

GAO

Report to the Chairman, Committee on
Energy and Natural Resources, U.S.
Senate

June 2004

LOW-LEVEL RADIOACTIVE WASTE

Disposal Availability
Adequate in the Short
Term, but Oversight
Needed to Identify
Any Future Shortfalls



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Highlights

Highlights of [GAO-04-604](#), a report to the Chairman, Committee on Energy and Natural Resources, U.S. Senate

Why GAO Did This Study

Low-level radioactive waste (LLRW) management concerns persist despite enactment of the LLRW Policy Act of 1980, as amended, which made states responsible for providing for disposal of most LLRW. It also enumerated guidance and oversight responsibilities for DOE and NRC. When GAO last reported on LLRW disposal, in 1999, the only existing facility accepting the more highly radioactive types of LLRW (known as class B and C waste) from most states was expected to be full within 10 years. In this context, GAO examined (1) changes in LLRW conditions since 1999, (2) recent annual LLRW disposal volumes and potential future volumes, (3) any current or anticipated shortfalls in disposal availability, and (4) potential effects of any such shortfall.

What GAO Recommends

The Congress may wish to consider directing NRC to report if LLRW disposal and storage conditions change enough to warrant congressional intervention. GAO also recommends that DOE halt dissemination of its on-line LLRW database as long as it has internal control weaknesses and other shortcomings. NRC disagreed that it was the most appropriate entity to prepare this report. DOE disagreed that it should halt dissemination of LLRW information despite known problems with its database. GAO remains firm in its suggestion to the Congress and in its agency recommendation.

www.gao.gov/cgi-bin/getrpt?GAO-04-604.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Robin Nazzaro, (202) 512-3851, Nazzaror@gao.gov.

LOW-LEVEL RADIOACTIVE WASTE

Disposal Availability Adequate in the Short Term, but Oversight Needed to Identify Any Future Shortfalls

What GAO Found

GAO identified several changes in LLRW disposal availability and federal agency oversight since its 1999 report that have had or might have significant impacts on LLRW management by the states. For example, while one disposal facility plans to close to most states and new options are evolving that may counteract this shortfall, federal guidance and oversight of LLRW management has virtually ended.

Annual LLRW disposal volumes increased 200 percent between 1999 and 2003, primarily due to LLRW shipped to commercial disposal by DOE. GAO identified this increase using data from the three commercial disposal facility operators because GAO determined that data from the national LLRW database, maintained by DOE to assist the LLRW community in managing LLRW, were unreliable. The uncertain timing and volume of future waste shipments from DOE and nuclear utilities make it difficult to forecast disposal needs for all classes of LLRW.

At current LLRW disposal volumes, disposal availability appears adequate until at least mid-2008 for class B and C wastes. There are no expected shortfalls in disposal availability for class A waste. If disposal conditions do not change, however, most states will not have a place to dispose of their class B and C wastes after 2008. Nevertheless, any disposal shortfall that might arise is unlikely to pose an immediate problem because generators can minimize, process, and safely store waste. While these approaches are costly, GAO did not detect other immediate widespread effects. NRC places no limit on stored waste and presently does not centrally track it. However, as LLRW storage volume and duration increase in the absence of reliable and cost-effective disposal options, so might the safety and security risks.

Lowering Radioactive Waste into a Concrete Barrier at a Commercial Disposal Facility



Source: US Ecology, Inc.

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Abbreviations

AEC	Atomic Energy Commission
DOE	Department of Energy
EPA	Environmental Protection Agency
LLRW	Low-level radioactive waste
MIMS	Manifest Information Management System
NRC	Nuclear Regulatory Commission

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Accountability * Integrity * Reliability

United States General Accounting Office
Washington, DC 20548

June 9, 2004

The Honorable Pete V. Domenici
Chairman
Committee on Energy and Natural Resources
United States Senate

Dear Mr. Chairman:

The management of low-level radioactive waste (LLRW) by the states has continued to be a concern despite two-decade-old federal legislation addressing the need for disposal. Under the LLRW Policy Act of 1980, as amended (the Act), each state is responsible for providing for disposal of LLRW generated within the state, either by itself or in cooperation with other states, with the exception of waste produced by the Department of Energy (DOE) and the nuclear propulsion component of the Department of the Navy. While not responsible for this federal waste, an LLRW disposal facility is allowed to accept it. LLRW is an inevitable byproduct of nuclear power generation and of government, industrial, academic, and medical uses of radioactive materials. LLRW includes items such as rags, paper, liquid, glass, metal components, resins, filters, and protective clothing that have been exposed to radioactivity or contaminated with radioactive material. The Nuclear Regulatory Commission (NRC) has divided the wastes covered by the Act into categories of increasing levels of hazard exposure, beginning with Class A, followed by B and C.¹

The aim of the Act was to provide for more LLRW disposal capacity on a regional basis and to more equitably distribute responsibility for the management of LLRW among the states. As an incentive for states to manage waste on a regional basis, the Congress consented to the formation of interstate agreements, known as compacts, and granted compact member states the authority to exclude LLRW from other compacts or unaffiliated states.² DOE and NRC were given responsibilities

¹Class A, B and C wastes for near surface disposal are defined in 10 C.F.R. § 61.55. DOE is responsible for the disposal of a fourth category of LLRW, known as greater-than-class C waste, and the waste owned and generated by the department.

²Generators of LLRW located in compact or unaffiliated states that do not have their own disposal facility can contract with a disposal facility in another compact if this compact allows them to do so.

to help guide and oversee implementation of the Act. DOE was to provide both financial and technical assistance to states and interstate compacts to develop disposal facilities, in addition to reporting annually to the Congress on management of LLRW by the states. Technical assistance was to include, among other things, providing guidance on waste disposal site selection, waste reduction methods, and transportation practices, as well as establishing a computerized database to assist the states and DOE in monitoring the management of LLRW. NRC's enumerated tasks included preparing licensing standards for disposal facilities, and granting individual waste generators emergency access to a regional or other nonfederal disposal facility if necessary to eliminate any immediate and serious threat to the public health and safety or for the common defense and security. In addition to these responsibilities, NRC is responsible under the Atomic Energy Act for licensing, among other things, the possession and disposal of radioactive materials, and for inspecting licensees to ensure safe and secure use of these materials. Under the Atomic Energy Act, NRC can enter into agreements with states, known as Agreement States, to discontinue its regulatory responsibilities with respect to byproduct, source, and certain quantities of special nuclear materials. These responsibilities relinquished to states include licensing LLRW disposal facilities.³

There are currently three licensed commercially operated LLRW disposal facilities. Each of these disposal facilities operates under different access and licensing restrictions. The commercial facility near Barnwell, South Carolina, is allowed to accept all classes of LLRW from the three member states of the Atlantic Compact, as well as waste from 36 other states, the District of Columbia, and Puerto Rico.⁴ The commercial facility near Richland, Washington, is allowed to accept all classes of LLRW, but only from the 11 member states of the Northwest and Rocky Mountain Compacts. And, the commercial facility operated by Envirocare of Utah, which, like the Richland facility, is located in the Northwest Compact, is allowed to accept class A waste from all states except those in the Northwest Compact. (See app. I for an overview of existing commercial LLRW disposal facilities.)

³There are currently 33 Agreement States including all three states in which commercial LLRW disposal facilities are located.

⁴Under the Act, the District of Columbia and Puerto Rico have the same responsibilities as the states.

When we last reported on LLRW disposal in 1999, we found that states were not developing new disposal facilities and that within 10 years the only facility available to waste generators in most states for their class B and C wastes could be full.⁵ Our report noted that this situation raised questions about the willingness of the states, under authorities granted to them in the Act, to develop new facilities. Our report also assessed options that the Congress could take to deal with a disposal shortfall if there were no change in conditions. (See app. II for a discussion of legislative options.) In this context, you asked us to report on (1) any changes in LLRW conditions since our 1999 report, (2) recent LLRW annual disposal volumes and potential future volumes, (3) any current or anticipated shortfalls in LLRW disposal availability, and (4) potential effects of any such shortfall.

To conduct our work, we interviewed regulators and disposal operators in the states that have or are proposing LLRW disposal facilities. We also spoke with representatives from DOE, NRC, a nuclear power association, environmental groups, LLRW generators, Department of Defense executive agent for LLRW, and an independent nonprofit association of LLRW stakeholders. We obtained disposal volume data directly from the three commercial facility operators and compared these data with information contained in DOE's online national LLRW database. This comparison and other analyses were used to assess the usefulness and reliability of this database in estimating disposal volumes. We also reviewed applicable laws and regulations, including the Atomic Energy Act, as amended, and the LLRW Policy Act, as amended. Finally, to identify any potential effects of a disposal shortfall, we sought information from groups likely to know about such effects: state and compact officials, and those engaged in the practice, science, or technology of radiation safety. Specifically, we surveyed officials from all compacts and unaffiliated states, and sent a separate e-mail questionnaire to the approximately 2,000 subscribers of the Radsafe Listserv for radiation safety officers. We also placed a notice in the Health Physics Society newsletter, which has a circulation of about 6,000, and asked for volunteers to answer the same questions that we had sent to the Radsafe Listserv subscribers. Our work was conducted in conformance with generally accepted government auditing standards between August 2003

⁵U.S. General Accounting Office, *Low-Level Radioactive Wastes: States Are Not Developing Disposal Facilities*, GAO/RCED-99-238 (Washington, D.C.: Sept. 17, 1999).

and May 2004. (See app. III for further information on the scope and methodology of our review.)

Results in Brief

Since our September 1999 report, we identified several changes that have had or might have significant effects on LLRW disposal availability and federal oversight. The changes that might have implications for long-term disposal availability include South Carolina's decision to close the Barnwell disposal facility to noncompact states by mid-2008, issuance of a license to Envirocare to accept class B and C wastes pending approval by the Utah legislature and governor, Texas legislation to allow the licensing of a new disposal facility in that state, and a federal appellate court ruling against Nebraska for reneging on its compact obligations to build a new disposal facility, which might prompt the state to reconsider development of a facility. Regarding changes in federal agency guidance and oversight of LLRW management by the states, DOE no longer has specific appropriated funds to support a National Low Level Waste Management Program, and the requirement that DOE report to the Congress on LLRW conditions terminated effective May 2000. Further, in the late 1990s, NRC decreased its direct involvement in LLRW management because no new disposal sites were being developed that would involve NRC licensing or the provision of technical assistance to state agencies that would license such a facility.

Annual LLRW disposal volumes have increased in recent years; however, the timing and level of future volumes needing disposal are uncertain. According to data provided by the three commercial LLRW disposal facility operators, disposal volumes grew to about 12 million cubic feet in 2003, an increase of 200 percent over 1999. Class A waste accounted for 99 percent of the disposal volume. The recent increases in disposal volumes are attributed to shipments of class A waste associated most with cleaning up DOE sites and some decommissioning waste from nuclear power plants; about 78 percent of the class A waste in 2003 came from DOE. We relied on data from these operators because the online national LLRW database maintained by the department lacked data on DOE waste shipped to commercial disposal facilities, it was not up to date, and it had other deficiencies. For example, some of the deficiencies in the database included discrepancies between amounts of waste disposal operators claimed they disposed and that which DOE recorded as accepted, and erroneous attribution of waste generation to states from which it did not originate. Notwithstanding problems obtaining complete and reliable LLRW data, uncertainties will remain regarding the timing and volume of

LLRW needing disposal in the future, which will largely depend on the disposal decisions made by DOE and nuclear utility companies.

There appears to be enough disposal availability to serve the nation's needs at least until mid-2008, when generators in many states might lose disposal access for their class B and C wastes. Disposal availability for class A waste is not a problem in the short or longer term. According to Envirocare, which accepted 99 percent of the nation's class A waste in 2003, the disposal facility can take 20 years or more of such waste under its current license. Capacity at the Barnwell and Richland facilities, which are licensed to accept all three classes of LLRW, is more than sufficient to serve the needs of the states within the compacts served by these facilities. However, there are an additional 36 states that currently rely on Barnwell as their only disposal option for their class B and C wastes. While there appears to be available space at Barnwell to meet their anticipated disposal needs in the short term, South Carolina has enacted legislation to terminate noncompact states' access to this facility after mid-2008. Unless South Carolina changes its position, or additional disposal capacity is made available, there will not be disposal options for class B and C wastes generated within these states in the longer term.

If after 2008, there are no new disposal options for class B and C wastes, licensed users of radioactive materials can continue to minimize waste generation, process waste into safer forms, and store waste pending the development of additional disposal options. While NRC prefers the disposal of LLRW, on-site storage is allowed as long as the waste remains safe and secure. Since September 11, 2001, both the public's concern with and its perception of risk associated with radioactive release, including that from stored LLRW, have increased. However, should an immediate and serious threat exist from any specific location of stored waste, NRC has the authority under the Act to override any compact restrictions and allow shipment of the waste to a regional or other nonfederal disposal facility under narrowly defined conditions. While use of waste minimization techniques and storage can alleviate the need for disposal availability, they can be costly. For example, one university recently built a \$12 million combined hazardous and radioactive waste management facility of which two-thirds is devoted to the processing and temporary storage of class A waste. Apart from the cost of managing LLRW, the survey we conducted of state and compact officials and the responses to questions we sent to two other LLRW stakeholder groups did not uncover any widespread national impacts if LLRW generators were to face limited or no disposal options in the short term. For example, given the opportunity to inform us of any concerns regarding the lack of a disposal

option for LLRW, only 14 of the 2,000 radiation safety officers surveyed responded, and only 1 of these respondents raised a concern. In addition, a 2001 National Research Council report concluded that it would take 10 to 20 years before the lack of an LLRW disposal option might adversely impact biomedical research or clinical practice.

