) the carbon-14 gaseous release issues are generally peculiar to an arid site with geologic features similar to those at Yucca Mountain, rather than a site having a greater presence of surface and ground water,

¹¹However, the EPA standards do not apply to ocean disposal or disposal in ocean sediments, which is prohibited by the Marine Protection, Research and Sanctuaries Act of 1972, as amended (P.L. 92-532, Oct. 23, 1972).

Appendix I
Chronology of High-Level Waste Standards

such as WIPP; and (3) the new energy legislation requires that separate standards be studied and developed for Yucca Mountain.

Chronology of Low-Level Waste Standards

In 1983, EPA announced its intent to develop standards for the management and disposal of low-level radioactive waste. EPA is developing such standards under authority established by the Atomic Energy Act and transferred to EPA through Reorganization Plan No. 3 of 1970. Using its authority under the Toxic Substances Control Act, EPA has included provisions in its draft proposed standards to dispose of low-volume naturally occurring and accelerator-produced waste¹ in low-level waste facilities. EPA originally submitted proposed standards to OMB for review in July 1988. Since that time, OMB has suspended its review on two separate occasions, citing EPA's inability to resolve differences with DOE and NRC.

Background

Each year, DOE and commercial nuclear power plants, as well as numerous businesses, hospitals, and universities, generate and must dispose of various types of radioactively contaminated waste. This waste is designated as low-level radioactive waste because its levels of radioactivity are generally lower than those of high-level waste, which is predominantly spent fuel from commercial nuclear power plants and certain radioactive waste from nuclear fuel reprocessing. Low-level waste includes protective clothing, machinery and related hardware, liquids, compacted solids, and other substances that have been contaminated with or contain certain levels of radioactivity from weapons production, nuclear power plant operation, or other civilian uses.

Most of the radioactivity in low-level waste decays rapidly within the first 100 years. However, some wastes contain radionuclides that continue to present a potential radiological hazard for 500 years or more. The dangers posed by radioactivity vary, depending on such characteristics as the quantity of radiation and its ability to concentrate in the body. There are three major types of long-term effects on health from exposure to radiation: cancer, hereditary effects in descendants of exposed persons, and developmental effects from in-utero exposure.

The volume of low-level radioactive waste generated each year has decreased from about 3.8 million cubic feet in 1980 to about 1.7 million cubic feet in 1992. This reduction has been attributed in large part to various waste-reduction techniques employed by the waste generators.

¹Naturally occurring and accelerator-produced radioactive material refer to radioactive materials that either occur naturally in the environment or become radioactive as a result of being exposed to radiation incidental to the operation of atomic accelerators. Naturally occurring radioactive material representing a significant source of human radiation exposure includes carbon-14, potassium-40, polonium-210, radon-222, and radium-226. Some of this material can be unintentionally concentrated through routine operations, such as by purifying drinking water and by transmitting oil and gas through pipelines.

Further volume reduction may occur, depending, in part, on the costs involved, according to the Office of Technology Assessment. However, although the annual generation rate of waste has been reduced in terms of volume during the 1980s, the radioactivity contained in the waste has increased.

Two-thirds of low-level waste accumulated in the United States is generated by DOE activities and is sent to DOE-owned disposal sites. The remaining low-level waste comes from commercial nuclear utilities, other industrial activities, universities, medical institutions, and some government agencies. In the 1970s, six commercial low-level waste disposal sites were operating, but three closed after experiencing waste management and operations problems. The three states hosting the remaining three facilities (Nevada, South Carolina, and Washington) became extremely reluctant to accept all the nation's low-level waste and threatened to shut the facilities down unless sites in other states were opened. In December 1980, the Low-level Radioactive Waste Policy Act was enacted to avert the shutdown by allowing states to form regional disposal compacts, approved by the Congress, that could turn away out-of-region waste. Because of the act, nine compacts were formed, consisting of a total of 42 states. Seven of the compacts are planning to build eight new disposal facilities. In addition, the existing disposal facility located near Richland, Washington, will remain open for an extended period to serve members of the Northwest compact and the Rocky Mountain compact. The Nevada facility closed in December 1992. The Barnwell, South Carolina, facility may no longer accept out-of-region waste after July 1, 1994, and waste generated within its compact will not be accepted after 1996. In addition, of the eight unaffiliated states, at least six are tentatively planning their own disposal facilities, giving the nation as many as 14 new operating low-level waste sites in the future.

