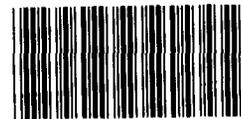


March 1990

NUCLEAR REGULATION

The Military Would Benefit From a Comprehensive Waste Disposal Program



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

B-238533

March 23, 1990

The Honorable John Glenn, Chairman
Committee on Governmental Affairs
United States Senate

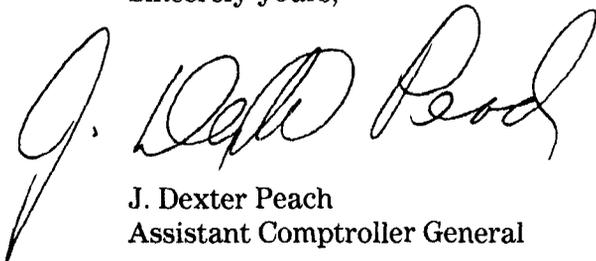
Dear Mr. Chairman:

As a result of an incident at Wright-Patterson Air Force Base, you asked us to examine the Nuclear Regulatory Commission's oversight of the Department of Defense's use, handling, and disposal of radioactive material. On the basis of subsequent discussions with your office, we agreed to conduct a detailed examination of the low-level radioactive waste disposal practices of the Departments of the Army, Air Force, and Navy. This report provides information on the three services' waste disposal practices and legislative uncertainties that could benefit or adversely affect them in the future.

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 send copies to appropriate congressional committees; the Secretary of Energy; and the Director, Office of Management and Budget. We will also make copies available to others upon request.

This work was performed under the direction of Victor S. Rezendes, Director, Energy Issues, who can be reached at (202) 275-1441. Other major contributors are listed in appendix III.

Sincerely yours,



J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

Because of an accidental release of low-level waste stored at the Wright-Patterson Air Force Base, Ohio, in 1986, several individuals inhaled small quantities of a radioactive substance. Throughout the Department of Defense (DOD), thousands of individuals in all 50 states and overseas routinely use hundreds of radioactive byproduct materials for academic, research and development, medical diagnosis and treatment, and industrial activities. Appropriate precautions must be taken to safely dispose of the low-level radioactive waste generated from these activities. In 1988, generators disposed of about 1.4 million cubic feet of such waste, including about 6 percent from federal agencies.

The Chairman, Senate Committee on Governmental Affairs, asked GAO to compare the low-level radioactive waste disposal practices of the Departments of the Army, Air Force, and Navy.

Background

The Atomic Energy Act of 1954, as amended, requires the Nuclear Regulatory Commission (NRC) to issue licenses to qualified individuals or organizations to use and to dispose of radioactive material. Within DOD, NRC has issued licenses to the Army, Air Force, and Navy. Each service has established its own procedures for managing low-level radioactive waste. DOD installations store low-level waste pending its long-term disposal in three commercial sites.

Under the Low-Level Radioactive Waste Policy Act, as amended, states either separately or through interstate compacts are required to have new sites available by January 1993 so that all waste generated within the boundaries of the compact or state will be disposed of there. DOD will have to send waste to as many as 16 sites. To encourage new site development, the act established surcharges ranging from \$10 to \$40 per cubic foot of waste disposed of between July 1986 and December 1992 and penalties of up to \$120 per cubic foot during calendar year 1992 if the compacts and states have not submitted site applications. The act requires NRC to establish criteria for waste whose radiological impacts would be so low that it could be considered "below regulatory concern" and exempt from the act. NRC expects to issue a final policy during the spring of 1990. (See ch. 1.)

Results in Brief

No comprehensive DOD waste disposal program exists, and none of the three services knows the full extent of its low-level radioactive waste disposal problems. As a result, DOD leaves itself open to errors and problems that could lead to adverse publicity and criticism. Throughout the

1980s, the Army and Air Force had, on occasion, been banned from disposal sites for failing to comply with federal and state requirements.

By December 1992, two of the three sites used by DOD to dispose of waste will close, and only a limited number of new sites may be available for several years. In the interim, DOD will incur substantial surcharges to dispose of waste. After January 1993, DOD would have to comply with disposal requirements for as many as 16 sites or store waste on-site pending the availability of the new sites. No provisions exist after that time for disposal of low-level waste generated at DOD overseas locations.

DOD needs to take full advantage of the time between now and January 1993 to establish a comprehensive low-level radioactive waste disposal program. A comprehensive program could help ensure that the three services (1) identify the types and amount of waste generated and disposed of, (2) aggressively pursue volume-reduction techniques, and (3) establish a more cost-effective method to dispose of their waste. In addition, DOD needs to work with the other federal agencies, compacts, and states to determine the feasibility of dedicating a portion of one or more disposal sites for the government's use.

Principal Findings

Benefits Could Be Realized From a Comprehensive Program

A comprehensive low-level radioactive waste disposal program could help resolve a number of weaknesses that GAO identified. First, none of the three services has complete information on the amounts or types of low-level radioactive waste generated or disposed. In 1988, the Navy conducted two surveys to develop this information, but the results were not complete. The Army expects to survey its installations in fiscal year 1990. The Air Force surveyed 23 bases in 1987. Although 46 bases buried waste on-site in the 1950s and only limited data exist on the number of sites and the types and amounts of material in them, the Air Force does not plan to conduct additional surveys.

Second, the Navy generally stockpiles its waste and has been doing so for many years. Long-term storage increases the potential that another accident similar to Wright-Patterson could occur. The accident, which cost almost \$1 million to clean up, could have been avoided if the Air Force had not stored its waste.

Third, throughout the 1980s, the Army and Air Force were banned at one time or another from all three disposal sites for failing to comply with a federal and state packaging and shipping requirements. This may be an increasing problem since after 1993, the services may have to comply with as many as 16 different compact and state disposal requirements. Fourth, differences exist among the waste management practices of the three services, as well as within each service. Some installations have NRC's approval to store some waste until it decays to a level where it can be disposed of as normal trash; others send all waste for burial. Some crush, compact, or consolidate waste prior to shipment, thereby reducing volumes disposed of and costs; others do not. Consistently utilized, these techniques could significantly reduce disposal volumes and, ultimately, costs.

A comprehensive DOD program could ensure that the military (1) identifies the types and amounts of waste generated, (2) consolidates management expertise and training to stay current with the different compact and state requirements, (3) consistently utilizes volume-reduction techniques to reduce costs, (4) uniformly considers alternatives for disposing of waste that meets NRC's below-regulatory-concern policy, and (5) establishes a more cost-effective method to dispose of its waste. (See chs. 2 and 3.)

Federal Sites Could Benefit the Military

As of January 1990, basic disposal costs and surcharges were almost equal. DOD now pays almost twice as much as it actually costs to dispose of waste because of surcharges. DOD will continue to pay substantial surcharges each time it disposes of waste—up to \$120 per cubic foot over and above disposal costs—through 1993. By December 1992, two of the existing three sites will close. As of January 1990, only one compact had submitted an application for a new site. If new sites are not available by January 1993, DOD will be required to store waste or each generator will have to seek an NRC exemption to dispose of waste outside its region. To request an exemption, the generator will have to demonstrate that an imminent public health and safety risk exists. According to NRC staff, it would be rare that such a risk would exist; therefore, NRC will probably grant few exemptions.

One or more federal sites could alleviate these and other problems. Working with other federal agencies, DOD can pursue several options. First, two of the existing three sites will close in December 1992, but all three have unfilled capacity. Second, a portion of new sites could be dedicated for federal agencies' use. Federal sites would (1) allow the

military to compact, consolidate, and reduce disposal volumes; (2) reduce the potential for packaging and shipping errors to occur; and (3) ensure that waste generated overseas can be disposed of. After January 1993, the compacts and states do not have to dispose of waste generated overseas.

Although the compacts or states may need to overcome a number of political issues, such as public opposition to accepting waste from outside their boundaries, GAO believes that the increased efficiencies and cost savings to be derived justify giving serious consideration to this option. Because of the widespread geographic location of its bases, DOD should spearhead the effort with other federal agencies. Although officials from the three services acknowledge that benefits would be derived if a federal site was available, they do not believe that DOD should lead this effort. (See ch. 3.)

Recommendations to the Secretary of Defense

To ensure that all DOD facilities appropriately dispose of low-level radioactive waste, GAO recommends that the Secretary of Defense

- establish a comprehensive low-level radioactive waste disposal program at a high departmental level, establish uniform policies and procedures for the program, and institute a mechanism to ensure compliance throughout DOD with the requirements;
- develop an inventory of the amounts and types of low-level radioactive waste that are stored or buried at all DOD installations;
- require all DOD installations to institute consistent waste minimization and treatment techniques; and
- develop a strategy for dealing with low-level waste after 1992, including working with other federal agencies, compacts, and states to determine the feasibility of dedicating a portion of one or more sites for the government's use and ensuring that low-level radioactive waste generated overseas would be accepted for disposal.

Agency Comments

GAO discussed the facts presented in this report with NRC, Army, Air Force, and Navy officials. They generally agreed with the facts but offered some clarifications that were incorporated where appropriate. As requested, GAO did not ask DOD or NRC to review and comment officially on this report.

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Abbreviations

AMCCOM	Army Armament, Munitions and Chemical Command
DOD	Department of Defense
DOE	Department of Energy
EPA	Environmental Protection Agency
GAO	General Accounting Office
GSA	General Services Administration
NRC	Nuclear Regulatory Commission
OTA	Office of Technology Assessment

Introduction

Throughout the Department of Defense (DOD), thousands of individuals in all 50 states and overseas routinely use hundreds of radioactive byproduct materials for academic, research and development, medical diagnosis and treatment, and industrial activities. Most of these materials emit relatively low levels of radiation, posing little or no threat to the users or the public, but some can result in significant radiation exposure if not properly handled. Therefore, appropriate precautions must be taken to safely dispose of the low-level waste generated from these materials.¹ Presently, most low-level waste (except that generated by the Department of Energy (DOE)) is being buried at three sites located in South Carolina, Nevada, and Washington. In 1988, low-level generators disposed of about 1.4 million cubic feet of such waste at these sites, including about 6 percent from government agencies, such as the Departments of Defense and Veterans Affairs, and the National Institutes of Health.