Although no shortfall in disposal availability appears imminent, uncertainties about future access to disposal facilities remain, such as the development of new disposal options and the increased safety and security risks associated with longer-term storage of LLRW. Therefore, continued federal oversight of disposal availability and the conditions of stored waste is warranted. However, as a result of decreased federal oversight and a national LLRW database with known shortcomings, there is no central collection of information to monitor this situation. Given that NRC is the federal agency responsible for overseeing the use, storage, and disposal of radioactive materials, and DOE's changed role in LLRW management, we believe that NRC is now the most appropriate agency to report to the Congress on LLRW conditions. Recognizing the deficiencies in the national LLRW database, we recommend that the Secretary of Energy halt dissemination of information from it as long as these deficiencies persist. Considering the need for federal oversight, the Congress may wish to direct NRC to report to it if LLRW disposal and storage conditions should change enough to warrant consideration of new legislation to ensure safe, reliable, and cost-effective disposal availability.

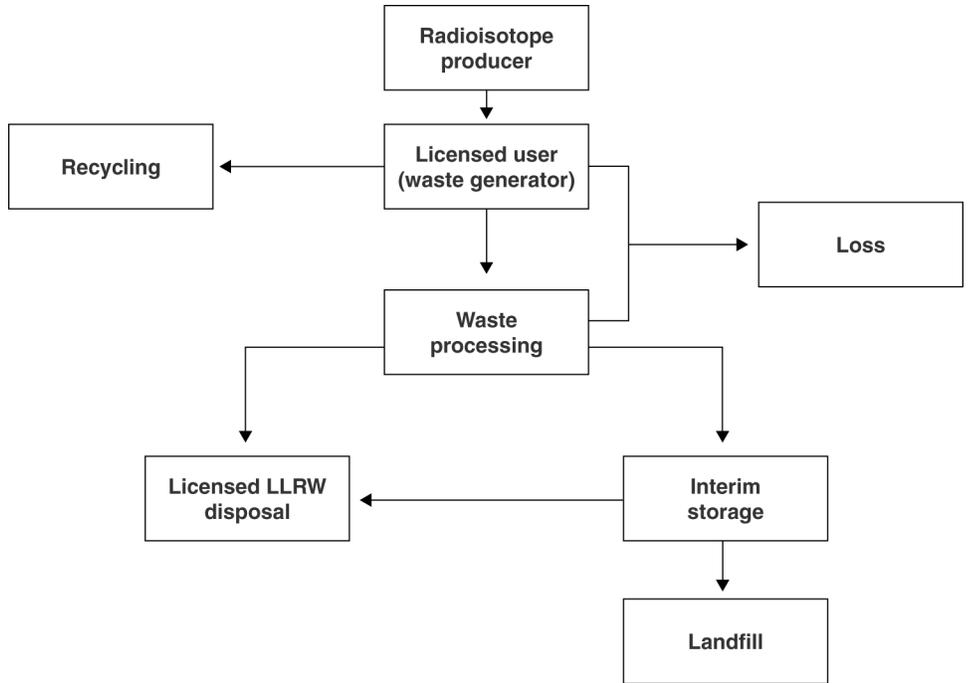
DOE and NRC commented that we provided an accurate summary of current LLRW disposal conditions and potential issues that may be encountered in the future. DOE disagreed with our recommendation pertaining to its national online LLRW database. However, in doing so, DOE did not address our concerns about internal control weaknesses and other shortcomings in the database. We stand by our recommendation to DOE because we believe that it is inappropriate to disseminate information that is known to be incomplete and unreliable. NRC disagreed with our suggestion that the Congress consider directing it to gather information and to report on LLRW disposal and storage conditions. In commenting on our draft report, NRC provided information on data gathering actions already in place or planned that would adequately ensure the safety and security of radioactive materials, including the storage of LLRW as an alternative to its disposal. Given these actions and the concerns of NRC with the regulatory cost of complying with any new data gathering requirements, such as additional rulemaking, we eliminated our suggested congressional directive in this regard. However, we maintain that NRC is now the most appropriate agency to report to the

Congress if LLRW disposal and storage conditions should change enough to warrant congressional intervention. We incorporated technical changes in this report where appropriate based on detailed comments provided by the agencies.

Background

The disposal of LLRW is only the end of the radioactive material life cycle that spans its production, use, processing, interim storage, and disposal. In general the cycle starts with procurement of the radioisotopes that have medical, industrial, agricultural, and research applications. The isotopes come in either sealed or unsealed sources. While a metal container shields a sealed source, unsealed sources remain accessible in a glass vial or other type of container. Common uses of this radioactive material are in radiotherapy, radiography, smoke detectors, irradiation and sterilization of food and materials, gauging, and illumination of emergency exit signs. In the course of working with these materials, other material, such as protective clothing and gloves, pipes, filters, and concrete that come in contact with them will become contaminated. The nuclear utility industry generates the bulk of this LLRW through the normal operation and maintenance of nuclear power plants, and when these plants are decommissioned. Once these materials have served their purpose, they are recycled or become LLRW. LLRW can be processed by those licensed to use these materials or by specialized companies to reduce the volume and sometimes the radioactivity level of the waste before it is either put into a licensed interim storage or a disposal facility. After a period of storage, some LLRW can decay to the point that it is safe for disposal in regulated landfill sites. During the life cycle, there will also be some loss of radioactive materials. Figure 1 diagrams the life-cycle process for radioactive materials.

Figure 1: Conceptual Flow Diagram of Radioactive Sources from Production to Disposal



Source: GAO.

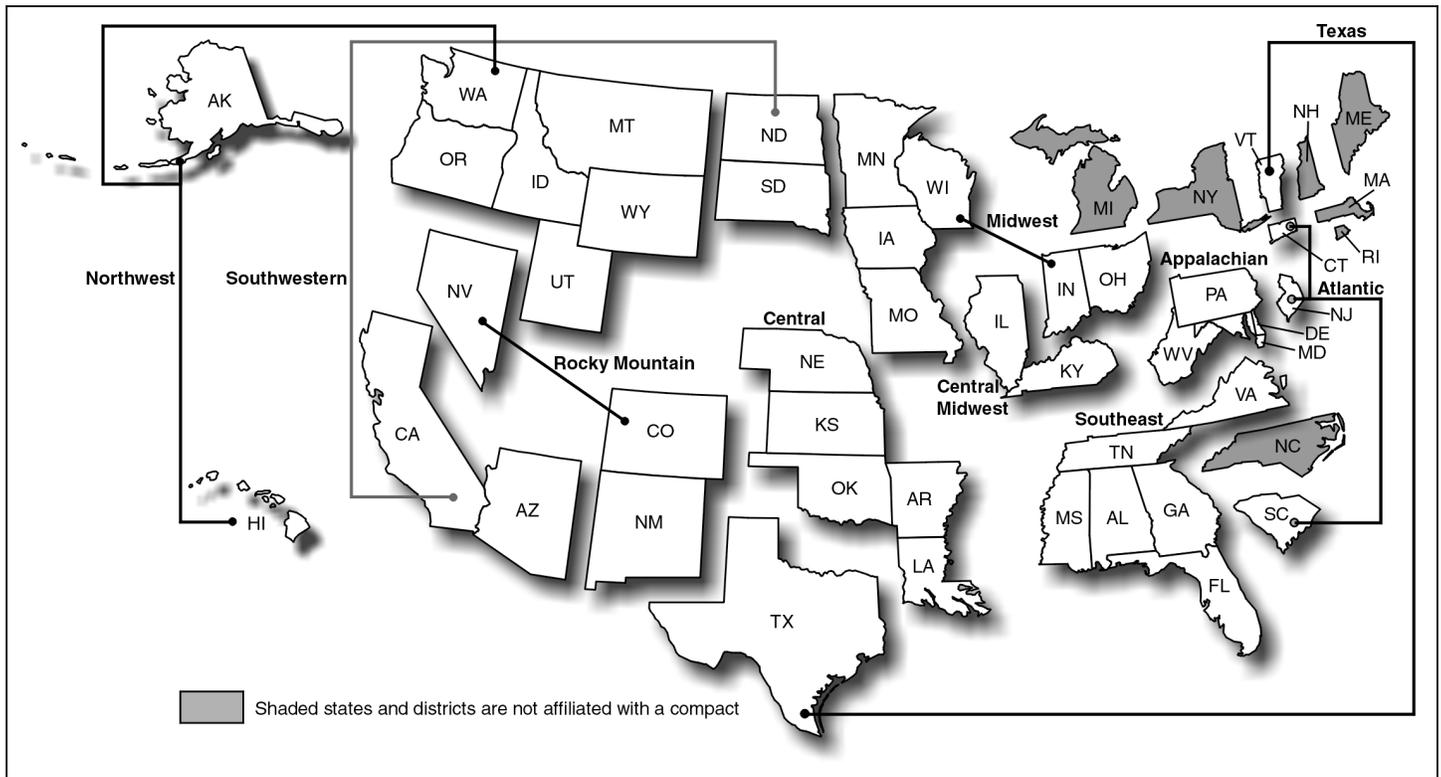
Back in the 1960s, the Atomic Energy Commission (AEC) began to encourage the development of commercial LLRW disposal facilities, as a substitute for ocean disposal, to accommodate the increased volume of commercial waste that was being generated. Six such disposal facilities were licensed, two of which, the facility in Richland, Washington, licensed in 1965, and in Barnwell, South Carolina, licensed in 1971, remain open today to accept class A, B and C wastes.⁶ Each of these facilities is located within the boundaries of or adjacent to a much larger site owned by DOE. The third facility, operated by Envirocare of Utah, is about 80 miles west of Salt Lake City. The state initially licensed the Envirocare facility in 1988 to accept naturally occurring radioactive waste. In 1991, Utah amended the license to permit the disposal of some LLRW and the Northwest Compact

⁶Under the auspices of the AEC, four other commercial disposal facilities were licensed in the 1960s, including facilities in Nevada, Kentucky, New York, and Illinois.

agreed to allow Envirocare to accept these wastes from noncompact states. By 2001, the facility was allowed to accept all types of class A waste.

Despite estimates by a nuclear industry association that expenditures may now have reached approximately \$1 billion on various facility development efforts, no new commercial LLRW disposal facility has been developed since passage of the Act, except for the Envirocare facility, which was not developed at the instigation of the compact in which it exists. In our 1999 report, we found that the impetus to develop new disposal facilities was dampened by a combination of factors that included significant decreases in LLRW generation, available capacity at the three existing facilities to meet national disposal needs, and rising costs of developing disposal facilities. Development costs were a concern because these costs and operating costs would need to be covered by the disposal fees placed on uncertain and perhaps limited LLRW generated within a compact. Developing new LLRW disposal facilities also encountered public and political resistance in states designated to host these facilities. There are presently 10 compacts comprised of 43 states; the Appalachian, Atlantic, Central, Central Midwest, Northwest, Midwest, Rocky Mountain, Southeast, Southwestern, and Texas compacts. There are also 7 unaffiliated states, as well as the District of Columbia and Puerto Rico. A graphic of the state LLRW compacts and unaffiliated states is provided in figure 2.

Figure 2: State LLRW Compacts and Unaffiliated States



Sources: NRC and Low-level Waste Forum.

Since 1999 LLRW Disposal Availability and Federal Oversight Have Changed

We identified a number of important changes that have occurred since our 1999 report that have had or might have significant effects on future disposal availability for these wastes and federal oversight of LLRW management by the states. The following changes that might have implications for long-term disposal availability include:

- In 2001, South Carolina legislation restricted the use of the Barnwell disposal facility to only generators in the three-member Atlantic compact after mid-2008. Presently, this facility is the only disposal option for the class B and C wastes generated in 36 other states and the District of Columbia and Puerto Rico. Approaching the threshold of capacity at Barnwell is not a new concern. In the past, the state legislature has changed its position on restricting access to this facility, both closing and reopening the facility to noncompact member states over the years.