In December 1982, NRC issued regulations for licensing commercial low-level waste disposal facilities (10 C.F.R. part 61) under the authority of the Atomic Energy Act. In September 1988, DOE issued Order 5820.2A, which includes requirements governing the disposal of DOE's low-level waste at DOE disposal sites.

EPA's Development of Low-Level Waste Disposal Standards

In a message to the Congress on February 12, 1980, President Carter outlined a comprehensive national radioactive waste management program which stated that EPA was responsible for establishing general

criteria and numerical standards applicable to nuclear waste management activities.

At the time that the President outlined this strategy, EPA staff resources were already committed to developing standards regulating releases from high-level waste sites and uranium mill tailings. On August 31, 1983, EPA published its intent to develop environmental radiation protection standards and/or guides for low-level radioactive waste disposal sites in the Federal Register (48 Fed. Reg. 39,563). In the notice, EPA also announced its intent to determine if there is some limit of exposure from the disposal of radioactive waste below which radiation-related regulation is not warranted, i.e., "below regulatory concern." EPA requested that comments and any information pertinent to the development of such standards be provided to EPA by November 29, 1983. According to a Section Chief in EPA's Criteria and Standards Division, EPA held outreach meetings in 1984 to determine public concerns about low-level waste disposal. EPA subsequently began developing the first draft of low-level waste standards. Since many states had expressed a need for standards to dispose of naturally occurring and accelerator-produced radioactive materials in low-level waste disposal facilities, EPA also began developing these standards in November 1984.²

In April 1985, EPA's Acting Assistant Administrator for Air and Radiation requested that EPA's SAB review the scientific basis for EPA's proposed low-level radioactive waste standards. In an October 1985 report to EPA, SAB concluded that EPA provided a reasonable presentation of the potential sources and risks associated with the disposal of low-level waste. However, SAB also noted the following deficiencies: (1) the Background Information Document needed a full explanation of how EPA arrived at and supported a generally applicable standard, (2) calculation procedures and uncertainties in data used to model risk assessment were not fully described, (3) the time spans of 1,000 and 10,000 years used for analyses were unrealistically long, (4) terminology used to discuss risk assessment needed clarification, and (5) the document needed more technical support.

In December 1986, EPA's Administrator and other senior officials met to discuss various issues concerning EPA's proposed standards for low-level radioactive waste. One of the major issues discussed at the meeting, but left unresolved, was the need for maintaining regulatory consistency with other groundwater standards. Following the meeting, EPA staff from the

²Certain radioactive substances, including naturally occurring and accelerator-produced radioactive material, are not regulated under the Atomic Energy Act. In order to regulate these materials, EPA cited the Toxic Substances Control Act as the authority.

Office of Air and Radiation and the Office of Water worked together on further technical evaluations without arriving at a solution for groundwater provisions. In July 1987, the Deputy Assistant Administrators for the Office of Air and Radiation and the Office of Water and other senior staff met to determine what action should be taken. In October 1987, the two Assistant Administrators for the Office of Air and Radiation and the Office of Water decided to include two options for groundwater protection requirements in the proposed standards. According to a Section Chief in EPA's Criteria and Standards Division, the standards were revised at about this time on the basis of comments received from SAB in its October 1985 report.