Military's Organization to Comply With NRC's Requirements

Under the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974, as amended, the Nuclear Regulatory Commission (NRC) is responsible for ensuring that radioactive material is handled safely and does not endanger the users and/or the public. Within NRC, the Office of Nuclear Material Safety and Safeguards is responsible for issuing licenses to qualified individuals, businesses, and other institutions, including the Departments of the Army, Air Force, and Navy, to handle specific radioactive material according to its regulations.² The regulations, as well as a number of NRC policies, also specify the methods that licensees can use to dispose of low-level waste. The methods range from burial in unlined trenches at NRC-licensed sites to disposal as normal trash.

The three services hold different types of NRC byproduct licenses. Both the Air Force and Navy have a master material license from NRC. Once issued, these licenses do not have to be renewed, and they allow these two organizations to issue permits to, conduct inspections of, and take enforcement actions against, individual users of radioactive material. The Army does not have a master material license. Instead, each organization must receive a license from NRC that must be renewed every 5 years. To carry out their licensed activities and safely dispose of waste,

¹Low-level waste is waste that is not classified as uranium mill tailings, high-level waste, or spent fuel and consists of discarded tools, rags, machinery, paper, sheet metal, glass, and protective clothing. About 3 percent of such waste can remain hazardous for 300 to 500 years or more.

²NRC's regulations are set forth in 10 CFR parts 19 through 21, 30 through 35, 40, 50, 70 and 71.

the three services have established their own organizations and procedures.

Army

The Army Material Command, Alexandria, Virginia, is responsible for overseeing the activities conducted by 61 byproduct licensees; the Office of the Surgeon General oversees an additional 26 medical use licensees. Both of these offices review new license applications and amendments before they are sent to NRC and perform annual inspections of some organizations to verify compliance with the license and related requirements. The Army Material Command also oversees the centralized radioactive waste disposal program.

In 1977, the Army transferred its low-level waste disposal program to the Army Armament, Munitions and Chemical Command (AMCCOM) in Rock Island, Illinois. AMCCOM oversees the safe packaging, transporting, and handling of waste from Army bases across the country and manages the contracts for its disposal in commercially operated facilities in Barnwell, South Carolina; Richland, Washington; and Beatty, Nevada. Under the program, the low-level waste generator can (1) ship the waste directly to the burial site, (2) request pick-up by a contractor, or (3) ship the waste to a contractor-operated facility in South Carolina that consolidates small quantities from numerous generators and ships it directly to the disposal site. Since the mid-1980s, the Army has had memoranda of understanding with several federal agencies, such as the General Services Administration (GSA), Environmental Protection Agency (EPA), and the Uniformed Services University of Health Sciences, to dispose of their low-level radioactive waste.

Air Force

To carry out the responsibilities set forth by its license, the Air Force established a Radioisotope Committee located at Bolling Air Force Base, Washington, D.C. The committee delegated management responsibility for day-to-day activities to Brooks Air Force Base, San Antonio, Texas. The committee reviews individual organizations' applications to possess and use radioactive material and issues permits to applicants that meet NRC and Air Force requirements. In addition, the Inspection and Safety Center at Norton Air Force Base, California, has been given inspection responsibility for the 192 permit holders.

In May 1985, the Air Force began to participate in the Army's program and shares 50 percent of some costs. The San Antonio Air Logistics Center, Texas, serves as the point of contact with the Army.

Navy

The Navy also established an oversight committee—Radiation Safety Committee, Washington, D.C. The committee manages the license, reviews applications, issues permits to eligible users, and ensures that inspections of permit holders are conducted. The Navy has two groups that assist the committee—the Environmental Health Center, Norfolk, Virginia, which oversees 39 medical permit holders; and the Radiological Affairs Support Office, Yorktown, Virginia, which oversees 161 industrial permit holders. Both groups perform the same functions for the permittees within their jurisdiction. For example, they review applications; recommend those that should be issued a permit; and conduct inspections of, and take enforcement actions against, the permit holders.

Although the Radiological Affairs Support Office also oversees the permittees' radioactive waste disposal activities, the Naval Supply Systems Command establishes the policies for these activities. The command delegates day-to-day oversight to its Norfolk, Virginia, and Oakland, California, centers. The Oakland center has contracted with a private company to transport and dispose of waste. With the exception of the nuclear propulsion program, which manages its own waste disposal activities, and three Navy permit holders—National Naval Medical Center, Bethesda, Maryland; Naval Medical Research Institute, Bethesda, Maryland; and Naval Surface Weapons Center, Dahlgren, Virginia—that participate in the Army's program, most Navy installations store, rather than dispose of, their waste.

Legislation Could Have an Impact on the Military's Program

In 1980, the Congress passed the Low-Level Radioactive Waste Policy Act to encourage states either separately or in conjunction with other states (compacts) to develop new disposal sites. The underlying premise of the act was that all states should be responsible for disposing of low-level radioactive waste generated within their borders. For states with active disposal sites, the act stipulated that they could refuse to accept waste generated outside the state and/or compact region after January 1, 1986.

Since new waste sites could not be developed by 1986, the Congress in 1985 passed the Low-Level Radioactive Waste Policy Amendments Act, which extended the exclusion date from January 1986 to January 1, 1993. The amendments also established (1) milestones—the compacts and states were required to submit applications to NRC or an agreement

state³ by January 1990 or within the 2-year grace period—and (2) surcharges and penalties to, in part, encourage new site development and volume reduction.

Between July 1986 and December 1992, the surcharges range from \$10 to \$40 per cubic foot of waste disposed. During calendar year 1992, penalties could triple the surcharges to a maximum of \$120 per cubic foot of waste disposed if the compacts and states have not submitted site applications. After that time and until January 1996, a generator granted an NRC exemption to dispose of waste outside the compact or state would pay the \$120 per cubic foot surcharge. The act required the three states with existing sites to collect the surcharges and later provide 25 percent to DOE for distribution to the compact regions or states for new site development; the three states would retain the remaining 75 percent. If new sites are not available by January 1993, the funds (25 percent) would be repaid monthly to generators rather than the compacts or states.

The amendments also established the three existing commercial low-level waste sites as compact regions until December 31, 1992, and required NRC to establish criteria for waste whose radiological impacts would be so low that it could be considered “below regulatory concern” and exempt from the act. NRC had expected to issue the criteria by November 1989; NRC now expects to do so during the spring of 1990.

In addition, the act identified 7 compact regions involving 39 states but also allowed the states to change compact regions, form new ones, or dispose of waste on their own. In the interim, a number of states have exercised the various options. As of December 1989, 43 states had formed 9 compact regions; the remaining 7 states (including Puerto Rico and the District of Columbia) were considering options to comply with the act. (Fig. 3.1 shows the status of the compact regions. App. I provides additional information on some of the act’s provisions.)

Wright-Patterson Air Force Base Incident

Sometime in the 1970s, a nonmilitary NRC licensee transferred americium—a highly toxic, potentially hazardous carcinogen—low-level waste to Wright-Patterson Air Force Base, Ohio. In October 1986, Air Force personnel accidentally opened a drum containing the waste, spilled the material, and contaminated the building in which it was

³NRC has formal agreements with 29 states to regulate certain licensees under programs comparable to NRC’s.

stored. During the cleanup activities, several individuals inhaled a small quantity of the radioactive material. According to NRC documents, Air Force personnel initially believed that they did not have to report this release. Furthermore, NRC staff could not initially agree whether the Air Force should have reported the spill to NRC. Later, NRC determined that a violation had occurred, and in June 1988 issued a notice of violation and proposed a \$102,500 civil penalty against the Air Force. Ultimately, the Air Force spent about \$1 million to clean up the contamination and to dismantle the building and in August 1989 paid the civil penalty that NRC imposed.

Objectives, Scope, and Methodology

As a result of the Wright-Patterson incident, the Chairman, Senate Committee on Governmental Affairs, asked us to examine NRC's oversight of DOD's use of radioactive materials and determine whether the Wright-Patterson incident indicated lax NRC oversight of the military's handling and storage of radioactive materials. On the basis of subsequent discussions with the Chairman's staff, we agreed to conduct a detailed examination and cost comparison of the Army's, Navy's (except the nuclear propulsion program), and Air Force's low-level radioactive waste disposal practices rather than examine NRC's oversight of DOD's activities.

In conducting this work, we reviewed the Atomic Energy Act, Low-Level Radioactive Waste Policy Act, and NRC regulations related to (1) byproduct material licensing, (2) standards for protection against radiation and disposal alternatives for low-level waste, and (3) commercial low-level disposal site licensing. We also interviewed NRC staff in the Offices of Nuclear Materials Safety and Safeguards and Nuclear Regulatory Research and reviewed NRC's internal policies, such as Regulatory Guide 10.8 (preparing medical use applications) and Regulatory Guide 7.10 (quality assurance programs for radioactive material packaging), and analyses of the impact of the proposed below regulatory concern criteria and the public comments received on them.

We also met with a DOE official in the commercial low-level radioactive waste program and reviewed documents, such as Low-Level Radioactive Waste Volume Reduction and Stabilization Technologies Resource Manual (DOE/LLW-76T, Dec. 1988), which discussed waste volume reduction and alternative disposal methods. We also reviewed two DOE reports, Recommendations for Management of Greater-Than-Class-C Low-Level Radioactive Waste (DOE/NE-0077, Feb. 1987) and 1988 Annual Report on Low-Level Radioactive Waste Management Progress (DOE/NE-0098, Oct. 1989), which were required by the Low-Level Radioactive Waste

Policy Amendments Act. In addition, we obtained a November 1989 Office of Technology Assessment (OTA) report, Partnerships Under Pressure, on the problems that the compacts and states have encountered. Furthermore, we met with the Electric Power Research Institute—a group funded by electric utilities—to obtain the industry's views on NRC's below regulatory concern criteria and reviewed a March 1989 report, Below Regulatory Concern Owners Group: Cost-Benefit Analysis of BRC Waste Disposal.

Work Conducted at Various Military Installations

Within the Departments of the Army, Air Force, and Navy, we met with numerous headquarters and field installation officials (app. II lists the locations that we visited) to discuss their policies, procedures, and practices for handling and disposing of low-level waste. We obtained a multiplicity of documents to support the oral evidence provided. Some of the more significant military locations that we visited are discussed below.