-
- In 2001, Envirocare received a license from the state regulatory authority to accept class B and C wastes pending approval by the Utah legislature and governor. Currently, the state has imposed a moratorium on approving the use of this license until February 2005, after a review of the recommendations of a hazardous waste regulation and policy task force. The legislative task force was set up to conduct a two-year study of how facilities in Utah that accept radioactive waste or radioactive materials for processing or reprocessing compare to other facilities in terms of competitive fees and tax structure. The task force is expected to issue its final report by November 2004. Granting approval for Envirocare to use its class B and C wastes license to accept these wastes nationally might eliminate any shortfall in disposal availability for class B and C wastes resulting from restricted access to the Barnwell disposal facility.
 - In 2003, Texas legislation designated a geographic area in the state as acceptable for a new LLRW disposal facility, and the state regulator developed a license application process for this facility. If a facility license is granted, the facility operator will be allowed to accept all classes of LLRW, as well as DOE site cleanup wastes. It has taken Texas two decades to garner the political support to move forward with developing a new disposal facility that would be privately operated instead of through a public entity. Access, however, may be granted only to generators in selected states outside of the Texas Compact. On the other hand, if access is granted nationally, the Texas disposal facility might eliminate any shortfall in disposal availability for class B and C wastes resulting from restricting access to the Barnwell disposal facility.
 - In 2004, a federal appellate court ruling has renewed discussions in Nebraska about building a disposal facility for the 5-member state Central Compact. The Court of Appeals for the 8th Circuit affirmed a federal district court decision that Nebraska, as a designated host state, is liable for \$151 million in damages for reneging on its obligations to the Central Compact to build a disposal facility by denying a license application for reasons not related to the merits of the application.⁷ While Nebraska may appeal this decision to the U.S. Supreme Court, the appeals court decision might encourage Nebraska to reconsider building a disposal facility and affect the decisions of other states that have prior obligations to build new disposal facilities for their respective compacts.⁸

⁷*Entergy Arkansas, Inc. v. Nebraska*, 226 F. Supp. 2d 1047 (D. Neb. 2002), *aff'd*, 358 F.3d 528 (8th Cir. 2004).

⁸In addition to the Nebraska litigation, the states of California and North Carolina are also in litigation over the development of new disposal facilities.

The remaining changes affect federal agency guidance and oversight of LLRW management by the states.

- In 2001, DOE significantly diminished its involvement in guiding and overseeing LLRW management by the states. DOE's reporting requirement on LLRW management, as originally required by the Act,⁹ terminated effective May 2000.¹⁰ The department's last report to the Congress covered the 1998 LLRW management situation. DOE's technical assistance activities under the Act have also essentially ended after a period of shifting emphasis and decline. According to a DOE Inspector General's report, starting in 1996, the department shifted its technical assistance to states and compact regions from developing LLRW disposal facilities to providing assistance on, among other things, tracking and storing waste.¹¹ The report found that the department's shift in technical assistance was a reaction to the states' inability to overcome barriers to disposal site selection. The funding level for the program in the late 1990s was about \$4 million annually. In fiscal year 2000, the Congress did not appropriate funds for DOE's National Low-Level Waste Management Program, with the exception of about \$600,000 to maintain the online LLRW national database, known as the Manifest Information Management System (MIMS), that was a component of this program. Since then, DOE has not received appropriated funds specifically to support a National Low-Level Waste Management Program.¹² Instead, according to DOE, it has requested and has been appropriated funds each fiscal year to purchase and maintain the MIMS database, although not as an identifiable line item in its budget.
- Since the late 1990s, NRC has decreased its direct involvement in LLRW management by the states because no new disposal sites were being developed and Agreement States have taken on more of these responsibilities. However, the perceived security risks of stored LLRW have heightened since 2001 because of the potential to use some of this material in radioactive dispersal devices, sometimes known as "dirty bombs." While NRC has set no time limits on the storage of LLRW, as long

⁹This requirement was originally codified at 42 U.S.C. §2021(g).

¹⁰See, Pub. L. No. 104-66, § 3003 (1995), as amended. See note under 31 U.S.C.A. § 1113.

¹¹Office of Inspector General. *National Low-Level Waste Management Program*, DOE/IG-0462 (Washington, D.C.: U.S. Department of Energy, Office of Inspector General, Office of Audit Services, February 2000).

¹²42 U.S.C. § 2021g(a) provides that DOE shall provide assistance to carry out the Act "to the extent provided in appropriations acts."

as it is safe, it prefers disposal. Agency officials told us that implementation of the Act has not resulted in reliable and cost effective disposal options for generators. They added that while storage is presently safe, they are concerned about the future safety and security of the increasing volumes of LLRW stored by thousands of licensees who have decided not to pay high disposal fees today, and who might not have disposal options for class B and C wastes in the future. NRC is in the process of conducting vulnerability studies of both reactor and radioactive materials licensees, including those with LLRW storage and disposal. According to agency officials, the result of these assessments will include recommendations for graded approaches to security enforcement based on the overall risk of particular facilities. In addition, NRC has surveyed the states to determine if new regulations should be developed for assured isolation facilities. The Commission decided to defer further rulemaking in this area and to review the need for future action annually, including the potential need for rulemaking and or regulatory guidance for long-term storage of LLRW. The Commission also directed NRC staff to participate, as resources allow, in the Conference of Radiation Control Program Directors' development of a suggested State regulation for control of radiation in assured isolation facilities. Notwithstanding these actions, NRC officials told us that the agency does not centrally track disposal availability or the volume and duration of stored LLRW.

Annual LLRW Disposal Volumes Have Increased, but Future Volumes Are Uncertain

Annual LLRW disposal volumes have increased significantly in recent years, primarily the result of cleaning up of DOE sites and decommissioning nuclear power plants. We chose to rely on disposal volume data from the three commercial disposal facility operators because the MIMS database does not include DOE waste volumes sent to commercial disposal, it is not as up to date, and it has other deficiencies. Future disposal volumes remain uncertain and will depend largely on waste disposal decisions by DOE and nuclear utility companies.

LLRW Disposal Volumes Increased Significantly since 1999

Since the beginning of 1999, disposal volumes have steadily increased to over 12 million cubic feet in 2003, an increase of over 200 percent. Class A waste accounted for 99 percent of this volume. Data from disposal facility operators indicate that annual disposal volumes for class A waste tripled, going from about 4 million cubic feet in 1999 to nearly 12 million cubic feet by 2003. The class A waste disposed of at Envirocare represented 99 percent of the total volume in 2003, and about 78 percent of this waste came from DOE. According to the disposal facility operator, DOE has increased its shipment of waste to the facility from initially about 36,000

cubic feet in 1994 (6.6 percent of the class A waste disposed) to almost 9.3 million cubic feet in 2003 (77.8 percent of the class A waste disposed). In contrast, disposal volumes of class B waste declined 47 percent, from about 23,500 cubic feet in 1999, to about 12,400 cubic feet in 2003. Class C waste disposal volumes were more volatile, changing as much as 107 percent in a single year. The total annual disposal volume of class C waste alternately rose and fell between 1999 and 2003, with the annual total reaching over 20,000 cubic feet in 1999, falling as low as about 11,000 cubic feet in 2002, then rising over 23,000 cubic feet in 2003. Of the total class B and C wastes disposed of in 2003, 99 percent went to Barnwell. Overall annual changes in disposal volume were driven by shipments of class A wastes, which are generated primarily by cleanup of DOE sites. Class B and C waste disposal volumes were affected by commercial nuclear power plant decommissioning activities, but these classes of waste represented slightly less than 0.5 percent of total volume of disposed waste between 1999 and 2003.

Concerns about Usefulness and Reliability of National LLRW Database

We chose not to use MIMS, which DOE maintains and operates for the LLRW community and public, to determine recent disposal volumes or to use other information in this database to analyze sources of LLRW by state, compact, and generator type because of shortcomings in its usefulness and reliability. Instead, we relied on data supplied to us by the three commercial disposal operators for our analysis because it includes DOE waste volumes sent for commercial disposal, it is more up to date, and because it is the primary source data input into the national LLRW database.

Even though DOE ships large quantities of LLRW to a commercial disposal facility, this useful information is not captured in MIMS. Other types of useful information, such as storage of waste and volume of waste reduction, are also not collected in this database.¹³ The consensus among the compact and unaffiliated state officials we surveyed was that they could more effectively regulate and monitor LLRW in their compacts and states if MIMS offered more comprehensive and reliable data. Despite these shortcomings, these officials have sometimes used MIMS data as a convenient source of information for public, media, and stakeholder

¹³This information was not included, but would have been useful in preparing DOE's annual reports to the Congress on LLRW management by the states. (The reporting requirement was eliminated, effective May 2000, by Pub. L. No. 104-66, § 3003, as amended.)

inquiries, as a means of monitoring LLRW within their compact or region, and as an external check on the LLRW interstate shipment data reported to compact and state regulators by the disposal operators.

We also identified shortcomings in the reliability of the MIMS database. We identified inconsistencies between what the disposal facility operators claimed had been disposed of at their facilities and what was recorded in this database. For example, the volumes of LLRW reported to us by Envirocare for 1999 to 2003 totaled 10.4 million cubic feet, compared to the 15.7 million cubic feet that was reported in MIMS.¹⁴ There were also problems with other kinds of data in MIMS. States and compacts have identified discrepancies that undermine the data's usefulness, particularly regarding the state-specific information on the origins of waste. For example, Tennessee, which is the base of operations for companies that transport and process the waste from generators in other states prior to disposal, reports that it is erroneously recorded in MIMS as the state of origin of this waste.

The data DOE puts into MIMS comes from the three commercial LLRW disposal facility operators in electronic format. DOE pays each operator varying amounts of money to extract data from the records accompanying shipments of LLRW that provide information on the volume, radioactivity level, source, and other information about the waste. These records are called manifests and NRC requires their use to track shipment of radioactive materials. The disposal operator then transmits some of this information to DOE for entry into MIMS. Each disposal facility operator is responsible for ensuring the validity of these data, but DOE's contracts with these operators leave to them what steps, if any, should be taken to validate the data. DOE takes no responsibility for verifying the accuracy of the data supplied by the disposal facility operators. Furthermore, while DOE takes some steps to ensure that it accurately uploads operator-supplied data into MIMS, it does not perform other systematic quality checks on the data, such as "reasonableness" checks, cross tabulations, or exceptions reports. As a result, we determined that the lack of consistent and comprehensive internal controls, such as controls over information processing, undermine our confidence in the data output in MIMS for

¹⁴We excluded the LLRW shipped to Envirocare by DOE in this comparison because the MIMS database does not record any DOE waste disposed of at commercial facilities.

several types of information, including sources of waste coming from states, compacts, and generator types.¹⁵

Uncertainties Surround Projecting Future LLRW Disposal Volumes

Notwithstanding problems obtaining reliable and complete LLRW disposal data, uncertainties remain concerning the timing and volume of LLRW needing disposal in the future, which largely will depend on the disposal decisions made by nuclear utility companies and DOE, as well as on possible changes in regulatory standards for what constitutes LLRW. The pace of nuclear power plant decommissioning has been slower than expected. Nuclear utility industry officials and federal officials told us that beyond the few nuclear power plants now being decommissioned, only a small number of plants are expected to be decommissioned in the next 20 years or more. The economics of electricity generation make it desirable for most utilities to keep their existing nuclear power plants running, in some cases even making investments to upgrade and extend the operating life of the reactors. Moreover, the nuclear power industry has aggressively minimized the amount of LLRW it produces, both in absolute volume and in decreasing the amount of the more radioactive class B and C wastes by, for example, changing some kinds of filters more often before radioactivity concentrates at higher levels.

Recent DOE experiences cleaning up its sites underscore how difficult making useful projections can be. Officials at DOE told us that such projections for sites now being cleaned up have not proven very accurate, and have tended to significantly overestimate waste volumes that would require disposal as LLRW. There are several reasons cited for this difficulty: records from “legacy” sites—former nuclear weapons production sites that DOE is cleaning up—have not proven to be reliable; the decay rate of known buried radioactive wastes have often been higher than expected so wastes that were expected to need disposal as LLRW can instead be legally classified as radioactive waste mixed with nonradioactive but hazardous wastes and sent to less expensive disposal facilities; contractors have become more innovative and skilled in sorting and segregating hazardous and mixed wastes from LLRW so that a higher percentage of wastes can be disposed of as hazardous or mixed wastes rather than LLRW; and some debris and material from site cleanup

¹⁵Controls over information processing that DOE could require in its contracts with disposal facility operators would include, for example, edit checks of data entered, accounting for transactions in numerical sequences, comparing file totals with control accounts, and controlling access to data, files, and programs.

projected to be LLRW has no appreciable radioactivity when generated and can therefore be disposed in sanitary landfills or other non-LLRW disposal facilities. Moreover, there are some indications that the volume of DOE cleanup waste likely to be sent to commercial LLRW disposal facilities is currently at or near a peak and will soon rapidly decline as cleanup at some DOE sites winds down and as cleanup activity shifts to other DOE sites that have considerable on-site disposal capacity. As a result, DOE officials expect the use of commercial LLRW disposal facilities to start declining after 2006 and to stay comparatively low until another anticipated spike in 2014. DOE officials stressed, however, that “high confidence numbers” are not yet available because the department is still in the process of reorganizing and developing new baselines for its accelerated cleanup projects, and it does not have a management system in place to develop corresponding waste projections.

Potential changes to the threshold at which waste is classified as LLRW that is currently under consideration could also affect the amount of waste needing disposal in the future. The National Research Council and the Environmental Protection Agency (EPA) are separately studying this issue and considering possible changes that might affect the future management of LLRW. The National Research Council is studying the issue because members of its Board on Radioactive Waste Management are concerned that the statutes and regulations that govern LLRW management may be overly restrictive; in some cases, leading to excessive costs and other burdens on the waste generator and, in other cases, possibly leading to an exaggeration of the potential risks posed by these materials. EPA is examining its existing waste regulations and has begun the process of soliciting public comment as it considers new rulemaking in this area. Specifically, EPA is exploring an option with NRC to establish a regulatory framework that allows some of the lower activity radioactive waste to be disposed of at non-LLRW disposal facilities.¹⁶ Finally, and in a similar vein, there has been discussion by government and industry LLRW stakeholders of harmonizing U.S. standards with prevailing international standards for LLRW under consideration by the International Atomic Energy Agency. Such a change could prompt consideration by U.S. regulators to raise the threshold at which the radioactivity of waste would trigger regulation as LLRW, and would allow for lower activity LLRW to be disposed of under other regulatory regimes.