External Review of EPA's Draft Low-Level Waste Standards

Following internal review, EPA submitted a draft proposed rule entitled "Environmental Standards for the Management, Storage and Land Disposal of Low-Level Radioactive Waste and Naturally Occurring and Accelerator-Produced Radioactive Waste" to OMB for review on July 18, 1988. In doing so, EPA proposed two separate but complementary standards: the low-level waste standards were proposed under 40 C.F.R. part 193, and the naturally occurring and accelerator-produced radioactive waste standards were proposed under 40 C.F.R. part 764. The low-level waste standards consisted of three parts. Subpart A of the standards provided limits on radiation exposure to the public from the management and storage of low-level waste prior to disposal. It also defined criteria for determining those low-level wastes that have so little radioactivity as to be "below regulatory concern." Subpart B established limits on potential exposures from low-level waste disposal systems and established implementation requirements to ensure that these limits would not be exceeded. Subpart C limited the level of potential radiological contamination of groundwater as a result of activities under Subparts A and B. The standards for naturally occurring and accelerator-produced radioactive material provided for the regulation of these wastes if they exceeded certain radioactivity levels and required their disposal at regulated low-level waste facilities.

OMB met with EPA in September 1988 to discuss the proposed standards. At that time, OMB stated that EPA drinking water standards provided adequate protection to people from radiation exposure from the consumption of water, and therefore, groundwater protection standards beyond the existing standards were an unnecessary federal intrusion into an arena that was more appropriately the purview of local authorities. The following month, EPA responded to OMB's groundwater concerns.

Specifically, EPA informed OMB that (1) the protection of groundwater as a resource is an EPA policy, (2) it is more cost-effective to prevent groundwater from becoming contaminated than to clean it up at a later date, and (3) the existing drinking water standards place the burden for compliance on the community water supplier, while the proposed low-level waste standard for groundwater protection would place the burden for compliance on the potential polluter.

In November 1988, NRC sent a letter to OMB expressing numerous concerns about the draft standards. Specifically, NRC stated that EPA should not promulgate the low-level waste standards because the estimated health benefit from the standards did not justify the costs. In addition, NRC stated that EPA should pursue the "below regulatory concern" issue by developing a consensus among affected federal agencies and issuing presidential guidance on the subject rather than an independent standard. Furthermore, NRC stated that EPA should defer proposing the naturally occurring and accelerator-produced radioactive material standard until after the Committee on Interagency Radiation Research and Policy Coordination had completed its review of federal regulation of this material. In November 1988, EPA and NRC staff began meeting to attempt to resolve their differences. The agencies reached an impasse in January 1989 and agreed to draft a joint letter to OMB outlining each agencies' concerns and positions. In March 1989, OMB suspended its review of the standards, pending receipt of the letter.

In April 1989, NRC informed OMB that issues with EPA had not been resolved. Three weeks later, EPA sent OMB a revised preamble and proposed standards and stated that it had adequately responded to NRC's concerns. In its cover letter, EPA urged OMB to immediately release the standards for formal proposal.

In a November 1989 letter to OMB, DOE stated that it had major concerns over the potential adverse impact that the groundwater protection provisions of EPA's revised standards would have. DOE suggested that the groundwater provisions not be proposed until an appropriately justified groundwater protection policy could be established.

About 2 months later, NRC sent a letter to OMB stating that the standards were not necessary to protect the public health and safety and would duplicate NRC's requirements for licensing commercial low-level waste disposal sites (10 C.F.R. part 61) if issued. NRC also said that the

promulgation of the standards would be disruptive to developing new low-level waste disposal sites.

On January 9, 1990, OMB again suspended its review of the standards, pending an EPA analysis of benefits and costs as well as of alternatives to the standards, and a review of legal and procedural issues raised by NRC and DOE. On June 21, 1990, NRC sent EPA a letter proposing a joint NRC/EPA task force to resolve all NRC/EPA issues. EPA responded to NRC's task force proposal on December 19, 1990. A memorandum of understanding, which outlines procedures for resolving differences, was signed by NRC and EPA on March 16, 1992.