To develop an understanding of the Army's centralized waste program, we met with the Chief-of-Staff and officials from the Procurement Directorate, Safety Office, and Transportation and Traffic Management Directorate at AMCCOM, Rock Island, Illinois. We reviewed applicable policies, such as the Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety) Regulation, and other information concerning the duties and responsibilities of the various offices involved in the low-level waste program. In addition, we reviewed the contract between Chem-Nuclear Systems, Inc., and the Army and delivery orders issued between November 1987 and March 1989. The delivery orders set out the specific activities the contractor would perform and estimated costs for the services.

We also visited several of the Army's larger waste generators, such as Chemical Research, Development, and Engineering Center, Edgewood, Maryland; Walter Reed Army Medical Center, Washington, D.C.; and Aberdeen Proving Grounds, Maryland. Although Aberdeen holds an NRC source rather than byproduct license, we decided to visit this site because we could observe the packaging, labeling, and loading of waste for shipment to the Barnwell site. While at Aberdeen, we also toured the Combat Systems Test Activity and Ballistic Research Laboratory—both test armor-piercing shells containing depleted uranium.

To obtain additional information concerning the Army's program, we met with officials from Chem-Nuclear and U.S. Ecology—the companies that operate the three licensed low-level waste disposal sites. At Chem-

Nuclear, we reviewed shipping records and waste processing and consolidation procedures. We also toured the Barnwell, South Carolina, disposal site and DOD's consolidation facility, which is adjacent to the site. At U.S. Ecology, we obtained information about its waste processing, consolidation, and disposal capabilities; toured its waste packaging and storage facility; and examined its contract with Oakland Naval Supply Center, California.

In addition, to assess the Air Force's low-level waste program, we met with Radioactive Waste Program Office officials at the San Antonio Air Logistics Center, Texas. We reviewed Air Force regulations on controlling radioactive material and technical manuals on handling such material and its disposal. Furthermore, we obtained information about waste shipments and burials made between August 1987 and April 1989, including shipment control numbers, items being shipped, the requester, and shipping and burial dates.

At the Navy, we met with officials from the Radiation Safety Committee, Environmental Health Center, and Radiological Affairs Support Office to determine their duties and responsibilities concerning the handling and disposal of low-level waste. We obtained regulations, policies, procedures, and the results of surveys conducted in February and April 1988 to determine the type and amount of radioactive waste being stored at various Navy bases.

Cost Comparison

To compare waste disposal practices and attendant costs for the three military services, we obtained information on the number of waste shipments between November 1984 and September 1989, type and volume of waste shipped, and consolidation and disposal costs. We also obtained data on the funds paid to Chem-Nuclear, calendar year 1987 and 1988 adjustments for the company's charges to all federal agencies in the Army's program, and costs to construct a new consolidation and compactor facility as well as estimated cost savings from using the new facility.

On the basis of this information, we have provided some cost data. We could not, however, conduct the cost comparison requested because consolidated data do not exist on the amount of waste generated, stored, or disposed of by the three services. In addition, individual generators in the three services use different methods to process the waste prior to shipment and different shipping schedules. For example, some generators reduce the volume of waste prior to packaging while others do not.

Also, some generators store waste until they have a full truck load while others ship waste on a quarterly basis, regardless of the amount. Furthermore, the number of waste shipments that occurred during the last several years is most likely not representative of historical or future waste disposal activities. For example, since the Wright-Patterson incident, the Air Force has made a concerted effort to clean up its installations. For these reasons, this report presents a limited perspective on the three services current and projected waste disposal costs.

**Internal Controls
Examined**

Using information provided by Army, Air Force, and Navy officials, we conducted a limited assessment of these agencies' internal controls. For example, we examined the Army's procedures to ensure that Chem-Nuclear provided the services specified in the delivery orders and that the contractor's request for payments was reviewed and verified prior to payment. We also examined the Army's procedures to review the Air Force's and three Navy facilities' requests for contractor's services, issue delivery orders for them, and ensure that Chem-Nuclear provided the services specified in the delivery orders.

We also examined the reporting and accounting systems used by (1) the Army to monitor the funds provided by the Air Force and obtain payment from the Navy and other government agencies under their memoranda of understanding and (2) Chem-Nuclear to assess service charges to its various governmental customers. At Chem-Nuclear, we also conducted a limited examination of time and attendance records, travel vouchers, and equipment purchases to verify that these were valid charges and the Air Force was appropriately assessed its 50 percent of agreed-upon costs.

We discussed the facts presented in this report with NRC, Army, Air Force, Navy, and Chem-Nuclear officials. They generally agreed with the information presented but offered some clarifications that were incorporated where appropriate. As requested, we did not ask these groups to review and comment officially on this report. Our work was conducted between May 1988 and November 1989 in accordance with generally accepted government auditing standards.

Military Can Improve Its Low-Level Radioactive Waste Disposal Practices

To improve its management of low-level radioactive waste and effectively address future uncertainties, the military needs complete information on the volumes and types of waste generated and disposed of. None of the three services knows the full extent of their low-level waste disposal problems. In 1988, the Navy conducted two surveys to develop this information, but the results were not complete. The Army expects to survey its installations in fiscal year 1990 to develop an inventory of waste but continues to identify material, such as 4,000 tons of contaminated steel, requiring disposal. Finally, although 46 Air Force bases buried waste on-site in the 1950s and limited data exist on the number of sites and the types and amounts of waste in them, the Air Force does not plan to survey its bases.

The Army has had a low-level waste disposal program for many years, but the Navy does not have a program. Since May 1985, the Air Force has participated in the Army's program. The program has helped ensure the timely disposal of waste, but we found numerous management weaknesses that limited its effectiveness and that the Army and Air Force have, on occasion, been temporarily banned from commercial sites for failing to comply with federal and state waste packaging and transportation regulations.

Full Extent of the Military's Low-Level Radioactive Waste Problems Is Not Known

The three services have not acted aggressively to identify the volumes or types of low-level waste generated or disposed of by their various installations. As of December 1989, only the Navy had made a concerted effort to obtain this information; however, the data are not complete. During fiscal year 1990, the Army plans to conduct a survey to obtain an inventory of low-level waste at its bases. The Air Force surveyed 23 bases in 1987 and has no plans to conduct additional surveys.

Navy

As a result of the Wright-Patterson incident, in February and April 1988 the Radiological Affairs Support Office sent questionnaires to Navy installations to determine the type and amount of waste being stored at its bases. The Navy not only wanted to identify waste volumes and locations but also wanted to use the information to develop a timely, cost-effective waste disposal program. Table 2.1 shows the number of questionnaires sent and replies received.

**Table 2.1: Results of the Navy's
 Radioactive Waste Surveys**

	Number of questionnaires	Number of replies
Permit holders	135	118
Nonpermit holders ^a	288	94

^aSome items, such as smoke detectors and exit signs, contain radioactive material. For those items, neither NRC nor the Navy requires the users to obtain a license or permit, respectively.

On the basis of those who responded to the survey, the Navy estimates that about 9,000 cubic feet of waste is being stored at its installations—permit holders reported having about 8,000 cubic feet and nonpermit holders, about 1,000. However, Navy officials do not believe that the survey results show the full extent of radioactive waste generated or stored. They noted that the

- waste volume for permit holders is only a rough approximation, with a variance of plus or minus 50 percent;
- installations estimated waste volumes differently;
- nonpermit holders' volumes are rough approximations because some installations may not know that certain devices contain radioactive material; and
- Navy knows that at least 25 percent of the nonpermit holders who did not respond to the survey store radioactive waste.

For these reasons, the Navy does not precisely know the amount and types of waste stored or disposed of by its various installations.

Air Force

Since May 1985, the Air Force has participated in the Army's program and has disposed of about 12,000 cubic feet of waste through it. Some of this waste resulted from the cleanup of 23 bases surveyed in 1987. The Air Force has no plans to conduct additional surveys but relies on its inspection program to ensure that its bases properly manage and dispose of low-level waste. Air Force officials estimate that about 7,000 cubic feet will be disposed of in fiscal year 1990.

Further, during fiscal year 1990, the Air Force expects to excavate some low-level waste that had been buried on 46 bases around the country in the 1950s.¹ In the late 1950s, headquarters directed the Air Force to stop this practice and use a contractor to dispose of waste. However, the Air

¹Until January 1981, NRC allowed licensees to bury waste on-site and required the licensee to maintain the burial records.

Force did not provide its bases with instructions for ensuring the integrity of the burial sites or maintaining necessary disposal records. In February 1971, after realizing that it did not have disposal records, the Radioisotope Committee directed all major commands to report on their buried waste sites. The committee found that the Air Force did not have complete information on the number of sites or the types and amounts of material in them. Subsequently, in 1974 and 1988, the Air Force issued policies concerning the maintenance of the sites. However, until the Air Force begins to excavate the waste, officials cannot estimate the volumes that may need to be disposed of.

Such projects and other efforts, such as decontamination, are very costly. For example, Norton Air Force Base, California,² expects to spend (1) over \$200,000 to excavate and dispose of about 360 cubic feet of waste and (2) over \$180,000 to decontaminate a building and dispose of about 460 cubic feet of waste. The Air Force also plans to spend (1) about \$116,000 to excavate a site and dispose of about 185 cubic feet of waste and (2) over \$600,000 to develop a plan to decommission a reactor at Wright-Patterson. The Air Force's contractor (Chem-Nuclear) estimates that between \$20 million and \$40 million will be needed to decommission the reactor and dispose of over 100,000 cubic feet of waste.

Army

The Army continues to identify additional material that may have to be disposed of as low-level waste. For example, the Army has 4,000 tons of contaminated steel at Aberdeen Proving Grounds; and Aberdeen and three other bases—Jefferson, Lake City, and Yuma—have contaminated soil as a result of testing ammunition containing depleted uranium. According to Army officials, NRC requires the four bases to monitor soil contamination and take corrective actions before exceeding contamination limits specified in the licenses. These officials also said that they do not expect to assess the extent of, and need to clean up, soil contamination at the four locations until a decision is made to close a base. Until such assessments are conducted, they could not estimate the volume of waste that may need to be disposed of. Since a test site can cover as much as 10 acres, the amount of contaminated soil could be significant. In fiscal year 1990, the Army plans to survey its installations to develop an inventory of waste.

²Norton Air Force Base and Jefferson Proving Grounds (discussed later) are scheduled to be closed in the early 1990s. Such closures could increase the volume of waste to be disposed of. According to Army, Air Force, and Navy officials, cleaning up soil contaminated with depleted uranium creates large waste volumes that pose a difficult and costly disposal problem.