¹⁶68 *Fed. Reg.* 65120 (November 18, 2003).

LLRW Disposal Availability Appears Adequate Until Mid- 2008

There appears to be enough disposal availability to serve the nation's needs at least until mid-2008, when many states might lose disposal access for their class B and C wastes. Disposal availability for class A waste does not pose a problem under current conditions. According to Envirocare representatives, their disposal site, which accepted over 99 percent of the nation's class A waste in 2003, has enough capacity to accept this waste at the current volume levels for more than 20 years. The Richland facility has about 21 million cubic feet of capacity remaining for all classes of waste, which is more than enough to accommodate the LLRW coming from the 11 states in the Northwest and Rocky Mountain compacts until the expected closure of this facility in 2056. The Barnwell disposal facility has about 2.7 million cubic feet of remaining capacity, most of which has been set aside for waste from generators in the Atlantic Compact until 2050. Barnwell also appears to have enough disposal capacity to continue accepting class B and C wastes from other states until mid-2008, when it is scheduled to close to all but the three Atlantic compact states. According to the Director of Disposal Services at Chem-Nuclear Systems, the operator of the Barnwell facility, there should be enough space at the facility to accommodate the typical 20,000 to 25,000 cubic feet of class B and C wastes accepted at this facility in recent years. This representative told us that many generators have already contracted to dispose of their B and C wastes in the short term, and any generator outside of the Atlantic Compact anticipating a need to dispose of these wastes could still contract for the necessary space until mid-2008.

A number of factors support the likelihood that disposal space for class B and C wastes will be available at Barnwell until mid-2008, if disposal volumes do not exceed anticipated levels. Based on current space commitments at this disposal facility under conditions of the volume caps set by the South Carolina legislature, there remains a range of 24,500 to 44,500 cubic feet of uncommitted space until 2008.¹⁷ The amount of space available depends on whether Atlantic Compact generators use all of their set-aside space through 2008. In addition, utilities are likely to take more aggressive efforts to ensure sufficient space for class B and C wastes at

¹⁷The South Carolina legislature has established annual caps on the amount of LLRW that can be disposed of at Barnwell. The caps diminish to 35,000 cubic feet per year by mid-2008 and at that point the cap remains at 35,000 per year for Atlantic Compact waste alone. The annual cap is comprised of (1) a volume amount set aside for generators in the Atlantic Compact, (2) committed amounts attributable to generators outside the compact that have contracts with the disposal operator, and (3) uncommitted amounts that can be used to accommodate additional waste.

Barnwell. Industry officials said utilities might consider several initiatives and conditions that could alleviate the diminishing disposal availability for class B and C wastes. For example, utilities could send class A waste to Envirocare rather than Barnwell to save the remaining space at Barnwell for class B and C wastes. In addition, utilities might increase waste reduction efforts and storage.

After 2008, disposal availability for the class B and C wastes generated in the 36 states outside the Northwest, Rocky Mountain, and Atlantic compacts is more uncertain. Disposal availability for these states will depend on a number of possibilities including extending access to Barnwell beyond mid-2008, or creating new disposal options for these classes of waste. The Barnwell facility has opened and closed to noncompact member states before and it could happen again. Given the difficulties of attracting class A waste to Barnwell because of the high disposal fees, and the fairly consistent level of class B and C wastes shipped to this site each year, the facility might not even reach its volume cap of 35,000 cubic feet per year after 2008. In addition, the set-aside of 2.2 million cubic feet for Atlantic Compact generators through 2050 may be negotiated downward, freeing up additional space at this disposal facility. There is also some possibility that new disposal options will become available in the future that could alleviate any disposal crisis for class B and C wastes. We mentioned these disposal options in the previous section on changes since 1999 in LLRW disposal availability and federal oversight. Finally, regardless of the outcome, representatives of the Nuclear Energy Institute, the policy organization of the nuclear energy industry, said that utilities, the greatest generator of class B and C wastes, have the ability to store these wastes on site if they have no disposal option.

Any LLRW Disposal Shortfall After Mid-2008 Unlikely to Pose Immediate Problem

If after mid-2008, there are no new disposal options for class B and C wastes, licensed users of radioactive materials can continue to minimize waste generation, process waste into safer forms, and store waste pending the development of additional disposal options. These approaches, however, can be costly, with a higher financial burden on some licensees than others. Notwithstanding these business costs, we did not detect other effects of any shortfalls in disposal availability that might have wider implications.

LLRW Minimization and Storage Can Lessen Effects of any Disposal Shortfall

The licensed users of radioactive materials that must eventually dispose of their LLRW have employed a variety of techniques to both minimize and process this waste to reduce its volume prior to storage and eventual disposal.¹⁸ These techniques include substitution of nonradioactive materials for radioactive materials, separation of radioactive materials from nonradioactive materials, recycling, compaction, dilution, and incineration. For example, it is reported that most large research institutions make concerted efforts to find suitable and appropriate alternatives to the use of radioactive materials. One university official told us that such efforts have reduced LLRW generation at his institution by 30 percent in the last 5 years. The Electric Power Research Institute is encouraging nuclear utilities to use vendor volume reduction programs for resins, the single largest component of class B and C wastes, to reduce volume. Some licensees have used processors to super-compact class A waste to achieve up to a 5,000 percent reduction in volume, or to reduce this waste to ash through incineration, albeit increasing the concentration of radioisotopes.

In addition to minimization of LLRW, licensees can decide to store this waste when no disposal option is available to them. In order to obtain a license to possess radioactive materials, entities must demonstrate the technical capability to safely manage them. Various reasons are given for storing waste, including allowing short-lived radioactive materials to decay to innocuous levels to avoid the need for disposal in a more expensive LLRW facility, the prohibitively high cost of disposal for some licensees, and concerns about the potential liability of sending the waste to a disposal site. Universities and biomedical companies generally rely on storage for decay for their LLRW, although finding space within large research institutions in urban settings is more difficult. The high cost of LLRW disposal can also pose financial problems for some licensees. Over the last 25 years, disposal costs have risen from \$1 per cubic foot of LLRW to over \$400 per cubic foot, with projections of well over \$1,000 per cubic foot in the future. For some LLRW, the Barnwell disposal facility now charges \$1,625 per cubic foot. These disposal costs can reach hundreds of millions of dollars for utility companies that are decommissioning their nuclear power plants. NRC reported to us that the cost to fully

¹⁸According to the NRC there are approximately 21,600 entities licensed by either NRC or an Agreement State to use radioactive materials, about 75 percent use either sealed sources, which can be returned to the manufacturer or small amounts of radioactive materials that decay rapidly leaving little or no residual radioactive contamination requiring clean up or disposal.

decommission a plant can run as high as \$675 million. Finally, some licensees will not send their LLRW to disposal facilities because they are concerned that the mixing of their waste with other waste might draw them into litigation if the disposal site should ever require cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (commonly referred to as Superfund).

While NRC policy favors disposal rather than storage over the long-term, since the mid-1990's, the Commission has allowed on-site storage of LLRW without a specified time limit as long as it is safe. The Commission took this approach in part because LLRW can be stored and the states were not developing any new disposal facilities. According to the agency, NRC and Agreement State license and inspection programs help ensure the safe management of stored LLRW. However, some licensees are concerned that a fire, flood, or an earthquake might cause an unintended radioactive release. If an emergency ever should arise from stored LLRW, NRC has authority under the Act to override any compact restrictions to allow shipment of LLRW to a regional or other nonfederal disposal facility, if necessary under narrowly defined conditions, to eliminate an immediate and serious threat to the public health and safety or to the common defense and security.¹⁹ Since September 11, 2001, the perception of the risks posed by potential use of stored LLRW by terrorists has increased. A recent report found that at least a few radioisotopes of greatest security concern are classified as LLRW.²⁰ According to the report, while radiological dispersal devices, such as a dirty bomb, are not weapons of mass destruction, they could cause mass disruption, dislocation, and adverse financial consequences associated with decontamination and rebuilding. NRC officials told us that as the volume and duration of stored LLRW increases so might the safety and security risks.

LLRW Minimization and Storage Can Be Costly

While waste minimization and storage can alleviate the need for disposal, they can be costly. The licensees that we interviewed provided many examples of the high cost of managing LLRW. For example, one university

¹⁹The narrowly defined conditions are pursuant to 10 C.F.R., Part 62. The alternatives that must be explored by the person making the request include storing at the site of generation or at a licensed facility, purchasing disposal capacity, or requesting disposal at a federal LLRW disposal facility.

²⁰Ferguson, Charles, Tahseen Kazi, and Judith Perera. *Commercial Radioactive Sources: Surveying the Security Risks* (Monterey, CA: Center for Nonproliferation Studies, Monterey Institute of International Studies, January 2003).

recently built a \$12 million combined hazardous and radioactive waste management facility of which two-thirds is devoted to the processing and temporary storage of class A waste. And, a medical center official took us to a small (12' x12') LLRW interim storage and processing room that cost the institution about \$150,000 to construct to meet stringent health and environmental standards. There are also costs associated with operating storage facilities. Representatives from one university system told us that about \$100,000 is spent annually to maintain its interim storage building in a remote area of the state. Added to the cost of building and operating a storage facility is the cost of securing it. Such costs have been accounted for in higher utility rates, university overhead charges, drug prices, and medical treatments. These costs of doing business are more difficult for some entities to absorb than others. For example, representatives from several biotechnology companies told us that the industry, particularly the smaller start-up companies, are not prepared for the financial cost of storing and securing LLRW.

No Other Widespread Effects Detected of Shortfall in LLRW Disposal Availability

Notwithstanding the cost of minimizing and storing LLRW, we did not detect widespread national impacts on LLRW generators that have resulted or might result from any disposal shortfalls. In an effort to identify any such effects, we initially asked some questions on our survey of compact and unaffiliated state LLRW officials regarding documented effects on LLRW generators of any restricted disposal availability. Virtually no citations were provided or current concerns raised. We then sought information from a broader constituency in a further attempt to find evidence of such effects. We collaborated with medical researchers at the University of Texas to seek information from two overlapping groups involved in LLRW management: the approximately 2,000 subscribers of the RadSafe Listserv, a listserv for radiation safety officers, and the approximately 6,000 members of the Health Physics Society, a scientific and professional organization whose members specialize in occupational and environmental radiation safety.²¹ We sought information on any known cases where there have been or might be adverse effects on research activities and clinical practice stemming from costs or difficulties related to the storage and disposal of LLRW. Specifically, we e-mailed questionnaires asking if these factors have caused or might cause a

²¹These surveys of RadSafe Listserv subscribers and Health Physics Society members are not considered scientific sample surveys because the self-selected respondents came from a nonprobability sample of a largely unknown list of people.

discontinuance or disapproval of any research or clinical endeavors to RadSafe Listserv subscribers and placed a notice in the Health Physics Society's newsletter asking for volunteers to answer the same questions we sent to the listserv subscribers. We obtained an extremely low response rate to these questions—14 responses from listserv subscribers and 6 from Health Physics Society members. Because these were nonprobability sample surveys the results are not generalizable and can only be used for anecdotal purposes. Of these respondents, only two said that the difficulties associated with LLRW had adversely affected research or clinical practice. Several respondents cited the challenges of dealing with LLRW, but also noted that they work around the difficulties through waste minimization, including substituting nonradioactive materials for radioactive materials when possible, and on-site storage as needed. The survey results provided no evidence of any widespread effects on research activities and clinical practice stemming from costs or difficulties related to the storage and disposal of LLRW in the last 5 years.

We also had limited success in identifying published reports on the possible effects that lack of LLRW disposal options might have on waste generators. We identified a report supported by DOE that surveyed LLRW generators in Michigan during a period when they had no disposal alternative from 1990 to 1995. The survey found that storage costs were actually a small cost for most businesses, and that few broader socioeconomic effects were noted.²² Another report reviewed the potential impact of LLRW management policies on biomedical research in the United States. The 2001 National Research Council report concluded that the central issue was the cost of managing LLRW, and not access to disposal facilities.²³ The report found that it would take 10 to 20 years before a lack of LLRW disposal options might have an adverse effect on biomedical research or medical care. However, the report cautioned that if use of radioisotopes increases or the use of longer half-life radioisotopes increases in the future, the system of LLRW storage, monitoring, inspection, and disposal might not be adequate to meet the needs of this expansion.

²²Stupka, Richard, Barbara Lewis and James Langsted, *Case Study of Michigan Low-Level Radioactive Waste Generators* (Denver, CO: Dames & Moore, DOE Programs Group, September 1993).

²³National Research Council, *The Impact of Low-Level Radioactive Waste Management Policy on Biomedical Research in the United States* (Washington, D.C.: National Academy Press, 2001).