In September 1991, DOE sent EPA a letter stating that it had reviewed EPA's draft standards and the accompanying technical support, and had concluded that the draft standards should not be published in their present form. Among other things, DOE informed EPA that its review of the proposed standards indicated that (1) the technical support was faulty; (2) the requirements of draft 40 C.F.R. part 193 could be implemented only at very large costs, with very little benefit, and could as likely increase overall risks to humans as decrease overall risks; and (3) the draft requirements for naturally occurring and accelerator-produced radioactive material lacked justification and would likely result in a new "orphan" class of waste.³

In June 1992, a Section Chief in EPA's Criteria and Standards Division told us that EPA could not respond to DOE's concerns over the standards because it had no resources to do so. He explained that EPA's priority was to repromulgate standards for high-level radioactive waste. According to the Section Chief, EPA met with NRC on March 24, 1993, to discuss the standards, and NRC agreed to reevaluate its concerns about the standards. He told us that, as of April 1993, he had no staff to work on the low-level standards because EPA was using its staff to try to comply with requirements imposed by the Energy Policy Act and the Waste Isolation Pilot Plant Land Withdrawal Act. However, the Office of Radiation and Indoor Air Director said EPA hopes to resubmit the standards to OMB for review by December 1993.

³According to DOE, although EPA's proposed standards prohibited near-surface disposal of certain naturally occurring and accelerator-produced radioactive material wastes, EPA did not address how such wastes would be disposed of or who would be responsible for doing so.

Chronology of Inactive Uranium-Processing Sites' Groundwater Protection Standards

In 1978, the Uranium Mill Tailings Radiation Control Act (UMTRCA) (P.L. 95-604) was enacted. The act recognized that mill tailings¹ may pose a significant radiation health hazard to the public and directed EPA to set generally applicable standards for the protection of public health, safety, and the environment. In January 1983, EPA issued standards for the cleanup and disposal of mill tailings at 24 inactive processing sites covered by title I of UMTRCA. In September 1983, EPA issued standards for the active processing sites covered by title II of UMTRCA. Standards for both active and inactive sites were challenged by industry and environmental groups. In September 1985, the U.S. Court of Appeals for the Tenth Circuit remanded the groundwater provisions for the inactive sites to EPA and directed EPA to treat toxic chemicals that pose a groundwater risk as it did for toxic chemicals at the active sites. Since the remand, EPA has worked to issue new standards to correct and prevent the contamination of groundwater beneath and in the vicinity of inactive uranium-processing sites by uranium mill tailings.

Background

In the 1940s, the U.S. government began purchasing large quantities of uranium for defense purposes. As a result, large piles of tailings were created by the uranium milling industry. Tailings piles pose a hazard to public health and the environment because they contain radioactive and toxic constituents which emanate radon to the atmosphere and may leach into groundwater. In the past, tailings were used in construction and soil conditioning. The radioactive and toxic constituents of tailings can elevate indoor radon levels, expose people to gamma radiation, and leach into ground and surface waters. Exposure to radioactive and toxic substances contained in mill tailings may cause cancer and other diseases, as well as genetic damage and fetal malformations.

Groundwater protection standards are important because groundwater is a source of drinking water and groundwater contamination has been detected at most of the sites. On the basis of detailed reports prepared by a DOE contractor for 14 of the 24 inactive uranium-processing sites and preliminary data for the balance of the sites, the volume of contaminated groundwater in aquifers at the 24 sites ranges from a few tens of millions of gallons to 4 billion gallons. Each of the 14 sites examined in detail have at least some groundwater contamination beneath and/or beyond the sites. The time for the natural flushing of the contaminated portions of some of these aquifers is estimated to vary from a couple of years to many

¹Uranium mill tailings are sand-like residues remaining from the processing of uranium ore. Most tailings have low levels of radioactivity but extremely large volumes that can pose a cumulative hazard particularly from radon emissions or groundwater contamination.

hundreds of years and many may never be cleaned up through natural processes. Therefore, actions to restore groundwater may have to be taken at the majority of sites. It is estimated that active restoration will take from less than 5 years at most of the 14 sites to approximately 50 years at 1 site.

EPA's Development of Groundwater Protection Standards

On November 8, 1978, UMTRCA was enacted. In UMTRCA, the Congress enunciated its finding that uranium mill tailings may pose a potential and significant radiation health hazard to the public.