During fiscal year 1990, officials estimate that the Army and its program participants will dispose of about 35,000 cubic feet of waste. Table 2.2 shows the volumes and costs of waste disposed of by the Army and its program participants between fiscal years 1985 and 1989.

Table 2.2: Volume and Disposal Costs of the Army and Its Program Participants, Fiscal Years 1985-89

Fiscal year	Volume disposed (in cubic feet)	Disposal cost ^a
1985	26,331.3	\$656,703
1986	22,687.3	626,623
1987	44,896.7	1,495,958
1988	20,854.7	736,588
1989	63,043.3	2,324,406

^aBasic disposal cost, excluding packaging, transportation, labor, materials, taxes, and other charges.

As can be seen from table 2.2, waste disposal volumes vary. Some of the variance is attributable to unanticipated cleanup activities, such as the Wright-Patterson incident that generated about 3,200 cubic feet of waste between November 1986 and December 1987, as well as planned decontamination projects. For example:

- Until 1976, the Lake City Army Ammunition Plant near Independence, Missouri, assembled, produced, and tested ammunition containing depleted uranium. To terminate its NRC license, the Army had to decontaminate the buildings. The work was conducted between August 1986 and February 1987 and resulted in the disposal of about 30,200 cubic feet of waste during fiscal year 1987.
- In 1967, the GSA acquired a facility in Watertown, Massachusetts, which had been used by the Atomic Energy Commission to package and store waste and burn depleted uranium scrap. Surveys conducted by DOE in 1983 and Chem-Nuclear in 1988 found contamination that needed to be cleaned up. Chem-Nuclear decontaminated the site and disposed of about 4,030 cubic feet of contaminated soil and concrete by November 1988. In June 1989, soil samples identified underground oil contaminated with both hazardous and radioactive material. As of January 1990, GSA had not resolved this problem.

Army's Program Has Several Advantages

Since 1977, AMCCOM has been responsible for overseeing the Army's waste disposal program. Under the Army's regulations for licensing, controlling, transporting, and disposing of low-level waste, AMCCOM manages the contract with Chem-Nuclear, which requires the company to receive, store, open, inspect, consolidate, repack, and solidify waste consistent with federal and state regulations.

The process begins when one of the Army's 460 waste generators submits a disposal request to AMCCOM, which reviews the request, assigns a control number, and processes the request. AMCCOM will then contact the generator and specify the packaging, labeling, and shipping requirements that apply or provide on-site assistance if requested. AMCCOM then prepares a delivery order that authorizes the contractor to dispose of the waste. The delivery order identifies the location of the waste and scope, timing, and cost of the work to be performed.

Under the current contract, Chem-Nuclear also consolidates small quantities of waste from numerous generators before disposal. According to AMCCOM officials, using the consolidation facility has reduced personnel travel costs and charges to dispose of small quantities of waste. In addition, shipping container utilization has increased because the generators can send the waste to the consolidation facility in a strong tight container, such as a cardboard box, rather than heavy wooden or metal boxes required by the state for disposal. The following three examples illustrate the savings that have been realized from using the consolidation facility:

- In July 1989, Eglin Air Force Base, Florida, shipped about 7,530 cubic feet of waste for disposal. Through consolidation, the volume disposed of was about 1,345 cubic feet—saving about \$228,000.
- In July 1989, three Air Force bases—Tyndall, Florida; McClellan, California; and Tinker, Oklahoma—shipped 1,851 cubic feet for burial. Through consolidation, the volume disposed of was 388 cubic feet—saving over \$80,000.
- In September 1989, the Anniston Army Depot, Alabama, shipped about 12,430 cubic feet of waste for disposal. Through consolidation, the volume disposed of was 3,847 cubic feet—saving about \$316,455.

Furthermore, the Army is building a new consolidation facility that will also include a waste compactor. The Army expects the new facility to be in operation by June 1990 and estimates that the program can save over \$500,000 during the first year and over \$3 million during the first 5 years the facility operates. To ensure the effective utilization of the new

facility, AMCCOM has asked all its program participants to separate material that can be compacted from the rest of their waste and store it until the last half of fiscal year 1990.

In addition to the benefits realized from consolidation and expected to be realized from the new facility, South Carolina has granted the Army and its program participants some waste packaging and disposal variances that have been cost beneficial to the program. For example, when the Army recently wanted to dispose of two tanks, the state allowed the tanks to be buried without an exterior container, such as a wooden or metal box. Since the contamination was contained inside the tanks, the state authorized direct burial. By receiving the variance, the Army realized savings of about \$119,265 for labor, material, and disposal costs.

Also, the state has granted the Army a variance from its prohibition against disposing of any devices (instruments, gauges, dials, and other items) containing tritium gas.³ Generally, the state does not allow the disposal of such items at Barnwell. Because the Army's program participants use tritium-containing devices in a number of ways (such as gun sights, exit signs, and runway lights), the Army asked for a variance to this regulation. In granting the variance, the state required Chem-Nuclear to seal the devices in concrete or a high-integrity container, such as polyethylene, to prevent damage to the devices. This variance has resulted in substantial cost savings to the Army and its program participants.

For example, between April 1986 and August 1987, Chem-Nuclear repackaged about 86 shipments containing tritium devices and estimates that the Army saved about \$797,000 in labor, supplies, materials, transportation, and disposal costs. Without the variance, AMCCOM estimates that disposal costs would have been over \$1.3 million because 62 of the shipments would have had to be sent to Richland, Washington, for disposal.

As a second example, in September 1989 the Navy wanted to dispose of five exit signs containing tritium in Nevada. U.S. Ecology estimated that the cost would be about \$4,000 to dispose of the signs. Because of the cost, the Navy has decided to store the waste. Depending on the number of these items at various Navy installations, the disposal costs could be significant. For example, in response to the Navy's February 1988 survey, 1 installation reported having 18 such signs. To dispose of the signs

³Tritium is a radioactive gas or oxide material with a half-life of about 12.3 years.

in Nevada, the cost would be about \$14,400. According to Army officials, the cost would be about \$1,800 under their program because of the variance granted by the state.

Other Agencies Participate in the Army's Program

Through memoranda of understanding, the Army has provided low-level waste disposal services to such federal agencies as GSA, EPA, Uniformed Services University of Health Sciences, the Air Force, and three Navy installations. Depending on the services required, AMCCOM will provide written instructions for the transportation of the waste or direct Chem-Nuclear to pick up the material.

The Air Force began to participate in the Army's program in May 1985. The San Antonio Air Logistics Center serves as the point of contact with the Army and functions much like AMCCOM—it receives disposal requests, assigns control numbers, approves requests, and/or provides instructions concerning shipping requirements. In addition, the command submits all requests for contractor assistance to AMCCOM, which prepares the delivery orders. Also, the Air Logistics Command has established two computer systems: one tracks all waste disposal requests; the other lists the items disposed of.

Three Navy activities—National Naval Medical Center, Bethesda, Maryland; Naval Medical Research Institute, Bethesda, Maryland; and Naval Surface Weapons Center, Dahlgren, Virginia—participate in the Army's program. Since February 1985, these organizations have disposed of about 8,000 cubic feet of waste under the program. Almost all other Navy installations store their waste. For example, in 1988, 34 installations reported that they were storing almost 7,900 cubic feet of waste.

However, officials within the Navy's Radiological Affairs Support Office believe that the rest of the Navy's facilities should be part of the Army's program. At the request of the Naval Sea Systems Command, the office prepared a position paper on the advantages and disadvantages of a consolidated, tri-service waste program. The September 1988 paper noted that:

- Navy installations traditionally have stored their waste until the quantities justified a large shipment. Although some economic benefits result from this practice, it has led to a potentially dangerous situation.
- During fiscal year 1987, two waste shipments totaling about 250 cubic feet took over 1 year from the receipt of the request by the Naval Supply Systems Command to disposal.

- A limited test of the effectiveness of the Army's program by two Navy installations showed that disposal costs were at least \$4,500 less than using the Navy's system and took less than 2 weeks from initiation of the request to disposal.

These officials believe the position paper strongly supported the need for the Navy to change its waste disposal practices. In December 1989, the Navy directed the Radiological Affairs Support Office to develop an agreement for participation in the Army's program. Navy officials expect to finalize the agreement and obtain funding during fiscal year 1990.

Although the three services are moving toward a consolidated waste disposal program, officials from each said they do not believe that DOD oversight is needed. Rather, according to these officials, they need assured and sufficient resources to effectively staff the activities that should be conducted. They also noted that having the three services work together is a better approach than having DOD oversee their efforts, and they believe that each base should retain technical control over its activities. They recognized, however, that this approach does not ensure that sufficient resources would be available.

Numerous Management Weaknesses Existed in the Army's Program

Although the Army has made a concerted effort to have a safe and effective low-level waste disposal program, we found that (1) both the Army and Air Force have been denied access to commercial waste disposal sites and (2) a number of management and internal control weaknesses raise questions about the program's effectiveness.

Access Denied to Burial Sites

In the past, both the Army and Air Force have been denied access to commercial waste disposal sites. For example, between September 1980 and July 1982, the states of Washington and Nevada banned the Army on three separate occasions from disposing of waste for between 1 and 2 months because samples taken by state inspectors showed that the waste did not meet federal and state packaging requirements. In other cases, Chem-Nuclear identified waste shipments that violated federal and state requirements. For example, in July 1986 Chem-Nuclear found significant deficiencies in the packaging of waste shipped from Fort Belvoir, Virginia, and in September 1987 from the New York Army National Guard, Albany, New York. AMCCOM stopped all shipments from these installations until corrective actions were taken.

Furthermore, in May 1985 the state of South Carolina found that waste received from the McClellan Air Force Base, Sacramento, California, did not meet federal and state requirements. As a result, the state told the Air Force that it could no longer dispose of any waste at the Barnwell facility. Following a meeting between Chem-Nuclear, Air Force, and South Carolina Department of Health and Environmental Control officials to discuss these concerns, the state reversed its position.

However, during fiscal year 1987, Chem-Nuclear found that three Air Force shipments violated Department of Transportation, NRC, and state regulations. Chem-Nuclear reported its findings to the state, which required the company to repackage the material and return two shipments to the point of origin. In response to the state's action, the Air Force Radioactive Waste Program Office barred the three installations from further shipments, pending verification and approval of the packaging process to be followed.