Conclusions

Although no shortfall in disposal availability appears imminent, uncertainties remain about future access to disposal facilities. Even with the prospect of new disposal options, there is no guarantee that they will be developed or be available to meet national needs for class B and C wastes disposal. While LLRW generators have options available to mitigate any future disposal shortfall, including storing waste, storage is costly and it can lead to increased safety and security risks. Therefore, continued federal oversight of disposal availability and the conditions of stored waste is warranted.

Federal oversight is necessary to oversee disposal availability and the conditions of stored waste. However, DOE and NRC have reduced their oversight of LLRW management by the states. DOE's involvement is now limited to maintaining its online national LLRW database, which has internal control weaknesses and other shortcomings. At the same time, DOE has become the largest LLRW generator shipping to commercial disposal facilities and thus has become a part of the system on which it was initially supposed to report. NRC's involvement with LLRW management has similarly decreased because no new disposal facilities were being developed, and an increasing number of Agreement State agencies have taken over many responsibilities for overseeing radioactive material use, storage, and disposal. As a result of this decreased federal oversight and a national LLRW database with known deficiencies, there is no central collection of information to monitor disposal availability and the conditions of stored LLRW.

Given that NRC is the federal agency responsible for overseeing the use, storage, and disposal of radioactive materials, and DOE's changed role in LLRW management, we believe that NRC is now the most appropriate agency to report to the Congress on LLRW conditions.

Recommendations for Executive Action

We recommend that the Secretary of Energy halt dissemination of information contained in the online national LLRW database as long as the database has internal control weaknesses and shortcomings in its usefulness and reliability.

Matters for Congressional Consideration

The Congress may wish to consider directing NRC to report to it if LLRW disposal and storage conditions should change enough to warrant congressional evaluation of alternatives to ensure safe, reliable and cost effectiveness of disposal availability.

Agency Comments and Our Evaluation

We provided a draft of this report to DOE and NRC for their review and comment. DOE's written comments are reproduced in appendix IV. DOE agreed with our assessment that disposal availability is adequate for the near future. DOE disagreed with our recommendation to halt dissemination of information in its national LLRW database. DOE stated that our report did not adequately characterize the usefulness of MIMS, and that removal of the national LLRW database without an alternative would evoke criticism from states and regional compacts and would not fulfill the requirement in the Act to maintain such a database. Our recommendation did not call for removal of this database. Instead, we recommended halting dissemination of information in this database as long as the database has internal control weaknesses and shortcomings in its usefulness and reliability. This action might only temporarily restrict access to the online national LLRW database. DOE did this for about 2 months in late 2003 and early 2004 to correct system problems with MIMS. With regard to the usefulness of MIMS, our report noted that state and compact officials use MIMS to respond to public inquiries and to monitor LLRW; however, the consensus among the officials we surveyed was that they could more effectively regulate and monitor LLRW if MIMS offered more comprehensive and reliable data. DOE did not address our concerns about internal control weaknesses and other shortcomings in the database. We stand by our recommendation to DOE because we believe that it is inappropriate to disseminate information that is known to be incomplete and unreliable.

NRC's written comments are reproduced in appendix V. NRC commented that we provided an accurate summary of current LLRW disposal conditions and potential issues that may be encountered in the future. NRC disagreed with our suggestion that the Congress consider directing it to gather information necessary to monitor the adequacy of LLRW disposal availability and the safety and security of stored waste, and to report to the Congress on significant changes in LLRW disposal and storage conditions. In commenting on our draft report, NRC provided information on data gathering actions already in place or planned that it contends would adequately ensure the safety and security of radioactive materials, including stored LLRW, which is an alternative to disposal. Given these actions and the concerns of NRC with the regulatory cost, such as new rulemaking, associated with gather information on LLRW disposal and storage conditions, we eliminated this suggested congressional directive. In regard to our reporting suggestion, NRC commented that it believes that such monitoring and reporting, if necessary, would fall within the responsibility of DOE as was previously recognized by the Act. However, as our report noted, the Congress

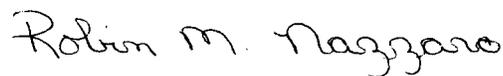
eliminated DOE's reporting responsibilities under the Act and no longer specifically appropriates funds to support a National Low-Level Waste Management Program. Given the need for continued federal oversight of LLRW conditions, we maintain that NRC is now the most appropriate agency to report to the Congress if LLRW disposal and storage conditions should change enough to warrant congressional intervention.

We incorporated technical changes in this report where appropriate based on detailed comments provided by the agencies.

As agreed with your office, we will make copies of this report available to others upon request. In addition, the report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-3841 or Dan Feehan, Assistant Director, at (303) 572-7352. Major contributors to this report include Doreen Feldman, Curtis Groves, Alan Kasdan, Thomas Laetz, Cynthia Norris, Daniel Semick, Richard Shargots, and Kevin Tarmann.

Sincerely yours,

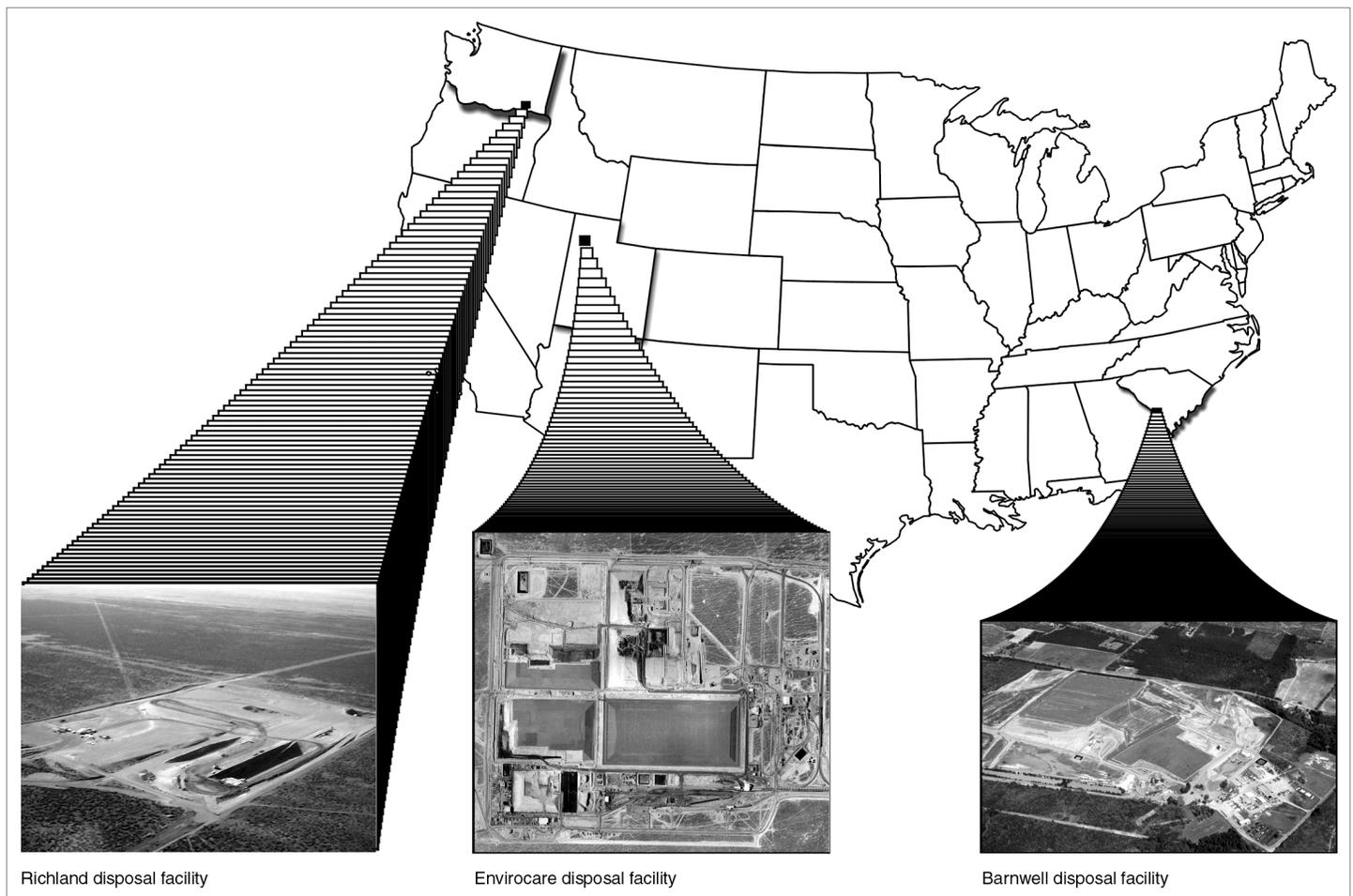


Robin M. Nazzaro
Director, Natural Resources
and Environment

Appendix I: Overview of Existing Commercial LLRW Disposal Facilities

There are currently three commercial disposal facilities operating in the country, two of which were part of the group of six facilities established back in the 1960s. The facilities in Barnwell, South Carolina, and Richland, Washington, are the only ones that remain open today. Each of these facilities is located adjacent to or within the boundaries of a much larger site owned by DOE. The third facility is located outside of Salt Lake City, Utah. Figure 3 shows the location of three commercial disposal facilities.

Figure 3: Location of Three Commercial LLRW Disposal Facilities



Richland disposal facility

Envirocare disposal facility

Barnwell disposal facility

Sources: US Ecology, Inc., Envirocare of Utah, Inc., Duratek, Inc., and GAO.

Barnwell Disposal Facility

The Barnwell disposal facility was opened in 1969, but the actual license to use about 17 acres of land for shallow burial of LLRW in Barnwell County, South Carolina, was issued in 1971. This commercial site is located near the much larger Savannah River Site owned by DOE. In 1976, the site was expanded to its present size of 235 acres with an original capacity to hold 30.6 million cubic feet of all classes of radioactive waste and some other types of waste.

Compact Affiliation

South Carolina is the current host state for the Atlantic Compact; the compact comprises South Carolina, Connecticut, and New Jersey. South Carolina was originally in the 8-member Southeast Compact that was ratified by the Congress in 1985. However, in 1995, the state withdrew from this compact to become an unaffiliated state primarily because another member of the compact, North Carolina, had failed to develop a new disposal facility as planned by 1992. In 2000, the state joined the Northeast Compact. The name of the Northeast Compact was later changed to the Atlantic Compact to better characterize the geographic affiliation of the three member states. During the history of South Carolina as a compact state and an unaffiliated state, the state legislature has only restricted national access to the Barnwell disposal facility for one year, between July 1994 and June 1995, excluding some temporary access restrictions placed on Michigan between 1990 and 1995, and North Carolina between 1995 and 2000.

State Regulators

Three state regulatory entities have roles and responsibilities associated with the operation of the Barnwell disposal facility. The South Carolina Budget and Control Board owns the land that is set aside for the LLRW disposal, and it will assume responsibility for the site after it closes. Among other responsibilities, this board approves the disposal rates and authorizes the import of out-of-compact waste to Barnwell. In conjunction with the South Carolina Public Service Commission, the board determines allowable operating costs that can be charged by the operator. The operator is reimbursed for these operating costs and is allowed a 29 percent margin above most of these costs. As South Carolina is an Agreement State, the Department of Health and Environmental Control has licensing and technical regulatory authority over Barnwell.

Disposal Operator

Chem-Nuclear Systems has operated the Barnwell disposal facility continuously since it opened. In 2000, this company became a subsidiary of Duratek, Incorporated, which had purchased the owner of Chem-

Nuclear Systems, Waste Management Nuclear Services. According to company officials, there are about 100 Duratek employees at the Barnwell facility, of which 60 to 70 deal with the disposal operations and retain the Chem-Nuclear Systems name. About 10 years ago there were about 350 employees at Barnwell, when disposal intake was higher.

Current Conditions

The Barnwell disposal facility is reaching its capacity. About 102 acres of the 235-acre site has been filled, with about 13 acres left for disposal. According to company officials, there is about 2.7 million cubic feet of space remaining. The vast majority of this remaining space, about 2.2 million cubic feet, has been set aside for the decommissioning of the 12 nuclear power plants in the three state compact region. The decommissioning waste is anticipated at about 12,000 cubic feet per facility annually, beginning around 2031 and lasting for about 20 years. Each facility is expected to produce much more LLRW, but much of this waste will likely be shipped to Envirocare of Utah.

The Barnwell disposal facility is planned for closure to out-of-compact waste by mid- 2008. In 2001, the South Carolina legislature imposed volume caps on the amount of waste that could be accepted at Barnwell. Between 2001 and 2008, the facility is allowed to accept decreasing levels of waste until it reaches a steady state level of 35,000 cubic feet in 2008. State officials told us that the legislature set the cap at 35,000 cubic feet to provide revenues sufficient to cover operating costs and all other obligations; however, at current disposal rates, the breakeven volume intake might be as low as 20,000 cubic feet annually. These caps were based on an earlier task force report that provided a “road map” for discontinuing South Carolina’s national role in providing disposal and ensuring that capacity would remain to serve the future needs of South Carolina generators.

