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LOW-LEVEL RADIOACTIVE WASTE

Status of Disposal Availability in the United States and Other Countries

Statement of Gene Aloise, Director
Natural Resources and Environment

May 2008

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Highlights

Highlights of GAO-08-813T, testimony before the Subcommittee on Energy and Air Quality, Committee on Energy and Commerce, House of Representatives

Why GAO Did This Study

Disposal of radioactive material continues to be highly controversial. To address part of the disposal problem, in 1980, Congress made the states responsible for disposing of most low-level radioactive waste (LLRW), and allowed them to form regional compacts and to restrict access to disposal facilities from noncompact states. LLRW is an inevitable byproduct of nuclear power generation and includes debris and contaminated soils from the decommissioning and cleanup of nuclear facilities, as well as metal and other material exposed to radioactivity. The Nuclear Regulatory Commission (NRC) ranks LLRW according to hazard exposure—class A, B, C, and greater-than-class C (GTCC) waste. The states are responsible for the first three waste classes, and the Department of Energy (DOE) is responsible for GTCC. Three facilities dispose of the nation's commercial and some DOE LLRW—in Utah, South Carolina, and Washington State.

The testimony addresses (1) LLRW management in the United States and (2) LLRW management in other countries. It is substantially based on two GAO reports: a June 2004 report (GAO-04-604) and a March 2007, report (GAO-07-221) that examined these issues. To prepare this testimony, GAO relied on data from the two reports and updated information on current LLRW disposal volumes, facility capacity, and accessibility.

To view the full product, including the scope and methodology, click on GAO-08-813T. For more information, contact Gene Aloise at (202) 512-3841 or aloisee@gao.gov.

What GAO Found

As GAO reported in 2004, existing disposal facilities had adequate capacity for most LLRW and were accessible to waste generators (hereafter referred to as disposal availability) in the short term, but constraints on the disposal of certain types of LLRW warranted concern. Specifically, South Carolina had decided to restrict access to its disposal facility—which was accepting about 99 percent of the class B and C wastes generated nationwide—to only waste generators in the three states of its compact. If there is no other disposal option for class B and C wastes after 2008, we found that 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 that LLRW be disposed of, it allows on-site storage as long as the waste remains safe and secure. In contrast, disposal availability for domestic class A waste is not a problem in the short or longer term. In 2004, GAO reported that the Utah disposal facility—which was accepting about 99 percent of this waste generated nationwide—could accept such waste for 20 years or more under its current license based on anticipated class A waste volumes. Since 2005, the volume of class A waste disposed of has declined by two-thirds primarily because DOE completed several large cleanup projects, extending the capacity of the Utah facility for an additional 13 years, for a total of 33 years of remaining disposal capacity. However, the June 2004 analysis, and our updated analysis, were based on the generation of LLRW only in the United States and did not consider the impact on domestic disposal capacity of importing foreign countries' LLRW.

Ten of the 18 countries surveyed for GAO's March 2007 report have disposal options for class A, B and most of C wastes, and 6 other countries have plans to build disposal facilities for this LLRW. Only 3 countries indicated that they have a disposal option for some class C and GTCC wastes; however, almost all countries that do not provide disposal for LLRW have centralized storage facilities for this waste. Only Italy reported that it had no disposal or central storage facilities for its LLRW, although it plans to develop a disposal site for this waste that will include waste from its decommissioned nuclear power plants and from other nuclear processing facilities. Italy initially expected this disposal site to be operational by 2010, but local governments' resistance to the location for a disposal site has delayed this date. The March 2007 report also identified a number of LLRW management approaches used in other countries that may provide lessons to improve the management of U.S. radioactive waste. These approaches include the use of comprehensive national radioactive waste inventory databases and the development of a national radioactive waste management plan. Such a plan would specify a single entity responsible for coordinating radioactive waste management and include strategies to address all types of radioactive waste. GAO had recommended that NRC and DOE evaluate and report to the Congress on the usefulness of these approaches. While the agencies have considered these approaches, they expressed particular concerns about the resources needed to implement some of them.