To minimize the potential for similar violations in the future, the Air Force began to participate in the Army's training course on the packaging, labeling, and shipping requirements with which it must comply. Also, the Air Force revised its waste disposal policies to more specifically define base-level responsibilities and to ensure that military personnel transferring into these activities are aware of the applicable requirements. Furthermore, in 1989, Army officials suggested that the Air Force institute a procedure to certify all waste packages before shipping them to a disposal site.

Internal Control Weaknesses

Generally, the Army's procedures contain requirements to ensure that its installations and contractors carry out their programs in an efficient and effective manner. These internal controls are also intended to ensure that the Army obtains and maintains reliable information to enable it to evaluate the contractors' activities and identify problem areas requiring its attention. We found, however, that numerous internal control weaknesses existed with the waste disposal program.

For example, AMCCOM had no implementing procedures to fulfill its duties and responsibilities and no central office to oversee and monitor the activities conducted. In addition, neither AMCCOM nor Chem-Nuclear followed the procedures set out in the contract. For example, the

- contractor performed work before delivery orders were executed;

- delivery orders did not contain required information, such as time frames to package, transport, and dispose of the waste;
- contractor performed work that was not specified in the delivery order;
- contractor and AMCCOM did not have a system to ensure that the program's participants were appropriately billed for services provided; and
- the procurement office within AMCCOM not only wrote the delivery orders but also negotiated the cost for services and authorized the payments to be made.

In addition, we found instances in which waste from several installations were shipped together, making it difficult to trace the material disposed of and to account for the funds paid. For example, AMCCOM received disposal requests from three installations for solid waste and medical and research vials, but the delivery orders only specified that the vials would be disposed of. According to Chem-Nuclear officials, they disposed of both the vials and solid waste. Although the contractor's actions resulted in cost savings to the government, they were outside the controls established because AMCCOM did not authorize the disposal of the solid waste, and the Army's records did not show that the waste had been disposed of.

Army's Actions to Address Program Weaknesses

As a result of our review, in May 1989 the Army began to change some aspects of its program. For example, AMCCOM established the Radioactive Waste Disposal Division within the safety office to manage the program. Many tasks previously performed by the procurement office and contractor will be assumed by the new division. AMCCOM also required the safety office to form a committee to oversee the activities of the new division. This committee involves numerous offices and should be an effective mechanism to oversee the program.

Following the reorganization, the Radioactive Waste Disposal Division took a number of actions to improve the program and address many of the weaknesses that we identified. For example, the division rather than the contractor will develop a work schedule for each fiscal year. In addition, the division will

- interact with and control funds from other federal agencies;
- evaluate all disposal requests (both the Army's and the other program participants'), approve the actions that will be taken, and control transaction documents; and

- establish a separate budget account to better manage program funds and a process to certify the actual work performed before payments are made.

According to Army Material Command officials, these and other actions taken by AMCCOM have strengthened the program's internal controls. In addition, Chem-Nuclear officials told us that they have initiated some new procedures, such as changing the accounting system to provide for more detailed billing information on the scope of work conducted. Because these changes were made near the end of our work, we could not evaluate their impact on the program. If instituted as proposed, these actions should enhance the effectiveness of the Army's program.

Uncertainties Exist for the Future Disposal of DOD's Low-Level Radioactive Waste

Over the next 4 years, several legislative requirements and regulatory changes could benefit and/or adversely affect the military's low-level radioactive waste disposal efforts. For example, NRC expects to issue criteria under which certain waste that is below regulatory concern may no longer have to be sent to a commercial disposal site. This change could reduce the military's disposal volumes and, ultimately, its cost. On the other hand, by January 1993, states either alone or in conjunction with other states (compacts) are required to have disposal sites for the waste generated within their borders or compacts. This requirement—set out in the Low-Level Radioactive Waste Policy Act, as amended—could adversely affect the military's waste disposal activities and increase costs. Under the act, the compacts or states could establish sites for federal agencies' use thereby alleviating these impacts; however, DOD has not pursued this option.

In light of these uncertainties, the military could realize significant benefits from a centralized waste disposal program. As noted previously, complete information does not exist on the amounts or types of waste generated, stored, or disposed of by the three services. In addition, differences exist with the waste management practices of the three services, as well as within each service. For example, some installations send all waste to a commercial disposal site; others allow some waste to decay and dispose of it as normal trash. A centralized program could take full advantage of these and other volume-reduction techniques, consolidate management expertise and training, and reduce costs.

Military Does Not Use Uniform Waste Management Practices

Significant differences exist among the waste management practices of the three services, as well as within each service. For example, some installations have received NRC's approval to store waste until it decays to a level where it can be disposed of in the sanitary sewage system (liquids) or as normal trash (solids); others send all waste for burial. Some compact or shred waste to reduce the volume to be disposed of; others do not. If consistently applied, these techniques could significantly reduce the military's waste volumes and, ultimately, its disposal costs.

In a 1988 report, Low-Level Radioactive Waste Volume Reduction and Stabilization Technologies Resource Manual, DOE assessed a number of volume-reduction techniques, such as compaction, supercompaction, and incineration. The study estimated that compaction reduces waste volume from 4 to 8 times depending on the material involved, and incineration reduces such volume 50 to 100 times. Although the military uses

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equipment different from what DOE used to reach its conclusions, some of the volume reduction already realized supports the study's findings. For example:

- The Uniformed Services University of Health Sciences shreds its waste. The hospital uses radioactive material—primarily iodine-125—for various diagnostic tests and research purposes. In mid-1987, the hospital began to shred glass vials and plastic containers and over the last 3 fiscal years reduced the amount of waste sent for burial by a factor of about 7—from 885 to about 113 cubic feet of material.
- Using a compactor, Walter Reed Army Medical Center, Washington, D.C., reduced the waste sent for disposal over the last several years by 300 percent.
- To facilitate the disposal of protective clothing, paper, and other items used to clean up a building contaminated by an accidental release of tritium, Letterkenny Army Depot, Pennsylvania, purchased a compactor. As a result, an Army official estimated that some waste volumes were four times less.
- The Army's Ballistic Research Laboratory, Aberdeen, Maryland, has used a compactor since 1982 and a shredder since 1986 for filters, protective clothing, and other solid material. A laboratory official estimates that the volume of waste has been reduced by a factor of 25. In June 1989, the Combat Systems Test Activity—also located at Aberdeen—began to use this equipment to reduce its waste volume. Because this was a recent activity, officials could not estimate any possible benefits.

Table 3.1 shows several examples of the different waste-handling techniques used by some of the military installations included in our review.

Table 3.1: Examples of Waste-Handling Techniques Used by Various Military Installations

Waste management practice	Installations ^a						
	Air Force		Army		Navy		DOD
	1	2	3	4	5	6	7
Vial crusher/ slicer	No	N/A	No	No	No	No	Yes
Compactor/ shredder	No	No	Yes	No	No	No	Yes
Dispose of liquid waste in sanitary sewer	Yes	N/A	Yes	No	Yes	Yes	Yes
Dispose of solid waste as normal trash	Yes	No	Yes	No	Yes	No	Yes

^a1 = Brooks Air Force Base.

2 = Kelly Air Force Base.

3 = Walter Reed Army Medical Center.

4 = Chemical Research, Development, and Engineering Center.

5 = National Naval Medical Center.

6 = Norfolk Naval Drug Laboratory.

7 = Uniformed Services University of Health Services.

N/A = Not applicable.

If consistently applied, the techniques shown in table 3.1 could significantly reduce the military's waste disposal costs. However, some techniques are predicated on the availability of, and funding for, specialized equipment and/or sufficient and properly designed storage facilities. For example, the Norfolk Naval Drug Laboratory does not have adequate on-site facilities to allow solid waste to decay in storage. As a result, the laboratory has contracted with a private company to remove the waste and allow it to decay.

Legislative Requirements Could Adversely Affect the Military's Waste Disposal Efforts

At least five issues related to the implementation of the Low-Level Radioactive Waste Policy Act, as amended, could adversely affect the military's waste disposal activities.¹ First, waste may eventually have to be disposed of in up to 16 different locations rather than the existing 3 sites. Second, since the three sites have different disposal requirements, it is likely that the nine compacts and seven states will establish some different requirements. Third, costs will increase from the surcharges and penalties that will be paid until January 1993. Fourth, the number of cost-ineffective small-volume disposals could increase. Finally, the act does not address the disposal of some waste generated overseas. Although an option is available to alleviate these impacts (i.e., sites for the exclusive use of federal agencies), DOD has not pursued this option.

In 1979, a series of packaging incidents and a reluctance to be the "dumping grounds" for the entire nation prompted the states of Washington and Nevada to temporarily close their low-level disposal sites and South Carolina to limit the volume of waste to be disposed of in its site. Because the potential loss of disposal capacity had national implications, the Congress began to consider legislation to address these concerns. One proposal would have made low-level waste disposal a federal responsibility. The governors of the three states where the existing sites are located opposed federal involvement and testified that all states needed to examine waste disposal alternatives.