Barnwell has the highest disposal rates among the three commercial disposal facilities. In part, the rates have increased over the years with the additions of special fees, taxes, and surcharges. Noncompact generators have increasingly paid far more to dispose their waste than generators within the compact states, especially South Carolina generators, that receive a 33 percent rebate on their disposal fees. The 2003 rate for compact generators does not exceed about \$400 per cubic foot for any class of waste, whereas for noncompact waste coming from processors with importation agreements, it is set at \$1,625 per cubic foot. The most sizeable increase in disposal fees came in 1995, when South Carolina imposed a \$235 per cubic foot tax on the LLRW accepted by Barnwell. In

fiscal year 2002, of the approximately \$34 million in gross disposal receipts from waste coming to Barnwell, about \$11.6 million went to the operator, and most of the remaining 66 percent went to the state, primarily to support education programs.

Notwithstanding the existing caps on the volume of waste that can be accepted at Barnwell through mid-2008, there are some indications that the legislature may reconsider its position on these caps. First, there has been a shortfall in the volume of waste that has actually come to Barnwell in the last 3 years. Company officials told us that this shortfall is 60,592 cubic feet. Negotiations are taking place to determine if this shortfall can be added to the cap levels over the next several years to make up the difference. Second, two utilities that had committed space at Barnwell have decided not to send a reactor vessel and several steam generators to this facility. This would free up even more space, if it were made available. Finally, other space might become available if prior allocation commitments to the 12 nuclear power plants in the Atlantic Compact are revised downward, given changes in how to manage the decommissioning of nuclear power plants. The Electric Power Research Institute is working with utilities on reducing their space needs at Barnwell. Figure 4 shows the delivery of a large reactor vessel to the LLRW trench at the Barnwell disposal facility.

Figure 4: Delivery of a Large Reactor Vessel to the LLRW Trench at the Barnwell Disposal Facility



Source: Duratek, Inc.

Envirocare Disposal Facility

Since 1988, Envirocare has operated a 540-acre disposal facility 80 miles west of Salt Lake City. The facility is located in Tooele County within a 100-square mile hazardous waste zone that includes two hazardous waste incinerators, the Army's nerve gas storage site, and the Army's Dugway Proving Grounds. Prior to the low-level waste disposal site, DOE used the area for the disposal of uranium mill tailings. Much of the waste disposed at Envirocare comes from cleanup of commercial and government facilities. Also, Envirocare is the only commercial disposal facility to accept mixed waste, which is a combination of radioactive and hazardous waste. In 2003, Envirocare took about 99 percent of the nation's class A waste.

Compact Affiliation

While Utah is part of the Northwest Compact, which includes seven other states, it is not the host state for the compact's LLRW disposal facility.

Originally, Utah approved Envirocare's operation for accepting naturally occurring radioactive material—large volume, low activity low-level radioactive wastes. In 1991, recognizing that the Northwest Compact planned to exercise its exclusionary authority at the beginning of 1993, Utah and Envirocare sought a resolution from the Compact that would allow this disposal facility to continue to accept these specific types of low-level waste once the compact exercised its exclusionary authority.²⁴ Realizing that proposed disposal facilities in other states and compacts were not designed to take wastes of such large volume, the Northwest Compact adopted a resolution and order that allowed continued access to Envirocare by those states that met the milestone requirements of the Act.²⁵ In 1995, the resolution and order were amended to include a provision that states and compacts in which low-level waste is generated, including the Northwest Compact, must authorize any shipment of this waste to Envirocare. This was done to ensure that states and compacts maintain control over the disposition of LLRW generated within their state or compact. The resolution and order was also amended to delete the provision regarding the statutory milestone requirements since those milestones were no longer relevant. According to the executive director of the Northwest Compact, the compact retains the right to modify or rescind this authorization at any time. In 1998, Utah issued a license amendment for Envirocare to accept all types of class A low-level waste. To date, the Northwest Compact has not approved sending LLRW generated within the compact states, including Utah, to the Envirocare disposal facility.

State Regulators

The Utah Department of Environmental Quality has licensing and regulatory authority for the Envirocare facility. Envirocare's license has been amended at least 10 times to allow more types of radioactive waste including in 1991 when the state permitted disposal of low-level waste, in 1995 when Envirocare became the only commercial disposal facility

²⁴The Low Level Radioactive Waste Policy Amendments Act of 1985 gave compacts the ability to exclude waste outside each compact's regional boundaries.

²⁵One milestone, for example, set a deadline of January 1, 1992, for states and compacts to submit a license application for disposal facilities in their respective regions. Another milestone required that if a state did not have a viable disposal facility by January 1, 1996, a state or state(s) in a compact must take title to the waste when requested by generators. However, in 1992, the U.S. Supreme Court ruled that this provision was unconstitutional. *New York v. United States*, 505 U.S. 144 (1992).

licensed for mixed waste, and in 2001 when Utah approved an amendment for Envirocare to accept all types of class A waste.²⁶

On July 9, 2001, the Utah Department of Environmental Quality approved Envirocare's license application to accept class B and C wastes. Appeals were filed and on February 10, 2002, the department affirmed the approval. In March 2003, the Governor of Utah signed a bill placing a moratorium on any acceptance of class B or C wastes through February 15, 2005, and requiring legislative and gubernatorial approval for acceptance of these wastes. Enactment of the bill also created a task force composed of 16 state legislators to study radioactive waste, hazardous waste, and commercial solid waste issues in the state, including state policy and an evaluation of fees and taxes imposed on these wastes. The task force will issue a report with specific recommendations by November 30, 2004, on, among other things, whether the state should accept class B and C wastes.

Disposal Operator

Envirocare, a privately owned company, has operated the disposal facility since its inception in 1988. The company said it has about 400 employees and about 250 employees are directly involved with low-level radioactive waste operations. Unlike the Barnwell and Richland sites, Envirocare owns the disposal site land. NRC normally requires institutional ownership of disposal sites in post-closure.²⁷ However, at the inception of a license for the disposal facility in Utah the state's Department of Environmental Quality established a national precedent when it exempted the site from rules requiring institutional ownership. At the time, Utah regulations contained a section compatible with NRC's rule that disposal from other persons would be permitted only on land owned by the federal or state government. Nevertheless, Utah did not have legislative authority to own land used for disposal of LLRW. While the private entity is allowed to own the land indefinitely, the state requires that Envirocare carry a surety fund,

²⁶Allowing all types of class A waste includes containerized class A waste, which is shipped, received, and disposed in remotely-handled sealed containers. By contrast, bulk waste is generally removed from its shipping containers and is "contact-handled" in a process that typically involves compacting the waste in 12-inch layers over the disposal area. Unlike the Barnwell and Richland commercial disposal sites, waste at Envirocare is placed in broad, shallow cells that are designed to finish above-grade. These disposal cells are constructed using native clay and rocks as liner and cap materials.

²⁷According to NRC, Utah exempted Envirocare from the requirement that the federal or state government own the disposal site land.

currently about \$40 million for low level and other wastes, for eventual site closure, decommissioning, and long-term stewardship. Utah will receive the funds if Envirocare should become unable to perform site closure and decommissioning.

Current Conditions

The disposal site has the capacity for more than 20 years of disposal under its current license. According to Envirocare officials, at the beginning of March 2004 the disposal facility had 58.9 million cubic feet of class A waste. The officials anticipate that the disposal facility will accommodate more than 20 years of waste for several reasons, such as a reduction in the annual disposal of waste at Envirocare.

Envirocare typically has a contract condition requiring that its commercial disposal rates not be disclosed. While disposal rates are available for DOE waste, they are not reflective of disposal rates for other LLRW generators. According DOE officials, DOE receives a more favorable disposal rate than generally available to other LLRW generators because DOE can obtain discounted rates from Envirocare given the large volumes of waste it has for disposal and that it can use its own disposal facilities. DOE represents more than half of Envirocare's business. DOE's contract with Envirocare, which expires June 29, 2004, includes disposal rates ranging from a minimum of about \$5.25 per cubic foot for soil to a minimum of about \$14.80 per cubic foot for debris.²⁸ Most DOE waste is shipped to Envirocare in bulk containers. According to DOE officials, Envirocare's rail access and closer proximity to DOE sites east of Utah provide a disposal cost advantage over using DOE disposal facilities.

Envirocare is subject to fees and taxes on waste disposal. The legislature raised fees and taxes in 2003 after a citizens' initiative to substantially increase the fee and tax structure failed. The state levies a fee of 15 cents per cubic feet of waste and \$1 per curie for radioactive waste. These funds are used to offset program costs for oversight. In addition, each generator pays a fee to the state ranging from \$500 to \$1,300 for a generator site access permit. These funds as well as a \$5,000 fee paid by each broker are for state oversight of the disposal facility. In addition, the state imposes a fee ranging from 5 percent to 12 percent of gross receipts of the disposal operator as general tax revenue to be used in a manner determined by the

²⁸The contract has 4 additional option years. New contracts and revisions may require that additional taxes be included.

state legislature. The amount is based on the type of waste and whether the source is from a government or nongovernmental generator. In addition, as of 2002, Envirocare is required to pay the state a perpetual care fee of \$400,000 per year. Also, Tooele County imposes a 5 percent fee on the operator's gross receipts. In recent years the operator has provided the county about \$4 million annually. Those funds are general tax revenue for the county. According to the disposal operator, on average, Envirocare provides 25 percent of the county's budget. Figure 5 shows the rail unloading facility for disposal of class A bulk waste at the Envirocare facility.

Figure 5: Rail Unloading Facility Associated with Class A Bulk Waste Disposal at the Envirocare Disposal Facility



Source: Envirocare of Utah, Inc.

Richland Disposal Facility

The Richland disposal facility was opened in July 1965. It is situated in Benton County, Washington, approximately 23 miles northwest of the city of Richland, near the center of DOE's 560 square mile Hanford reservation on 100 of the 1,000 acres of land leased by the State of Washington from the federal government in 1964 for 100 years. The state had hoped to

attract other nuclear-related businesses to the site as part of an economic development strategy for the Richland-Kennewick-Pasco region. In 1993, DOE exercised its right under the terms of the lease to reclaim the 900 acres that remained unutilized.

Compact Affiliation

Washington is the current host state for the Northwest Interstate Compact on Low-Level Radioactive Waste Management. Besides Washington, the original members of the compact are Alaska, Hawaii, Idaho, Montana, Oregon, and Utah. The Northwest Compact was established in 1981 and ratified by the Congress in 1985. An eighth state, Wyoming, joined the compact in 1992. Also in 1992, the Rocky Mountain Compact, comprised of Colorado, Nevada, and New Mexico, reached agreement with the Northwest Compact and the state of Washington to send up to 6,000 cubic feet of LLRW to the Richland disposal facility annually, plus a 3 percent per annum growth factor. The Northwest Compact did so because the Rocky Mountain Compact expected generation of only a relatively small volume of LLRW once the decommissioning of its only nuclear power plant (Fort St. Vrain in Colorado) was completed. Since 1993, the Richland disposal facility has been open to LLRW only from generators in the 11 states of the Northwest and Rocky Mountain compacts. Regardless of the state of origin, Richland may accept naturally-occurring and accelerator-produced radioactive material, which is not addressed by the compact. The Richland facility accepted nonradioactive hazardous and mixed wastes until 1985.

State Regulators

Three state regulatory bodies have roles and responsibilities associated with the operation of the Richland disposal facility: the Department of Health, the Department of Ecology, and the Washington Utilities and Transportation Commission. The Department of Health exercises primary regulatory responsibility over the disposal facility. It issues licenses to the facility operator and regulates radioactive materials. A Department of Health inspector examines each shipment of waste prior to disposal to ensure compliance with the requirements of the U.S. Department of Transportation, the NRC, and the State of Washington. The Department of Ecology has primary program responsibility. It issues individual permits for radioactive waste disposal to generators, serves as the site landlord, and monitors the activities of the Northwest Compact. The Washington Utilities and Transportation Commission approves the disposal fees on an annual basis. Fees are set at a rate estimated by the facility operator, US Ecology, to produce enough revenue to cover all costs of operating the facility and provide a 29 percent profit. As an integral part of the fee

setting process, the operator polls site users to obtain their projections for how much waste they plan to ship in the coming year. These estimates are the basis on which fees are set.

Disposal Operator

The private, for-profit contractor, US Ecology Incorporated, a subsidiary of Boise, Idaho-based American Ecology Corporation, and its corporate antecedents, has operated the Richland disposal facility since it opened. According to company officials, there are currently 18 US Ecology employees working at the Richland facility, in addition to 4 administrative staff.

Current Conditions

The Richland facility has much unused capacity to accept LLRW. According to state regulators and company officials, the remaining capacity at Richland is approximately 21 million cubic feet. To date the facility has disposed of approximately 13.9 million cubic feet of LLRW in 20 trenches. About 95 percent of the waste received is class A. There has been a significant decline in disposal volumes since 1993, when the Northwest Compact placed restrictions on the origin of the waste that the Richland disposal facility could accept. In the 5 years preceding these restrictions, the average annual amount of LLRW waste disposed was 395,000 cubic feet. In the 11 years since Richland began excluding waste from outside the Northwest and Rocky Mountain Compacts, the average amount of waste disposed annually is about 142,000 cubic feet, though individual years have been as high as 282,000 and as low as 61,000. At the current rates of disposal, fewer than 10 more trenches will be filled, or approximately 60 percent of the total available disposal capacity, when the facility is expected to close in 2056, 7 years before the state lease on the land expires.