Mr. Chairman and Members of the Subcommittee:

We are pleased to be here today to discuss our past work on the management of low-level radioactive waste (LLRW) as the Subcommittee considers H.R. 5632, which would prohibit the importation of certain LLRW into the United States. LLRW is an inevitable byproduct of nuclear power generation and of government, industrial, academic, and medical uses of radioisotopes. It includes items such as rags, paper, liquid, glass, metal components, resins, filters, and protective clothing that have been exposed to radioactivity or have been contaminated with radioactive material. LLRW also includes debris, rubble, and contaminated soils from the decommissioning and cleanup of nuclear facilities. Almost 30 years ago federal legislation addressed the need to dispose of LLRW, but management of LLRW continues to be a concern. Under the LLRW Policy Act of 1980, as amended (the act), each state is responsible for providing for the disposal of LLRW generated within the state, either by itself or in cooperation with other states. States are not responsible for waste produced by the Department of Energy (DOE) or the nuclear propulsion component of the U.S. Navy. The aim of the act was to provide for the safe and effective management of LLRW disposal capacity on a regional basis. 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.[1]

[1] There are 10 compacts: the Appalachian, Atlantic, Central, Central Midwest, Northwest, Midwest, Rocky Mountain, Southeast, Southwestern, and Texas Compacts. Together, these 10 compacts encompass 43 states. Generators of LLRW located in a compact or in unaffiliated states that do not have their own disposal facility can contract with a disposal facility in another compact if the other compact allows them to do so.

The Nuclear Regulatory Commission (NRC) is responsible for licensing LLRW disposal sites and has divided the wastes covered by the act into categories of increasing levels of hazard exposure, beginning with class A—the least hazardous category—followed by class B and class C.[2] There is also a fourth category, known as greater-than-class-C (GTCC) waste, which DOE is responsible for disposing of. NRC has relinquished to 34 states—called "Agreement States"—portions of its authority to license and regulate the use and disposal of radioactive materials. Although NRC has not licensed any disposal facilities, the Agreement States have licensed three commercial LLRW disposal facilities: one in Clive, Utah, operated by Energy*Solutions*, accepts almost all of the nation's class A waste; one in Barnwell, South Carolina, also operated by Energy*Solutions*, accepts almost all of the nation's class B and class C waste; and one in Richland, Washington, operated by US Ecology, accepts class A, B, and C wastes from the 11 states of the Rocky Mountain and Northwest LLRW compacts. Currently, there is no disposal facility for GTCC waste, although DOE is studying the feasibility of various disposal options.

Disposal of radioactive material continues to be highly controversial. We found that the impetus to develop new disposal facilities has been dampened by many factors, including decreases in disposal volumes, existing disposal availability, rising costs of developing a new facility, and public and political resistance in states designated to host these facilities. The United States is a large generator of LLRW because it has 104 nuclear power reactors and thousands of radioactive material licensees. NRC has reported that future disposal availability and the costs of disposal under the current system remain highly uncertain and waste generators need predictability and stability in the national

[2] The classification of waste is determined by the type of radionuclide (e.g., americium-241) and the

disposal system. Disposal availability for LLRW is also a concern in some foreign countries. Specifically, 29 other countries generate electricity from 331 nuclear power reactors, and many others generate LLRW from academic, industrial, and medical uses of radioactive material. Like the United States, these countries face LLRW disposal challenges.

Our testimony today is substantially based on two reports: (1) our June 2004 report, which examined the adequacy of LLRW disposal availability for class A, B, and C wastes,[3] and (2) our March 2007 report, which examined the approaches foreign countries use to manage their LLRW.[4]

To prepare this testimony, we relied on data from our two reports and updated information on domestic LLRW disposal availability and volumes. Estimates of disposal volumes and capacity came from the operators that we interviewed for our June 2004 report. We updated the information from an LLRW database through discussions with a cognizant DOE official. Information on disposal availability for foreign countries came directly from survey information that we used in preparing the 2007 report. Information on Italy came from survey data and supplemental reports. We conducted the work in the prior reports we used in preparing this testimony and the work we conducted in updating LLRW disposal information in accordance with generally accepted government auditing standards.

In summary, we found the following:

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concentration of radioactivity (often measured in curies per gram).

[3] GAO, *Low-Level Radioactive Waste: Disposal Availability Adequate in the Short Term, but Oversight Needed to Identify Any Future Shortfalls*, GAO-04-604 (Washington, D.C.: June 9, 2004).

As we reported in June 2004, existing disposal facilities had adequate capacity for most LLRW and were accessible to waste generators (hereby referred to as disposal availability) in the short term, but constraints on the disposal of class B and C wastes warranted concern. Specifically, South Carolina had decided to close the Barnwell disposal facility to noncompact states by mid-2008. When this restriction begins on June 30, 2008, Barnwell, which currently accepts about 99 percent of the nation's commercial class B and C wastes, will be available only to waste generated in three states. If after this date 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, it allows on-site storage as long as the waste remains safe and secure. In contrast, disposal availability for domestic class A waste is not a problem in the short or longer term. We reported in June 2004 that the Clive, Utah, disposal facility, was accepting about 99 percent of the nation's class A waste and could accept such waste for 20 years or more under its current license based on then-projected class A disposal volumes. Since 2005, the volume of class A waste disposed of has declined by two-thirds primarily because DOE has completed several large cleanup projects. This has extended by 13 years the time when this facility will be expected to reach its capacity. It is important to note, however, that our June 2004 analysis and our updated analysis of the availability of disposal capacity for class A, B, and C wastes was based only on the generation of this waste in the United States and did not consider the impact on domestic disposal capacity of importing foreign countries' LLRW.