UMTRCA, as amended, directs DOE to conduct the cleanup and disposal of tailings at inactive sites and directed EPA to promulgate standards by October 1982 for DOE to carry out this responsibility. UMTRCA charges NRC with overseeing DOE's implementation of EPA standards. According to OMB, these assignments were made by the Congress in view of the general environmental and regulatory responsibilities of the respective agencies, and because the uranium handled at these mills was produced primarily for the federal government.

The 24 inactive sites that qualify for cleanup under title I are primarily located in arid areas in the western United States, although one site is located in Canonsburg, Pennsylvania. Tailings piles at the inactive sites cover from 5 to 150 acres and range in height from only a few feet to as much as 230 feet. The 24 sites combined contain about 26 million tons of tailings covering a total of about 1,000 acres.

On April 22, 1980, EPA published "Proposed Cleanup Standards for Inactive Uranium Processing Sites" in the Federal Register (45 Fed. Reg. 27,370). These proposed standards were for the cleanup of open lands and buildings contaminated with residual radioactive materials (mainly tailings) from inactive uranium-processing sites. EPA published disposal standards for the inactive sites in the Federal Register on January 9, 1981 (46 Fed. Reg. 2556). The disposal standards placed limits on the radon released to the atmosphere from the tailings piles and also placed limits on water contamination from the piles.

EPA received extensive comments on both the proposed cleanup and disposal standards. The comments were wide-ranging—industry petitioners argued that there was insufficient evidence of risk of harm to warrant the standards, while environmental groups argued that the proposed standards did not provide adequate protection against the risks

posed by the tailings. Both sides supported their arguments with technical studies and expert analysis.

Issuance of Cleanup Standards for Inactive Uranium Processing Sites

On January 5, 1983, EPA issued final "Standards for Remedial Actions at Inactive Uranium Processing Sites," which covered both the cleanup and disposal requirements (48 Fed. Reg. 590). On September 30, 1983, EPA issued similar standards for active milling sites covered by title II of UMTRCA. Both sets of standards were challenged in court by industry, environmental groups, and the state of Colorado for various reasons. On September 3, 1985, the U.S. Circuit Court of Appeals for the Tenth Circuit rejected all challenges except one; it remanded the groundwater provisions of the title I standards (40 C.F.R. part 192.20(a) (2)-(3)) and directed EPA to treat toxic chemicals that pose a groundwater risk as it did for sites regulated under title II of UMTRCA.² While the title I standards included a guideline stating that DOE should assess each site individually and establish any corrective or preventative programs necessary to meet relevant state and federal water quality standards, the title II standards included general groundwater protection standards. The court concluded that UMTRCA required EPA to adopt general standards rather than site-specific ones. In the court's view, by directing DOE to follow relevant state and federal quality standards, EPA was unlawfully delegating to the states or to DOE its own rulemaking authority or was itself establishing standards that could vary from site to site.

External Review of EPA's New Proposed Groundwater Protection Standards for Inactive Uranium-Processing Sites

According to an OMB official, EPA submitted new proposed groundwater protection standards for inactive processing sites to OMB for review on July 7, 1987. Among other things, the standards required the installation of a groundwater-monitoring system, a plan for monitoring the groundwater, and standards for cleaning up contaminated groundwater. While some of the provisions in EPA's new proposed standards for the title I sites were essentially identical to provisions for the title II sites, the new standards differed in some respects. For example, EPA included concentration limits for some additional hazardous constituents that had been identified at title I sites. In addition, EPA included explicit provisions for relying on the natural cleansing of these sites where there were no current uses and the process would result in meeting the standards within 100 years. The OMB official said that OMB completed its review of EPA's new proposed standards in August 1987.

²American Mining Congress v. Thomas, 772 F.2d 617 (10th Cir. 1985) (inactive sites case); American Mining Congress v. Thomas, 772 F.2d 640 (10th Cir. 1985) (active sites case).