Disposal fees and other assorted fees for LLRW or naturally-occurring and accelerator-produced radioactive material waste at Richland are lower than the Barnwell disposal facility, but generally higher than those charged by Envirocare of Utah. Unit costs for disposal are calculated on a declining volume scale. That is, the lower the volume of waste disposed in a given year the higher the unit costs of disposal must be in order to reach the annual, state-approved revenue requirement. Generators pay a number of fees and surcharges to the State of Washington and US Ecology on each cubic foot they dispose at Richland. The state charges a site use permit fee that varies according to volume. For example, fees for waste disposed between March 1, 2004, and February 28, 2005, range from \$425 for up to 50 cubic feet to \$14,840 for 2,500 cubic feet and more. Nuclear utilities and

brokers pay flat annual site use permit fees of \$42,400 and \$1,000, respectively. The state also imposes other fees and taxes to support local economic development, state agency expenses directly related to the regulation and operation of the facility, and for the Perpetual Care and Maintenance Fund. Unlike the other two commercial LLRW disposal facilities, none of these fees or taxes go directly to the state's general revenue fund. The facility also pays a business and occupation tax.

In addition to the state fees, generators also pay US Ecology's disposal charges, which are based on an annual revenue requirement authorized by the Washington Utilities and Transportation Commission. All LLRW disposed at Richland is assessed charges based on access, volume, shipment(s), container(s), and exposure. For example, based on a projected disposal volume of 50,000 cubic feet of LLRW in 2004 and an annual revenue requirement of approximately \$5.4 million, the site operator charges average approximately \$108 per cubic foot. The surcharges assessed by the state on disposed waste would generate another \$325,000 for local government (\$6.50 per cubic foot), \$450,000 to cover the regulatory costs of the Washington Department of Health (\$9.00 per cubic foot), and at least \$230,000 in site use permit fees to cover the regulatory costs of the Washington Department of Ecology and the administrative expenses of the Northwest Compact. The sum of these fees, charges, and surcharges paid by generators to the state and US Ecology in 2004 is expected to total approximately \$6.4 million. These associated fees increase the average cost of disposal of LLRW to approximately \$128 per cubic foot. This average is calculated based on the expectation that 95 percent of the waste disposed will be class A; typical class B and C waste disposal costs per cubic foot would be higher than this average as activity and other surcharges, which could be considerable, would apply.

There is a strong desire to control the origin, and therefore the volume and nature of the waste disposed at Richland. The State of Washington was a lobbying force behind passage of the Act that allowed compacts to restrict access to disposal facilities. The state and US Ecology have agreed in concept to a new clause in the sublease agreement, which is expected to be renewed in 2005, providing for termination of the sublease if federal law eliminates the Northwest Compact's restrictive authority on waste importation. This policy is also reflected in the host state agreements with the Northwest Compact and indirectly with the Rocky Mountain Compact. Terminating the sublease would effectively shut down the disposal facility. Figure 6 shows the LLRW disposal trench at the Richland disposal facility.

Figure 6: LLRW Disposal Trench at the Richland Disposal Facility



Source: US Ecology, Inc.

Appendix II: LLRW Legislative Options

The inability of states to develop any new regional disposal facilities since passage of the Low-Level Waste Policy Act (the Act) and occasional shortfalls in disposal availability have perpetuated debate about the need for further congressional intervention. GAO reported on the status of commercial LLRW disposal in 1995 and 1999. In our last report, we assessed three management options to address concerns about limited or no disposal access for generators of LLRW. While we acknowledged that LLRW could be stored for decades or even longer in assured isolation facilities, we noted that storage would only postpone, not replace, the need for disposal. The three options were (1) allowing the compact system under existing federal legislation to adapt to the changing LLRW situation, (2) repealing the existing federal legislation to allow market forces to respond to the changing LLRW situation, and (3) using DOE disposal facilities for commercial waste. The changes that occurred since our 1999 report affect the viability of these options in various ways, particularly the status quo option to maintain the existing compact system if no disposal options are available for class B and C wastes after mid-2008.

Retain the Compact Approach

Proponents of retaining the compact approach cite the degree of control that states exercise over LLRW management and flexibility in meeting changing circumstances. For example, facing declining waste volumes and satisfactory access to existing disposal facilities, states and compacts were able to avoid building expensive facilities that were not needed. In addition, an existing non-LLRW disposal facility was allowed to accept high volume, low-activity radioactive wastes nationally, even though it was located in a state that already had access to a licensed LLRW disposal facility. Further, under the compact system states were allowed to move from one compact to another or to become unaffiliated, and two compacts decided to share one disposal facility. And, most recently, the state regulator in Texas will begin accepting license applications to develop a new disposal facility that might be open in early 2008.

Opponents of the compact approach point out that, despite all of this flexibility, not one compact has successfully developed a new disposal facility for LLRW despite spending millions to do so. Even the proposed disposal facility in Texas is moving through the approval process having never formed a Texas LLRW disposal compact commission. In 1999, we estimated that collectively, the states and compacts had spent about \$600 million in trying to develop these facilities. Nuclear industry association officials estimate that expenditures may now have reached approximately \$1 billion. Some of these additional costs are associated with ongoing litigation in California, Nebraska, and North Carolina regarding the failure

of these states to fulfill their host state obligations to build LLRW disposal facilities after expenditures had been made to do so. In addition, there are certainly opportunity costs associated with this expenditure, and there may be an incalculable loss of advancement in nuclear research and medicine because the cost of disposal or lack of options may have diminished the desire to use radioactive materials. This option to maintain the status quo, as discussed in our 1999 report, may no longer be tenable if there are no assured safe, reliable, and cost-effective disposal options put forward to address a potential shortfall in disposal availability for class B and C wastes after mid-2008.

Repeal the Compact Legislation

Opponents of the compact system have called for repealing the LLRW Policy Act because of the unsuccessful attempts to develop new regional LLRW disposal facilities, coupled with authority under the Act to restrict access to existing commercial facilities that otherwise have disposal capacity. Eliminating access restrictions would allow commercial disposal operators to better adapt and respond to changing market conditions. And, repeal of the legislation could create a national LLRW disposal market that might lead to more competition and lower disposal fees.

It would probably be difficult to build enough political support to repeal the LLRW Policy Act, however, given no imminent national crisis in the short term, and some states would likely resist opening their disposal facilities nationally. Even if the Congress repealed the Act, it would not necessarily affect the existence of each compact consented to prior to repeal. This would mean that a compact provision prohibiting the acceptance of waste for disposal from outside the compact region would continue in effect. However, under the Act, each compact must provide that the Congress may withdraw its consent every 5 years after the compact has taken effect.²⁹ Apart from congressional action, states with privately managed disposal facilities could decide not to renew the disposal operators' leases located on state-owned land. In addition, states that are concerned about the extent to which they would be able to restrict access to a commercial disposal facility within their borders might erect administrative barriers to developing such a facility.

²⁹42 U.S.C. §2021d(d). In addition, under the terms of the statutes providing congressional consent to the compacts, the Congress may alter, amend, or repeal each statute providing consent after 10 years. Even without these provisions, the Congress could pass specific legislation withdrawing its consent at any time because a previous Congress cannot bind a future one.

Use DOE Disposal Facilities for Commercial Waste

The capping of disposal volumes through mid-2008 at Barnwell and restrictions on access to only Atlantic Compact member states after this time have heightened interest in having DOE open its disposal facilities to at least some commercial LLRW. Access might be allowed on an interim basis, as requested in the past by California generators, or permanently. According to NRC officials, the Act established a compact system that has not provided reliable and cost-effective disposal options to generators of LLRW, forcing many of them to store their waste. Establishing federal responsibility for disposal of at least the class B and C wastes would be similar to federal responsibilities for greater-than-class C waste, transuranic, and high-level waste. This approach would also be consistent with the management approaches taken by some European countries.

Similar to the commercial disposal facilities in Richland and Barnwell that are operated by private companies on state-leased land, contractors manage and operate the two principal DOE disposal facilities on federal land.³⁰ These two DOE disposal facilities in Nevada and Washington accept waste that exists on site, as well as from other department sites across the country. Each of these facilities has enormous capacity to accept LLRW. In 1999, about 171 million cubic feet of space was available at these two sites, with DOE estimating that it would only use less than 30 million cubic feet for its cleanup waste. This estimate may even be lower given the increasing volume of DOE waste that is being sent to a commercial disposal facility.

In the past, DOE disposal facilities have not been considered appropriate repositories for commercial waste, but commercial facilities were viewed as appropriate for receiving DOE waste. The federal government has encouraged the development of private LLRW disposal facilities since the early 1960s when the volumes of waste were increasing at the same time as the cost of disposal in the ocean. As an interim measure, the AEC allowed such waste to be disposed of at its own facilities at the Idaho National Engineering Laboratory and at the Oak Ridge National Laboratory until commercial disposal facilities became available. As an incentive, in 1963, the AEC instructed its sites without disposal facilities to use commercial facilities for unclassified waste disposal.

³⁰As discussed in appendix I, US Ecology operates the Richland commercial disposal facility on land that the federal government has leased to the State of Washington for 100 years.

The proposed use of DOE facilities for commercial waste disposal would require resolution of a number of issues and may require legislation. These issues include whether DOE is presently authorized to accept commercially generated LLRW waste at its disposal sites. While previous AEC sites accepted commercial waste for a short time, it is not clear whether DOE currently has such authority. Another issue to be resolved is who (for example, generators, states, or DOE) would be responsible for paying the additional cost for disposing of commercial waste at DOE facilities and whether DOE would be allowed to keep any funds it receives. (Funds received by an agency normally must be paid into the U.S. Treasury, unless federal legislation authorizes the agency to retain the funds.) An additional issue concerns the potential licensing and regulation of a DOE facility that accepts commercial waste. The NRC and Agreement State regulations that govern commercial facilities do not apply to DOE disposal facilities or the wastes that are shipped to these facilities.

Shifting waste to DOE facilities might also have the adverse effect of eliminating the financial viability of commercial disposal facilities and possibly putting DOE disposal facilities in competition with private facilities. However, one option might be to commercialize the DOE facility in Nevada by leasing at least some of the existing disposal site to the state, as is done in Washington for the commercial facility on DOE's Hanford site. Nevertheless, given the significant excess capacity at DOE disposal facilities, there might not be any incentive to develop new commercial disposal facilities. Without any new disposal facilities, most waste would be shipped to Nevada and Washington, which have objected in the past to having to accept a disproportionate burden of LLRW disposal.

Appendix III: Scope and Methodology

To obtain information on changes in LLRW management conditions since our 1999 report, we interviewed regulators and disposal operators in states that have commercial disposal facilities or are considering opening one. We visited the Barnwell disposal facility and met with disposal site operators and state and Southeast Compact officials. In Texas, we met with state regulators and legislative staff. We interviewed DOE and NRC officials, and representatives of the nuclear power industry, the Department of Defense executive agent for LLRW, and several environmental groups. We also interviewed generators and waste processors in California, Texas, Maryland, and Tennessee that were suggested to us by various LLRW stakeholders in the course of this review. In addition, we met several times with members and officers from an independent nonprofit association of LLRW stakeholders, including obtaining feedback from this association on our preliminary findings during a March 2004 meeting. Finally, we reviewed applicable laws and regulations, including the Atomic Energy Act, as amended, and the LLRW Policy Act, as amended.

In gathering information on recent annual disposal volumes, we relied on data provided to us by the three commercial disposal facility operators because, in contrast to MIMS data, these data included DOE waste and they were current through 2003. We also determined that MIMS data had other shortcomings in its reliability that hindered its usefulness for other types of analysis, such as sources of waste by state and generator type. These and other concerns prompted us to more closely examine the department's internal controls over this database. In doing so, we reviewed DOE documents and written and oral DOE responses to our questions about the structure, development, and management of these data. We also interviewed, and in some cases surveyed, users of MIMS regarding their assessment of the database's reliability. While we did not independently verify the reliability of the data obtained from the disposal facility operators, we relied on these data for our analysis for the reasons stated and because they are the primary source data input into the national LLRW database. To gather available data and analysis on projected future disposal volumes, we interviewed a spectrum of LLRW stakeholders, including state regulators, disposal facility operators, waste processors, compact officials, and DOE officials. We also reviewed documents from the EPA, the National Research Council, and the International Atomic Energy Agency to obtain information relating to the current management of LLRW.

To obtain information on any current or anticipated shortfalls in LLRW disposal availability, we interviewed state regulators, compact officials,

and disposal site operators in South Carolina, Utah, and Washington, and reviewed the planning documents they provided to us. This review allowed us to estimate how much disposal capacity remains at each of the commercial disposal facilities given current disposal volumes accepted at each facility and other factors, such as licensing agreements and compact restrictions on disposal access to these facilities. We also reviewed relevant state legislation and other activities pertaining to the regulation of the disposal facilities in these states, monitored activities in Texas, which is accepting applications for a new disposal facility, and tracked the effects of LLRW disposal litigation between the Central Compact and Nebraska.