Under the Low-Level Radioactive Waste Policy Act, as amended, states or compacts are required to have new disposal sites by January 1, 1993. In October 1989, DOE provided its third annual report to the Congress on the compact regions' and states' progress to achieve the act's goals. DOE

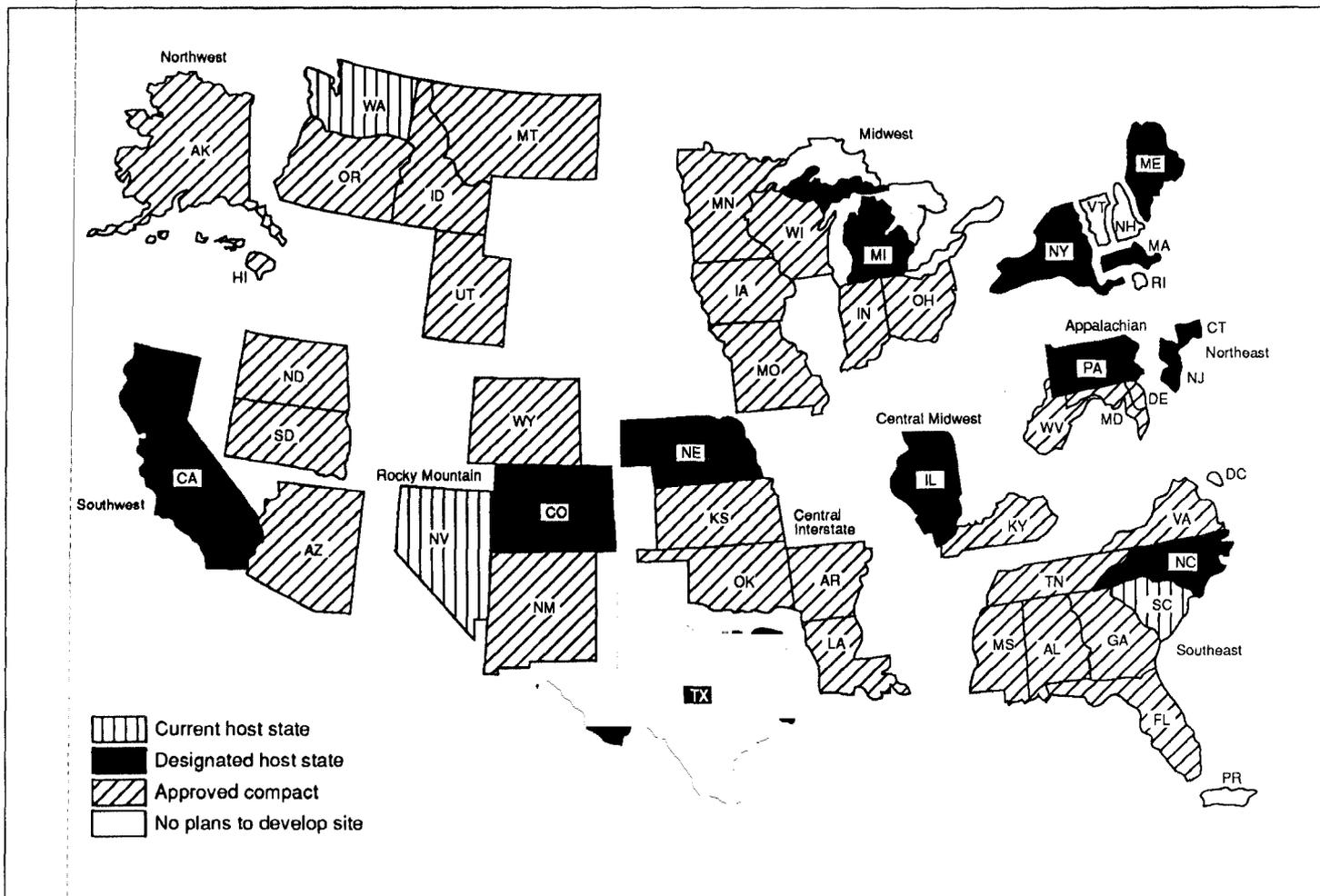
¹Other NRC licensees disposed of about 94 percent of all low-level waste in 1988. Although these licensees could be similarly affected by the act, we limited our review to the Army, Air Force, and Navy.

reported that only four compacts and one state expect to begin site operations by January 1993, and one state plans to accept waste but place it in interim storage until its site is available.

Of the six, the report noted that two compacts and one state expected to submit applications by January 1, 1990; only one compact (Southwestern) did so. DOE also pointed out that several regulatory uncertainties could further delay new site operations. DOE noted that EPA had not finalized its groundwater protection standards, NRC had not finalized its exemption policy for below regulatory concern waste, and disagreement existed between NRC and EPA concerning the regulatory requirements for waste that has both radioactive and hazardous constituents (mixed waste).

NRC expects that about 15 months will be needed to review the applications and issue licenses for the sites. The compacts and states cannot begin site construction until they receive a license. However, DOE's annual report noted that "it appears likely" that a number of compacts and states will not meet the act's milestones, and some states have urged that the act be amended to allow for the disposal of waste at the three existing sites beyond January 1993 or realign the existing compacts and states into larger regions. Also, in a November 1989 report, OTA noted that most compacts and states have selected disposal designs that have not been built in this country; therefore, the licensing process could take longer than expected. Figure 3.1 shows the compact regions as of December 1989.

Figure 3.1: Status of Compact Regions, December 1989



Source: DOE.

Impact on the Military's Waste Disposal Efforts

At least five issues related to the act could significantly affect the three services' waste disposal activities. Each is discussed below.

16 vs. 3 Disposal Sites

The exact number of sites that will be available is not currently known, but at least 12 new sites are expected to be developed and 4 states are evaluating alternatives to comply with the act. Although DOD could continue to use the consolidation facility, the number of sites where the waste will then have to be sent for disposal could increase costs and pose an administrative burden on the military. To illustrate, in February

1989 the Air Force and Army sent 43 waste shipments (about 640 cubic feet) from 21 states for disposal in South Carolina. If we assume the organization of compact regions and states shown in figure 3.1, these shipments—after consolidation—would have to be sent to six compact regions and three states for disposal. The contractor will have to segregate the waste and package it in accordance with the various site requirements.

In addition, OTA's November 1989 report noted that the volume of waste disposed of has decreased about 55 percent over the last 9 years through various waste minimization efforts but disposal costs have more than tripled. The report also noted that, because many costs associated with developing new sites are fixed, disposal costs will vary significantly from one site to another, depending in part on the amount disposed of and land values. According to the report, disposal costs could range from \$50 to \$590 per cubic foot.

Different Disposal Requirements

The military may have to comply with the disposal requirements of the 16 compacts or states. For environmental and public health and safety reasons, the three existing sites have some different disposal requirements. For example, Washington State will accept liquids that are absorbed with other material, similar to kitty litter, whereas Nevada and South Carolina require that all liquids be mixed with concrete and solidified. Also, Washington will allow the disposal of some solidified waste that contains organic oils; South Carolina and Nevada do not allow the disposal of such waste. To illustrate the possible impact of differing requirements on the military's activities, in fiscal year 1987 the Navy wanted to dispose of two 55-gallon drums containing radium dials and five 55-gallon drums containing radium gauges. To meet Washington State disposal requirements, the material in the 7 drums had to be sorted and repackaged into 34 drums at a cost of about \$101,500, excluding disposal costs.

In addition, some waste contains both radioactive and hazardous substances, and NRC and EPA share regulatory responsibility for such mixed waste. According to OTA's report, between 3 and 10 percent of low-level waste may be mixed waste. Although nine states, including South Carolina and Washington, have been authorized by EPA to dispose of mixed waste, no site exists to do so. As a result, according to OTA's report, some generators are either treating their waste to make it exclusively radioactive or hazardous and acceptable for disposal or storing it on-site. The report also raised the possibility that some mixed waste may have been

disposed of in unauthorized sites. As of October 1989, only two compacts (Central Midwest and Central Interstate) and one state (Texas) expected to dispose of mixed waste.

OTA raised a number of other issues concerning the disposal of mixed waste, such as the overlapping regulatory jurisdiction between EPA and NRC and the conflict and inconsistencies with both agencies' disposal requirements. For example, EPA requires generators to take samples to characterize the substances in the waste; NRC does not have such a requirement, fearing that worker exposures could increase. In addition, EPA requires liners and leachate systems at hazardous waste sites; NRC does not have this requirement for low-level waste sites. The agencies are working to resolve these and other differences; NRC staff could not estimate when these actions would be complete.

Financial Implications

The act established surcharges and financial penalties to encourage the use of volume-reduction techniques and to pay for new site development costs. Between July 1986 and December 1992, the surcharges ranged from \$10 to \$40 per cubic foot of waste disposed of. To illustrate the impact of the surcharges on the military, in May 1989 the Army initiated efforts to dispose of 4,000 tons (about 16,360 cubic feet) of contaminated steel before January 1, 1990, when the surcharge rate doubled. For this volume of waste, the surcharge would have increased from \$327,200 to \$654,400—over and above disposal costs of more than \$600,000, excluding about \$800,000 in labor, material, and transportation costs. The Army was unable to obtain funding before January 1990 and continues to store the contaminated steel at Aberdeen, Maryland.

During calendar year 1992, the penalties could triple the surcharges to a maximum of \$120 per cubic foot of waste disposed of if the compacts and states have not submitted site applications. If the Army does not dispose of the steel before that time, the surcharge would increase from \$654,400 to a maximum of almost \$2 million, excluding disposal and other costs discussed above. However, the Army could continue to store the steel until the Appalachian compact, of which Maryland is a member, has its Pennsylvania site available.

Furthermore, as noted in chapter 2, the Navy generally stores its low-level waste. In response to its survey, Navy installations reported having at least 9,000 cubic feet of waste.² On the basis of historical data, we

²Although the survey results were incomplete, the information reported is useful for illustrative purposes.

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estimate that about 85 percent of the waste disposed of under the Army's program was generated outside the existing three compact regions. If we assume that this same percentage would apply to the Navy's waste, about 7,650 cubic feet could be subject to surcharges ranging from \$306,000 to \$918,000 (between Jan. 1990 and 1993), excluding disposal, labor, material, transportation, and packaging costs. The costs could increase even more, depending on the disposal requirements of the various compact regions or states. On the basis of historical data, the special treatment or packaging requirements of the three existing sites have doubled or tripled the volume of some types of waste disposed of.

Because complete information is not available on projected waste disposal volumes for the three services, we have used historical data from the Army's program to illustrate the possible affect of the surcharges on the military's waste disposal costs. Table 3.2 shows the estimates that we derived.

Table 3.2: Example of Possible Impact of Surcharges on the Military's Waste Disposal Costs

Fiscal year	Volume disposed (in cubic feet)	Disposal costs^a	Surcharge^b	Total
1985	26,331.3	\$656,703	\$ •	\$656,703
1986	22,687.3	626,623	96,421	723,044
1987	44,896.7	1,495,958	381,622	1,877,580
1988	20,854.7	736,588	354,530	1,091,118
1989	63,043.3	2,324,406	1,071,736	3,396,142
1990	35,563.0 ^c	1,376,644 ^d	1,209,142	2,585,786
1991	35,563.0	1,445,636	1,209,142	2,654,778
1992	35,563.0	1,517,829	3,627,426 ^e	5,145,255

^aBasic disposal costs, excluding packaging, transportation, labor, materials, taxes and other charges.

^bCalculated on the basis of historical data showing that about 85 percent of the waste disposed of was generated outside the three existing compact regions.

^cEstimated volume for 1990 through 1992 based on the average of waste disposed of from 1985 through 1989.

^dAccording to Chem-Nuclear officials, the base rate is expected to increase 5 percent annually.

^eAssumes maximum \$120 per cubic feet of waste disposed of.