On September 24, 1987, EPA published the new proposed groundwater protection standards in the *Federal Register* (52 Fed. Reg. 36,000). After receiving public comments, EPA revised the proposed standards and submitted them to OMB in final form on March 9, 1989. In April 1989, OMB provided a copy of EPA's draft final standards to NRC for review. NRC met with OMB on May 15, 1989, to discuss concerns about the draft final standards. These concerns included issues about the ambiguity, internal consistency, completeness, and complexity of the draft final standards. NRC proposed to work with EPA to resolve remaining NRC concerns. NRC and EPA staffs met periodically throughout the remainder of 1989 and resolved all the concerns by December 1989, except EPA's role in approving site-specific alternate concentration limits for hazardous constituents in groundwater. In January 1990, OMB responded to EPA. An OMB official told us that the staff member responsible for the review of the standards in 1989 had left OMB and that he did not know why OMB's review of the standards lasted 10 months. In responding to EPA, OMB said it was suspending its review of the standards because EPA had not (1) given adequate attention to assuring that costs bear a reasonable relationship to benefits, (2) addressed differences between cost estimates provided by DOE and EPA, (3) examined alternatives for addressing groundwater contamination, and (4) resolved DOE and NRC concerns. DOE had expressed concern about the potential cost and duration of meeting EPA's proposed standards at all cleanup sites and suggested that a more flexible approach would be to deal with only a limited number of inactive processing sites.

Over the next 16 months, EPA met with both NRC and DOE to discuss their concerns. EPA resubmitted final groundwater standards for inactive sites to OMB on May 13, 1991. In resubmitting the standards, EPA informed OMB that it had resolved DOE's concerns and most of NRC's concerns. EPA further stated that it had attempted to address NRC's concern about provisions in the standards authorizing EPA to concur with alternate concentration limits for hazardous constituents before and during NRC licensing.³ In June 1991, OMB requested that EPA provide additional information regarding the present and potential uses of the groundwater and the possible cost savings that would result from relaxing the proposed standards. Although EPA submitted additional information to OMB in August 1991, OMB suspended its review of the standards on September 5, 1991, stating that EPA had still not provided benefit estimates for the rule and that OMB was concerned that the benefits were significantly less than the cost of the proposal. OMB also stated that DOE had requested extra time to provide OMB

³EPA stated that it had incorporated a provision in the proposed standards which delegates this authority to NRC if NRC demonstrates that its criteria for granting alternate concentration limits will provide the same level of protection as would EPA's criteria.

with comments on EPA's revised standards. About 2 weeks later, however, EPA sent OMB a letter containing additional information on DOE's and EPA's analyses of uranium mill tailings site remediation. In addition, EPA also informed OMB that DOE had sent comments on EPA's standards to OMB in early September 1991.

According to an OMB official, OMB resumed its review of EPA's standards in October 1991, after receiving a letter from DOE stating that the groundwater standards were acceptable and strongly recommending that EPA's standards be returned to EPA for promulgation in final form "as quickly as possible." On January 15, 1993, OMB informed EPA that it had not adequately addressed OMB's four primary concerns and returned the rule to EPA for further consideration. Specifically, OMB stated that EPA had not (1) identified the likely benefits of the draft rule; (2) adequately analyzed all reasonable alternatives to address groundwater contamination from inactive uranium-processing sites; (3) conducted a benefit-cost analysis to determine whether its preferred option yields net benefits, nor developed sufficient information to determine that benefits bear a reasonable relationship to costs; and (4) resolved NRC's concerns that the rule would confer upon EPA certain authorities that NRC believes belong solely to NRC. In March 1993, the Director of EPA's Office of Radiation and Indoor Air said that EPA plans to arrange a meeting with OMB to discuss its concerns and will then decide what action should be taken.

Chronology of Residual Radiation Standards/Guidance

EPA's efforts to develop standards or guidance specifically for residual radiation, or for that radiation remaining after efforts have been made to clean up contaminated sites, have been delayed because of resource constraints. Although EPA published in the Federal Register (51 Fed. Reg. 22,264) on June 18, 1986, its intent to develop radiation protection criteria for cleaning up land and facilities contaminated with residual radiation, EPA has still not done so because of resource constraints. While there is no legislative mandate for EPA to issue cleanup criteria in the form of either guidance or standards, EPA, NRC, and DOE agree that uniform criteria are needed. Guidance or standards would establish when a site has been sufficiently cleaned up to allow unrestricted public use. Guidance or standards would also address other issues, such as the need for institutional control at sites that cannot be sufficiently decontaminated to meet cleanup criteria.