To determine the effects, if any, on LLRW generators of any shortfalls or other difficulties associated with the disposal of this waste, we initially relied on the interviews that we had with representatives from biotechnology companies, environmental groups, hospitals, LLRW processors, and nuclear power plants. We also used our survey of compact and unaffiliated state officials to identify any documented adverse effects when generators had limited or no disposal option for their LLRW. This research led us to collaborate with the University of Texas Health Science Center in Houston on two nonscientific sample surveys of radiation safety officers and Health Physics Society members to identify any actual (since 1999) or potential adverse effects on biomedical research and clinical practice resulting from costs or difficulties related to the storage and disposal of LLRW. The E-mail survey of radiation safety officers was conducted through the approximately 2,000 subscribers to the Radsafe Listserv. The approximately 6,000 members of the Health Physics Society, a scientific and professional organization whose members specialize in occupational and environmental radiation safety, were invited to participate in a survey through a notice in the Society's monthly newsletter, Health Physics News. These surveys are considered nonscientific sample surveys of self-selected respondents from a nonprobabilistic sample of a largely unknown list of people, and there is overlap in affiliation between the samples. Our work was conducted between August 2003 and May 2004 in conformance with generally accepted government auditing standards.

Appendix IV: Comments from the Department of Energy

Note: GAO comment supplementing those in the report text appear at the end of this appendix.



Department of Energy

Washington, DC 20585

May 20, 2004

Ms. Robin M. Nazzaro
Director
Natural Resources and Environment Team
United States General Accounting Office
Washington, DC 20548

Dear Ms. Nazzaro:

My office has reviewed the draft report entitled *Low-Level Radioactive Wastes: Disposal Availability Adequate in Short Term, but Oversight Needed to Identify Any Future Shortfalls* (GAO-04-604). The information in the report demonstrates an enormous amount of work by the General Accounting Office (GAO) and extensive interaction with the Department of Energy as well as other federal agencies, states, industry groups, waste generators, and other stakeholders.

We agree with your assessment that existing commercial low-level radioactive waste (LLRW) disposal availability is adequate for the near future. We offer no opinion on the recommendation that Congress consider directing the Nuclear Regulatory Commission to perform data gathering and oversight of commercial low-level waste (LLW) disposal.

However, we disagree with the recommendation that the Secretary of Energy halt dissemination of information contained in the online national LLW database, known as the Manifest Information Management System (MIMS). The report's characterization of the usefulness of the MIMS data does not fully represent the utility of the system, and removal of MIMS without an alternative would evoke sharp criticism from states and regional compacts who use it as a source of information on radioactive waste disposal. MIMS was developed and is now maintained to address a requirement in the National Low-Level Waste Policy Act of 1980. Specifically, the Department was required to establish "a computerized data-base to monitor management of low-level radioactive wastes" (Section 7.(a)(1)). If MIMS were no longer available without another alternative being developed, DOE's compliance with the Act could be questioned.

The enclosure provides additional comments on the report to correct some misunderstandings and accurately present the current status of commercial LLW management.



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See comment 1.

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If you have any questions, please contact Ms. Alice Williams, Associate Deputy Assistant Secretary for Logistics and Waste Disposition Enhancements, at (202) 586-0370.

Sincerely,


Jessie Hill Roberson
Assistant Secretary for
Environmental Management

Enclosure

The following is GAO's comment on the Department of Energy's letter dated May 20, 2004.

GAO Comment

1. DOE disagreed with our recommendation to halt dissemination of information in its national LLRW database. DOE stated that our report did not adequately characterize the usefulness of MIMS, and that removal of the national LLRW database without an alternative would evoke criticism from states and regional compacts and would not fulfill the requirement in the Act to maintain such a database. Our recommendation did not call for removal of this database. Instead, we recommended halting dissemination of information in this database as long as the database has internal control weaknesses and shortcomings in its usefulness and reliability. This action would prevent user access to DOE's online database. With regard to the usefulness of MIMS, our report noted that state and compact officials use MIMS for various purposes; however, the consensus among the officials we surveyed was that they could more effectively regulate and monitor LLRW if MIMS offered more comprehensive and reliable data. DOE did not address our concerns about internal control weaknesses and other shortcomings in the database. We stand by our recommendation to DOE because we believe that it is inappropriate to disseminate information that is known to be unreliable and incomplete.

Appendix V: Comments from the Nuclear Regulatory Commission

Note: GAO comments supplementing those in the report text appear at the end of this appendix.



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

May 25, 2004

Ms. Robin M. Nazzaro, Director
Natural Resources and Environment
United States General Accounting Office
441 G Street, NW
Washington, D.C. 20548

Dear Ms. Nazzaro:

Thank you for the opportunity to review and submit comments on the May 2004 draft of the General Accounting Office's (GAO) report entitled "Low-Level Radioactive Waste: Disposal Availability Adequate in Short Term, but Oversight Needed to Identify Any Future Shortfalls" (GAO-04-604). The U.S. Nuclear Regulatory Commission (NRC) appreciates the time and effort that you and your staff have taken to review this topic.

The GAO report provides an accurate summary of current low-level radioactive waste (LLRW) disposal activities and potential issues that may be encountered in the future. It also recommends that Congress consider directing NRC to gather information necessary to monitor the adequacy of LLRW disposal and the safety and security of stored waste, and to report to Congress if LLRW management conditions should change enough to warrant consideration of new legislation to ensure safe, reliable, cost-effective disposal availability. We fully support the goal of having a safe, reliable, and cost-effective system for the disposal of LLRW in the U.S. It is also our view that other actions in place of those GAO is recommending would be more effective in moving towards this goal, as we discuss below and in our more detailed enclosed comments.

The current report is a sequel to GAO's 1999 report, "Low-Level Radioactive Wastes: States Are Not Developing Disposal Facilities" (GAO/RCED-99-238). That report concluded that none of the States' or compacts' efforts to develop new disposal capacity had been successful and the State efforts to do so had "essentially stopped." This earlier report also examined alternatives to the current system for development of new disposal capacity in the U.S., but did not recommend any of them. Appendix II of the current report updates those alternatives. We believe that it is now time for GAO to explore these alternatives further because the future availability of disposal capacity and the costs of disposal under the current system remain highly uncertain and LLRW generators need predictability and stability in the national disposal system. We acknowledge that the potential approval for Envirocare to accept Class B and Class C wastes and licensing of a LLRW waste disposal facility in Texas could significantly improve the current LLRW disposal system in the U.S. At the same time, the nearly 20 years of experience under the Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLRWPA) has demonstrated the difficulties in siting and licensing a LLRW facility. Not one new facility has been developed in this time under the LLRWPA. Therefore, we believe it is in the national interest to begin exploring the alternatives identified in Appendix II that would potentially provide a better legal and policy framework for new disposal options for commercial generators of LLRW.

See comment 1.

Appendix V: Comments from the Nuclear
Regulatory Commission

R. Nazzaro

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See comment 2.

We also believe that the specific recommendations in your current report for NRC to monitor LLRW disposal adequacy, safety, and security of stored wastes, and to report to Congress when new legislation needs to be considered, will not be effective or efficient. Most of the data to be collected are not related to, or needed for, carrying out our mission to protect public health and safety and promote the common defense and security. We believe that such monitoring and reporting, if necessary, would fall within the responsibility of the Department of Energy (DOE), as was previously recognized by Congress in LLRWPA. Also, until 2000, much of this data was required to be collected by DOE per the LLRWPA of 1985 because such data collection was inconsistent with NRC's health and safety mission.

See comment 3.

The regulatory costs associated with complying with this recommendation are not balanced by the negligible benefits. Although we have not fully considered all of the types of data that would need to be collected, it would include such information as DOE's plans for disposal at commercial sites, cost information for disposal and processing, future waste generation rates for NRC and Agreement State licensees, the status of court decisions affecting LLRW disposal, and specific details of plans for disposal facilities in the U.S. (such as the proposed Texas facility). The recommendation would also have NRC and Agreement States collect information on the security and safety of stored waste. The 33 NRC Agreement States license most of the uses of radioactive materials in the U.S., and any safety and security data collection requirements would have to be implemented by them, as well as NRC. This could involve rulemaking within each of the Agreement States. An NRC rulemaking would require Office of Management and Budget clearances for requiring this information to be submitted, presumably annually. For NRC to request that Agreement States obtain this information and carry out similar monitoring would likely result in Agreement State requests for NRC funding. Without such funding, the Agreement States would likely view such a workload as an unfunded mandate.

See comment 3.

NRC is already taking other actions, described in our detailed comments in the enclosure, to identify radioactive materials of concern, including LLRW, and to enhance their safety and security. It is our view that the actions we are currently implementing will adequately ensure safety and security of radioactive materials, including stored LLRW.

See comment 3.

The report notes that NRC is in the process of conducting vulnerability studies, but fails to mention other actions NRC has taken to manage and minimize these risks. The comprehensive vulnerability assessments involve all licensees in the industrial and medical areas, including those with LLRW storage and disposal. The results of these assessments will include recommendations for graded approaches to security enhancements based on overall risk of particular facilities. The risks from LLRW storage will be appropriately factored into the NRC staff recommendations.

See comment 4.

Further, we do not agree that LLRW is an attractive target for adversaries. Much of this material is dispersed radioactive material within other non-radioactive waste materials and, in this form, requires procurement of large volumes of material to obtain significant quantities of radioisotopes of greatest security concern. We do consider that spent sealed sources (discrete radioactive sources), which are collected by licensed waste brokers and either recycled or packaged and transported for disposal, present a potential vulnerability. The NRC, through the Materials Security Working Group, is addressing the security risks associated with this group of licensees and will be issuing enhanced security measures as part of its ongoing efforts to

**Appendix V: Comments from the Nuclear
Regulatory Commission**

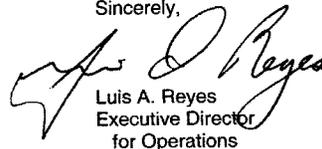
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address security for medium-priority radioactive materials licensees. The NRC has completed the enhanced security measures for high-priority licensees (e.g., reactor licensees) and anticipates completing enhanced security measures for the medium-priority radioactive materials licensees by December 2004. These measures consider all radioactive materials at licensees' facilities (both for NRC and Agreement State licensees). In addition, the NRC has undertaken other efforts to enhance security, such as establishing an interim database for sealed sources and ultimately establishing a National Source Tracking System.

Our detailed comments on the draft report are enclosed. If you have any questions on our comments or would like to discuss these issues further, please contact Melinda Malloy of my staff at 301-415-1785.

Sincerely,



Luis A. Reyes
Executive Director
for Operations

Enclosure:
Comments on Draft GAO Report

cc: D. Feehan, GAO (Denver)

See comment 3.

The following are GAO's comments on the Nuclear Regulatory Commission's letter dated May 25, 2004.

GAO Comments

1. We disagree with NRC's suggestion that GAO commence a study to explore alternative options to the current LLRW management system. Given current disposal availability through mid-2008, and uncertainties about future disposal availability, we believe that such an evaluation by us is not needed at this time. As long as NRC places no time limits on LLRW storage and provides assurance that it is safe and secure, any shortfalls in disposal capacity would be manageable in the short-term.
2. We disagree with NRC's position that it would be outside its mission to report to the Congress on changes in disposal availability and the conditions of stored waste. As the federal agency with statutory responsibility to protect public health and safety and promote the common defense and security, NRC is responsible for overseeing the use, storage, and disposal of radioactive materials. NRC and Agreement State agencies already have license and inspection programs in place to monitor the safety and security of stored waste. NRC is the agency that developed the manifest that is the only mechanism available to track LLRW nationally. According to NRC, it has also begun to establish an interim database for sealed sources, some of which become LLRW, that may lead to establishing a National Source Tracking System. As such, we believe that NRC is the most appropriate agency to determine when the safety and security of stored LLRW are approaching a level of risk that might warrant congressional assessment of legislative options to ensure disposal availability for all LLRW, and to consider disposal costs as a factor behind storing LLRW even if disposal options are available. In our opinion, DOE is no longer the most appropriate agency to oversee states' management of LLRW given that it has become the major user of commercial disposal facilities since establishment of the Act, as amended, and that the Congress eliminated its reporting responsibilities under the Act.
3. We agree with NRC that there is no need for a congressional directive to require that NRC gather additional information necessary to monitor disposal availability and the safety and security of stored waste. In commenting on our draft report, NRC provided information on data gathering actions already in place at or planned by NRC to adequately ensure the safety and security of radioactive materials, including stored LLRW. Given these actions and the concerns of NRC with the regulatory cost of complying with our suggested actions, such as

additional rulemaking, we eliminated our suggested congressional action in this regard.

4. We are not in a position to independently judge if LLRW is or is not an attractive target for terrorists. We do point out in our report that one study found that a few radioisotopes of greatest security concern are classified as LLRW. More importantly, this cited study noted that while use of these materials in radiological dispersal devices, such as a dirty bomb, are not weapons of mass destruction, they could cause mass disruption, dislocation, and adverse financial consequences associated with decontamination and rebuilding. Interviews we conducted with generators of LLRW also identified other threats posed by the unintentional dispersal of radiological materials that could be caused by fires, floods, and earthquakes that have raised public concerns and the perception of risk.

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