Small-Volume Disposals

The number of cost-inefficient small-volume disposals could increase. Currently, the Army and its program participants send their waste to South Carolina, where the contractor consolidates small shipments and repackages the material for disposal. As pointed out in chapter 2, these activities have been cost beneficial to the program. Once the compacts

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and states have their disposal sites, some of this benefit may deteriorate. For example, 27 of the 43 waste shipments by the Air Force and Army in February 1989 (discussed above) were 1 cubic foot or less and may require special treatment and packaging to meet burial site requirements.

Disposal of Overseas Waste

The act does not address the disposal of waste that is generated by the military outside the United States. Currently, overseas bases ship some waste, such as instruments and gauges, to the United States for disposal. In fiscal year 1989, the Air Force sent 22 shipments from Japan, the United Kingdom, Germany, and other locations for disposal, and the Army disposed of about 150 cubic feet of waste from overseas. For fiscal year 1990, the Army estimates that about 750 cubic feet of waste generated overseas will be disposed of. Although the existing three sites can refuse such waste, South Carolina has allowed its disposal at Barnwell. However, beginning in January 1993, no certainty exists that the compacts and states would accept waste generated overseas.

**Option Available to
Alleviate These Impacts**

Taken together, the five issues could impose substantial administrative and cost burdens on the military after January 1993. However, one option exists that could alleviate these burdens. The act gives the compacts or states the option to establish sites for the exclusive use of federal agencies, thereby exempting them from the requirement to dispose of waste in the region or state in which it is generated. By December 31, 1992, both the South Carolina and Nevada sites will close, and new disposal sites are planned for their compacts. Yet, all three existing sites have unfilled capacity that could be committed for the federal government's use. As of January 1990, DOD had not contacted other federal agencies to work with the compact regions and states to determine the feasibility of dedicating a portion of one or more sites for federal agencies' use.

Nevertheless, officials from the three services believe that a federal repository would result in increased efficiencies and cost savings to DOD. However, they do not believe that DOD has the authority to resolve this issue for the entire federal government. They suggested that the GSA, NRC, or the Committee on Interagency Radiation Research and Policy Coordination should lead the effort for such a site.

Future Regulatory Uncertainties

Two regulatory issues can also affect the military's waste disposal activities. The two issues are the (1) timely submission of site applications by the compacts and states and (2) criteria for the disposal of below regulatory concern waste.

Under the act, the 16 compacts and states were required to submit their site applications by January 1990—only 1 compact met this milestone—or January 1992. NRC expects that 15 months will be needed to review an application and issue a license for a site, assuming that (1) EPA issues final regulations for radiation release and groundwater contamination limits that the new sites must meet and (2) NRC and EPA resolve the regulatory uncertainties concerning mixed waste. The compacts and states cannot begin site construction until they receive a license.

If we assume the worst scenario—the remaining compacts and states do not submit applications until January 1992—it seems unlikely that NRC or the agreement states could review the applications and issue licenses and the sites could be constructed by January 1993. In the event sites are not available, the act requires NRC to consider granting each waste generator temporary access to existing sites to dispose of their waste if an imminent public health and safety risk exists. According to NRC staff, it would be rare that this condition would exist such that NRC would grant temporary access. Therefore, generators may have to store their waste until the regional or state sites are available. This could result in not only the military's stockpiling waste but also stockpiling by other NRC licensees, including federal agencies (such as the Department of Veterans Affairs and the National Institutes of Health), 112 commercial nuclear power plants, and more than 23,000 other organizations. Furthermore, if NRC grants access to existing sites, the licensees will have to pay the \$120 per cubic foot surcharge.

However, another of the act's requirements could be cost beneficial to the military because it would reduce the amount of waste that would have to be disposed of in the compact regions or states. Section 10 required NRC to develop criteria and procedures by July 1986 concerning the information that licensees would have to provide in seeking an exemption for waste that is below specified limits. In August 1986, NRC added a policy statement to its regulations outlining this information. In the policy statement, NRC set out 14 criteria that must be met and said that the licensee must demonstrate that no undue public health and safety risk would result from the alternative selected. However, the policy statement did not establish limits for below regulatory concern waste.

As a result, in December 1988 NRC published an advance notice of a proposed policy in the Federal Register and asked for public comments on it. In January 1989, NRC held a public meeting and proposed two criteria—an individual dose of 10 millirem and a collective population dose of 500 person-rem.³ Subsequently, in October 1989, the Commission directed NRC staff to revise the collective dose to 1,000 person-rem. In doing so, the Commission noted that this limit would be sufficiently low to be of negligible significance to public health and safety yet practical and cost beneficial to achieve. NRC had expected to have a final policy by November 1989; NRC now expects to do so during the spring of 1990. According to NRC staff, disagreements between NRC and EPA contributed to this delay. EPA believes that the annual individual dose should be 4 millirem rather than the 10 millirem proposed by NRC.

NRC received over 200 comments as a result of the notice and meeting. The comments were almost evenly divided with regard to the need for an exemption policy. Those who favored the exemption noted that the individual dose of 10 millirem is low compared with the annual exposure that the public receives from background radiation (which varies by location, but, in Denver, Colorado, is about 60 millirem annually), their own bodies (30 millirem annually), or flying (5 millirem per 10 hours of flight time). Others questioned the need for a collective dose criterion, stating that the individual dose would be adequate. Still others believed that all levels of radiation pose some public health and safety risk, and all should be regulated.

As proposed, a licensee or group of licensees would have to submit a petition to NRC to use an alternative method to dispose of below regulatory concern waste. The petition will have to include an analysis of the expected benefits to be derived, risk to the public, projected dose limits, and method used to ensure that exposures are kept as low as reasonably achievable. Also, those granted an exemption will be required to maintain records of waste generated and disposed of and the volume and level of radioactivity. NRC expects to grant exemptions through a rulemaking procedure but could also do so through a license amendment. NRC staff could not estimate how long the process could take.

³Rem (roentgen equivalent man) is a measurement used to quantify the effects of radiation on man. A millirem is one-thousandth of a rem.

As of January 1990, NRC had received only one petition from the Rockefeller University to incinerate some solid waste. NRC rejected the petition, noting that the licensee had not provided sufficient information on the nationwide radiological effects of the requested exemption.

Impact on the Military's Program

NRC's below regulatory concern rule could significantly reduce the amount of waste disposed of by the three services. We cannot, however, estimate this impact. Since no need previously existed to maintain this information, neither the three services nor their disposal contractors has historic data that would allow us to develop an estimate.

However, since 1981, NRC has allowed some licensees involved in research and medical diagnostic and treatment activities, such as the National Institutes of Health and Walter Reed Army Medical Center, to dispose of waste as normal trash or into the sanitary sewage system. According to NRC staff, these same types of licensees as well as nuclear utilities would most likely petition NRC for an exemption under the below regulatory concern rule. Both DOE and OTA have reported that the rule could reduce the volume of waste requiring disposal. In addition, a March 1989 study by the Electric Power Research Institute estimated that nuclear utilities could save as much as \$127 million annually (if all dry activated waste is considered below regulatory concern) in part because sanitary landfills generally charge less than \$0.20 per cubic foot of waste disposed of.

Although a number of uncertainties exist concerning the criteria that will be in NRC's final rule, the activities conducted by some military organizations provide a perspective on the possible impact of it. For example:

- During calendar year 1988, Walter Reed disposed of over 1,000 gallons of waste into the sanitary sewage system and 127 bags and 94 boxes (volume unknown) of solid waste as normal trash. The hospital also incinerates animal carcasses. If the waste had been sent to a commercial disposal site, the liquids would have had to be mixed with concrete, and the animal carcasses would have required special packaging prior to burial.
- The National Naval Medical Center stores some liquid and solid waste contaminated with iodine-125 and other radioactive material until it decays to background levels. After surveying the material, the center disposes of it into the sanitary sewage system or as normal trash.

Chapter 3
Uncertainties Exist for the Future Disposal
of DOD's Low-Level Radioactive Waste

- According to Navy officials, they have used these techniques for many years but could not estimate the cost savings that have been realized.
- Uniform Services University of Health Sciences stores liquid waste in large tanks (that hold several hundreds of gallons) and then disposes of the material in the sanitary sewage system.

In addition, we found that the Army and its program participants have disposed of waste that may ultimately meet the below regulatory concern criteria. For example, records for the third quarter of fiscal year 1989 showed numerous disposals of material with low radiation levels and short half-lives—51 microcuries of iodine-125 and 151 microcuries of iodine-131 with a half-life of 60 and 8 days, respectively.⁴ Also, in July and August 1989, the Letterkenny Army Depot shipped 32 drums (about 200 cubic feet) of absorbed liquid waste to Richland that contained about 527 microcuries of tritium and shipped 17 drums (about 128 cubic feet) of solid waste to South Carolina that contained about 17 microcuries of tritium. According to NRC staff, this material would merit consideration as below regulatory concern waste because the expected radioactive releases would be within the 10 millirem and 1,000 person-rem criteria under the Commission's consideration.

⁴A curie is a measure of the rate of radioactive decay. A microcurie is equivalent to one-millionth of a curie.

Conclusions and Recommendations

The military generates low-level radioactive waste from thousands of activities in all 50 states and at overseas bases. Because of the large number of generators, the military must ensure that the waste is properly handled and disposed of not only to protect its own personnel but also public health and safety. Yet, after January 1993, the military's waste disposal activities may be stymied by crosscutting federal and state requirements. Furthermore, two of the three sites that the military now uses will close by December 1992, and a likelihood exists that many of the planned new sites will not be available. Therefore, DOD needs to take full advantage of the intervening time to (1) establish a comprehensive low-level radioactive waste disposal program with high departmental-level oversight and (2) work with other federal agencies to determine the feasibility of the compacts or states dedicating a portion of one or more sites for the government's use.

Benefits Could Be Realized From a Comprehensive Program

The military should not allow another incident like Wright-Patterson to occur. The accident, which cost almost \$1 million to clean up, could have been avoided if the Air Force had disposed of, rather than stored, its waste. Yet, the same situation exists today—the Navy stockpiles its waste and has been doing so for many years. The military cannot continue its passive attitude on low-level waste disposal. A comprehensive military waste disposal program could ensure that military installations temporarily store waste until it is shipped for disposal. It could also ensure that each service appropriately identifies the types and amounts of waste generated. Presently, the three services do not have this information, and they continue to identify material that may need to be disposed of. To make matters worse, 46 Air Force bases buried waste in the 1950s, but they do not have information on the number of sites or the types and amounts of material in them. In our opinion, the military needs complete information to prudently address its waste disposal needs, establish adequate budgets to meet these needs, and set priorities for waste that should be disposed of first.