Background

Thousands of sites throughout the United States are currently or were formerly used in the production or use of radioactive materials, or in the manufacturing of products that use or produce radioactive materials. Contaminated and potentially contaminated sites include those under the control of federal agencies, those licensed by NRC and/or agreement states,¹ and those state and private sites for which states have sole cognizant regulatory authority.

DOE has responsibility for most of the federally controlled contaminated sites and materials. Contaminated DOE sites are located in almost every state and range from small, slightly contaminated laboratory rooms to large, highly contaminated nuclear-processing plants and surrounding contaminated property.

Potentially contaminated sites under the control of other federal agencies include, but are not limited to, Department of Health and Human Services research centers and inactive uranium-processing sites on Department of the Interior land. Other federal agencies with potentially contaminated sites include the Department of Defense (DOD), the Government Services Administration, the National Aeronautics and Space Administration, the Tennessee Valley Authority, the Veterans Administration, and EPA.

Sites under the control of NRC or agreement states include, but are not limited to, nuclear power reactors, hospitals and medical centers, and

¹An agreement state is one that has signed an agreement with NRC allowing the state to regulate the use of radioactive material within that state under section 274 of the Atomic Energy Act.

manufacturing plants. Sites with potential contamination under the control of states include manufacturing plants, mineral- and uranium-processing facilities, oil and gas production facilities, coal-fired and hydrothermal power plants, research facilities, and water treatment facilities.

Between June 1990 and February 1991, EPA conducted a study to identify contaminated and potentially contaminated sites in the United States and to briefly characterize the magnitude and nature of the residual radioactivity that remains once readily removable sources of contamination have been removed. In February 1991, EPA released a preliminary draft report identifying over 45,300 sites as having potential radioactive contamination.² Both DOE and NRC have questioned the validity of these numbers. According to the Director of EPA's Office of Radiation and Indoor Air, EPA is currently revising the draft report and plans to issue the report in final form by December 1993.

As contaminated sites are cleaned up, residual radioactivity criteria are necessary to determine when the sites no longer require regulatory control and can be released for unrestricted use. Because sites are controlled by different federal agencies, states, and private entities, a uniform set of criteria is needed. In the absence of such criteria, a Branch Chief in EPA's Radiation Studies Division informed us that site cleanups will be performed on an "ad hoc" basis and vary in degree.

EPA's Development of Residual Radiation Standards

An interagency group comprising officials from NRC, DOE, and other agencies started meeting under EPA's leadership in June 1984 to discuss various issues that EPA should address in developing standards or guidance for residual radioactivity. According to the Deputy Director of EPA's Criteria and Standards Division, the group met intermittently through 1986. On June 18, 1986, EPA published in the Federal Register an Advance Notice of Proposed Rulemaking on residual radioactivity. The Federal Register notice solicited opinions on whether EPA's cleanup criteria should be issued as guidance or environmental radiation standards. Under the authority of Executive Order 10831 and the Atomic Energy Act, EPA can recommend federal guidance to the President for use by federal agencies in developing and implementing their own regulations and procedures. In contrast, environmental radiation standards can be issued by EPA under several different authorities, such as the Atomic Energy Act, the Toxic Substances Control Act, and the Clean Air Act. Environmental standards

²"Sites Contaminated and Potentially Contaminated With Radioactivity in the United States" (EPA preliminary draft, Feb. 1991).

are generally more specific than guidance, and federal agencies and states have less discretion in applying them.

In September 1986, EPA invited additional agencies to join the working group to develop guidance for residual radiation. EPA informed the agencies that an interagency working group had formed to develop the guidance, which must be consistent with general federal radiation protection guidance for limiting exposure of workers and of the public. However, the group agreed that some aspects of the existing general guidance for the public, which was issued in 1960, should be reviewed to ensure that it reflected current thinking and practice.³ The Deputy Director said that work to revise the 1960 federal exposure guidance began in January 1987 and ended in August 1990, when the group stopped meeting because of resource constraints. At that time, the group had completed a draft of the revised guidance for general exposures, including the corresponding Federal Register notice and request for public comment. In addition, the group had also developed some preliminary drafts of residual radiation guidance over the last 3 months before it stopped meeting.

According to the Deputy Director, the interagency group resumed meeting on September 3, 1992, and has since completed a review of the August 1990 draft revisions of federal guidance for exposure to the general public. He said that the group has also begun working on residual radiation guidance. The Deputy Director said that many factors led the group to resume meeting. DOE and DOD have informed both EPA and the Congress of the need for standards so that they can clean up contaminated sites. At NRC's request, EPA is cooperating with NRC in developing decommissioning standards for their licensees.⁴ Additionally, EPA's Superfund program needs guidance for its cleanup activities.

In April 1993, DOE agreed to transfer \$1.5 million to EPA to provide funding for seven full time equivalents (FTE) and program contract funds for developing cleanup standards for radiologically contaminated sites. The Director of EPA's Office of Radiation and Indoor Air stated that OMB asked the previous EPA Administrator to reprogram four FTEs and \$1 million from EPA's 1993 budget to develop these standards. The Director stated that she will chair a recently established steering committee comprising representatives from EPA, DOD, DOE, and NRC for residual radiation

³"Radiation Protection Guidance for Federal Agencies" (25 Fed. Reg. 4402) was published on May 18, 1960. The guidance established dose limits for radiation workers and the general population.

⁴NRC is currently considering an enhanced participatory rule-making process for developing radiological criteria for the decommissioning of licensed facilities.

**Appendix IV
Chronology of Residual Radiation
Standards/Guidance**

standards development. She said that EPA hopes to submit two sets of proposed standards to OMB by March 1994. One set of standards will address the cleanup of soil, groundwater, and contaminated structures, while the other will pertain to the management of waste resulting from the cleanups.

Objectives, Scope, and Methodology

The Chairman, Environment, Energy, and Natural Resources Subcommittee, House Committee on Government Operations, requested that we provide information on the status of radiation protection activities at EPA, including an analysis of the length of time involved in completing such activities and the cause for EPA's delays in issuing the relevant standards. We agreed to examine four sets of standards, namely, those for: (1) high-level waste, (2) low-level waste, (3) inactive uranium-processing sites, and (4) residual radiation. In addition, the Chairman asked us to obtain information on the activities of EPA's radiation laboratories, specifically those activities related to the development of standards.

To determine the current status of these four standards, the length of time EPA has spent in promulgating them, and the reasons why such promulgation has been delayed, we interviewed officials from EPA's Office of Radiation and Indoor Air and collected drafts of proposed standards. We also reviewed EPA's budgets from October 1977 to September 1992 to determine the level of funding and FTEs provided for radiation protection. We interviewed officials from OMB, DOE, and NRC and obtained correspondence regarding (1) their involvement in the promulgation of the standards and (2) their concerns about EPA's development of the proposed standards. In addition, we interviewed officials from the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) and reviewed copies of CIRRPC policies and procedures to determine its role in radiation activities and the manner in which it facilitates policy coordination between federal agencies.

We also interviewed officials at EPA's Office of Radiation and Indoor Air and its two radiation laboratories to determine laboratory activities, specifically their role in developing radiation protection standards.

We conducted our work from March 1992 to February 1993 in accordance with generally accepted government auditing standards. We discussed the facts in this report with the Director and Deputy Director of EPA's Office of Radiation and Indoor Air. We also obtained comments from officials in NRC's Office of Nuclear Material Safety and Safeguards and Office of Nuclear Regulatory Research; DOE's Office of Environment, Safety and Health; OMB's Office of Information and Regulatory Affairs; and from the Director of CIRRPC's Executive Committee, on excerpts of the report that were relevant to their respective organizations. The officials generally concurred with the information presented and provided technical corrections and clarifying information, which have been incorporated in

**Appendix V
Objectives, Scope, and Methodology**

the report as appropriate. As requested, however, we did not obtain written comments on this report from these agencies.

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