In addition, without a comprehensive program, the military leaves itself open to errors and problems that could lead to adverse publicity and criticism. Throughout the 1980s, the Army and the Air Force were banned from all three disposal sites at one time or another for failing to comply with federal and state requirements. This may be an increasing problem since after 1993, the 3 services may have to comply with the requirements of up to 16 sites. Because the existing three sites have different requirements, a strong likelihood exists that the compact regions and states will each set different requirements to protect the public and

environment. In addition, a number of controversies and uncertainties exist concerning the disposal of mixed waste. Under a comprehensive program, the military could consolidate existing management expertise and training to stay current with the requirements rather than having thousands of individuals around the country and overseas devoting time and effort to do so under separate programs.

Finally, a comprehensive program could ensure that the military aggressively pursues volume-reduction techniques and utilizes a centralized facility to compact and consolidate waste, thereby reducing costs. In addition, by consolidating numerous small shipments, the military can reduce the potential that shipments sent by thousands of generators could be lost when sent to the regional or state sites, or worse, improperly discarded rather than properly disposed of as radioactive waste. Also, the facility operator would know the disposal requirements of the 16 sites, alleviating the need for the military to do so. Furthermore, a comprehensive program could ensure that the three services uniformly consider alternatives for waste that meet NRC's below regulatory concern criteria.

Although we found a number of management weaknesses with the Army's program (incomplete information on the number and cost of waste shipments), we believe that the benefits of a comprehensive program far outweigh the individual approaches used by the three services and the piecemeal approach used by the Navy. In addition, DOD can establish appropriate internal controls and management oversight for the program and a mechanism to ensure that the controls established are appropriately implemented.

Federal Sites Could Benefit the Military

The military also needs to consider the most expeditious and cost-effective manner to dispose of its waste. As of January 1990, basic waste disposal costs and surcharge fees at commercial sites were almost equal. In other words, the military now pays almost twice as much as it actually costs to dispose of its waste. In addition, by December 1992, two of the existing three sites will close, and the potential exists that only a limited number of new disposal sites will be available. For example, two compacts and one state had expected to submit applications by January 1990; only one did so. The longer the compacts and states wait to submit license applications, the less likely sites will be in operation by 1993. If additional sites are not available, the military will have to store its waste, thereby increasing the potential for another Wright-Patterson incident, or seek an NRC exemption to dispose of waste outside the region

or state in which it is generated. Whether NRC will grant the exemption is uncertain.

If sites were available for the exclusive use of federal agencies, the need for the military to store waste would be eliminated and significant savings of taxpayer dollars could occur. Several options exist that DOD, working with other federal agencies, can pursue. First, two of the existing three sites will close by December 1992, but all three have unfilled capacity. Second, a portion of new sites could be dedicated for federal agencies' use. We recognize that this approach could be viewed as providing preferential treatment to federal agencies that dispose of only a small percentage of low-level waste. On the other hand, federal sites could reduce the potential for packaging and shipping errors to occur and could ensure that low-level waste generated overseas can be safely disposed of. Although other NRC licensees may experience problems in complying with the act, we believe that the benefits to be derived—increased efficiencies and cost savings—justify giving serious consideration to federal sites.

Because of the widespread geographical location of bases—50 states and overseas—DOD, in our opinion, should spearhead the effort for federal sites. In doing so, DOD could consider working with the compact regions or states to (1) use the unfilled capacity at the existing three sites or (2) dedicate a portion of new sites for federal agencies' use. If DOD could obtain a commitment now from one of the states with an existing site, our previously identified concerns could be resolved. In addition, if the sites were located in South Carolina or Washington State, federal agencies may be able to dispose of mixed waste because EPA has authorized these two states to dispose of such waste. Although officials from the three services recognize that benefits would be realized if a federal site was available, they do not believe that DOD should lead this effort.

We recognize that the compact regions or states could raise a number of concerns related to such sites. First, under the act, the sites would be outside the regions' or states' control. To resolve this, the compacts or states could require that the facilities be licensed. Second, the compact regions or states may need to overcome a number of political issues, such as public opposition to accepting federal waste from outside their boundaries. Yet, DOD does not have information on the opposition, if any, that may be encountered concerning disposal sites for federal agencies' use.

Recommendations to the Secretary of Defense

To ensure that all DOD installations appropriately manage and dispose of low-level radioactive waste and reduce the potential for another incident similar to the one at Wright-Patterson, we recommend that the Secretary of Defense

- establish a comprehensive low-level radioactive waste disposal program at a high departmental level;
- establish uniform policies and procedures for the program and institute a mechanism to ensure compliance throughout DOD with the requirements;
- develop an inventory of the amounts and types of low-level radioactive waste that are stored or buried at all installations;
- require all DOD installations to institute consistent waste minimization and treatment techniques; and
- develop a strategy for dealing with low-level waste after 1992, including working with other federal agencies, compacts, and states to determine the feasibility of dedicating a portion of one or more sites for the government's use. In these discussions, DOD should ensure that low-level radioactive waste generated overseas would be accepted for disposal.

Some Provisions of the Low-Level Radioactive Waste Policy Act, as Amended

The Low-Level Radioactive Waste Policy Act, as amended, established a federal policy that the safest and most efficient way to dispose of low-level waste would be on a regional basis. To ensure consistency among the compact regions, the act incorporated NRC's low-level waste definition—waste that is not classified as uranium mill tailings, high-level waste, or spent fuel.¹ The act also

- established milestones, surcharges, and penalties to encourage—and fund—the development of new disposal sites by January 1, 1993. Between July 1986 and December 1987, the surcharges were \$10 per cubic foot of waste disposed of; in 1988 and 1989, \$20; and between 1990 and 1992, \$40. Also, during calendar year 1992, the surcharge could be as much as \$120 per cubic foot of waste disposed of if the compacts and states have not submitted site applications.
- established the three existing sites in Barnwell, South Carolina; Beatty, Nevada; and Richland, Washington, as compact regions until December 31, 1992 and limited the amount of waste that could be disposed of in them until that time.
- required the three states with existing sites to collect the surcharges and later to provide 25 percent to DOE for distribution to the compact regions or states for new site development; the three states would retain the remaining 75 percent. If new sites are not available by January 1993, the funds (25 percent) will be repaid monthly to generators rather than to the compacts or states.
- called for 7 compact regions and identified 39 states that would be members of them but also allowed the states to select the compact in which they wanted to participate, to change compacts, or to dispose of waste on their own.
- required the compacts to identify a host state and develop a site plan by January 1, 1988 (New Hampshire, North Dakota, Puerto Rico, Rhode Island, Vermont, and Washington, D.C., did not meet this milestone).
- required the compact regions and states to file certifications by January 1990 and license applications by that date or within a 2-year grace period (Jan. 1992). As of January 1990, only one compact—Southwestern—had submitted an application.
- required NRC and the agreement states to review applications and issue licenses to the sites within 15 months of receiving the application.
- allowed NRC, after January 1993, to grant each waste generator (from outside the compact regions) temporary access to disposal sites if an imminent public health and safety hazard exists.

¹NRC has established three classes of low-level waste that are based in part on the half-lives of the material and the types of radiation emitted.

Appendix I
Some Provisions of the Low-Level Radioactive
Waste Policy Act, as Amended

- required NRC to establish criteria for below regulatory concern waste that would be exempt from the act.
- identified certain waste that is the responsibility of the federal government, including waste generated by (1) DOE, (2) the Navy from decommissioning its nuclear vessels, and (3) the private sector that exceeds NRC's Class C limits.²

²Greater than Class C waste is discarded material contaminated with long-lived radioactive elements having concentrations greater than those specified in 10 CFR Part 61.

List of Organizations Visited and Officials GAO Contacted

Name of Organization	Location	Title of Officials Contacted
Air Force		
Radioisotope Committee	San Antonio, Tex.	Executive Secretary
Brooks Air Force Base	San Antonio, Tex.	Radiation Safety Officer and three other officials
Kelly Air Force Base	San Antonio, Tex.	Radioactive Waste Manager and one other official
Army		
Armament, Munitions and Chemical Command	Rock Island, Ill.	Chief of Staff and 13 other officials
Army Material Command	Alexandria, Va.	Chief, Safety Office, and one other official
Surgeon General's Office	Falls Church, Va.	Radiological Hygiene Consultant
Walter Reed Army Medical Center	Washington, D.C.	Chief of Staff and seven other officials
Brooks Army Medical Center	San Antonio, Tex.	Commander and three other officials
Health Services Command	Fort Sam Houston, Tex.	Commander and five other officials
Chemical Research, Development, and Engineering Center	Edgewood, Md.	Commander and three other officials
Environmental Hygiene Agency	Edgewood, Md.	Chief of Staff and six other officials
Ballistic Research Laboratory	Aberdeen, Md.	Safety Manager and one other official
Test and Evaluation Command	Aberdeen, Md.	Deputy Commander and three other officials
Combat Systems Test Activity	Aberdeen, Md.	Safety Manager and three other officials
Navy		
Radiation Safety Committee	Crystal City, Va.	Executive Secretary and six other officials
Naval Sea Systems Command	Crystal City, Va.	Deputy Director, Radiological Controls Program Office
Navy Environmental Health Center	Norfolk, Va.	Head, Radiation Division and one other official
Radiological Affairs Support Office	Yorktown, Va.	Commander and two other officials
National Naval Medical Center	Bethesda, Md.	Deputy Commander and three other officials
Naval Medical Research Institute	Bethesda, Md.	Deputy Commander and two other officials
Mare Island Naval Shipyard	Vallejo, Calif.	Director of Radiation Control and three other officials
Oakland Naval Supply Center	Oakland, Calif.	Commanding Officer and seven other officials

(continued)

Appendix II
List of Organizations Visited and Officials
GAO Contacted

Name of Organization	Location	Title of Officials Contacted
Norfolk Naval Drug Laboratory	Norfolk, Va.	Commanding Officer
Department of Defense		
Uniformed Services University of Health Sciences	Bethesda, Md.	Acting Radiation Safety Officer and one other official

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