[4] GAO, *Low-Level Radioactive Waste Management: Approaches Used by Foreign Countries May Provide Useful Lessons for Managing U.S. Radioactive Waste*, GAO-07-221 (Washington, D.C.: March 21, 2007).

Ten of the 18 countries we surveyed for our March 2007 report have disposal options for LLRW similar to U.S. classes A, B and most of C wastes, and 6 other countries indicated that they have plans to build such facilities. Only 3 countries indicated that they have a disposal option for LLRW similar to some class C waste and all GTCC waste. However, almost all of the countries that do not provide disposal for LLRW provide centralized storage facilities for this waste. Only Italy reported that it had no disposal or central storage facilities for its LLRW, although Italy indicated in our survey that it had plans to develop a disposal site for radioactive waste from its decommissioned nuclear power plants and from other nuclear processing facilities. Italy initially expected this disposal site to be operational by 2010, but local governments' resistance to the location of this disposal site has delayed this date. Our March 2007 report also identified a number of LLRW management approaches used in other countries that may provide lessons to improve the management of U.S. radioactive waste. These approaches include the use of comprehensive national radioactive waste inventory databases and the development of a national radioactive waste management plan. Such a plan would specify a single entity responsible for coordinating radioactive waste management and include strategies to address all types of radioactive waste. We recommended that NRC and DOE evaluate and report to the Congress on the usefulness of these approaches. While the agencies considered these approaches, they expressed particular concerns about the significant resources required to develop and implement a national inventory and management plan for LLRW.

Background

The disposal of LLRW is the end of the radioactive material lifecycle that spans production, use, processing, interim storage, and disposal. On the commercial side, the nuclear utility industry generates the bulk of this LLRW through the normal operation and maintenance of nuclear power plants, and through the decommissioning of these plants. Other LLRW is generated from medical, industrial, agricultural, and research applications. Common uses of radioactive material are in radiotherapy, radiography, smoke detectors, irradiation and sterilization of food and materials, measuring devices, and illumination of emergency exit signs. In the course of working with these radioactive materials, other material, such as protective clothing and gloves, pipes, filters, and concrete, that come in contact with them will become contaminated and therefore need to be disposed of as LLRW. DOE also disposes of radioactive waste at its own sites and at commercial disposal facilities.

In the 1960s, the Atomic Energy Commission, a predecessor agency to DOE, began to encourage the development of commercial LLRW disposal facilities to accommodate the increased volume of commercial waste that was being generated. Six such disposal facilities were licensed, two of which, the Richland facility, licensed in 1965, and the Barnwell facility, licensed in 1971, remain today. Each of these facilities is located within the boundaries of or adjacent to a much larger site owned by DOE. The third facility, in Clive, Utah, operated by Energy*Solutions* (formerly known as Envirocare), was originally licensed by the state of Utah in 1988 to only accept naturally occurring radioactive waste. In 1991, Utah amended the facility's license to permit the disposal of some LLRW, and the Northwest Compact agreed to allow the facility to accept these

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

The United States Currently Has Available Disposal Capacity for Most Domestically Produced LLRW

At this time, sufficient available disposal capacity exists for almost all LLRW. However, fast-approaching constraints on the availability of disposal capacity for classes B and C wastes could adversely affect disposal of this waste by generators in most states. Specifically, beginning in June 30, 2008, waste generators in 36 states will be precluded from using the Barnwell disposal facility for their class B and class C LLRW. That facility currently accepts about 99 percent of the nation's class B and C commercial LLRW. Although there is more than sufficient capacity to serve waste generators from the 3 compact states that use Barnwell and the 11 compact states that use Richland until at least 2050, the remaining 36 states will have no disposal options for their class B and class C LLRW.

Although waste generators in these 36 states will no longer have access to Barnwell, they 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, it allows on-site storage 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 come 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. Waste minimization techniques and storage can alleviate the need for disposal capacity, but they can be costly. For example, in June 2004 we reported that one university built a $12 million combined hazardous and radioactive waste management facility. Two-thirds of this facility is devoted to the processing and temporary storage of class A waste.

Additional disposal capacity for the typical 20,000 to 25,000 cubic feet of class B and class C LLRW disposed of annually at Barnwell may become available with the opening of a new disposal facility in Texas. This facility is expected to receive a draft license by mid-June 2008 and appears to be on schedule to begin operations in 2010. Although the facility may accept some DOE cleanup waste, there is presently no indication that it will be made available to all waste generators beyond the two states that are members of the Texas Compact (Texas and Vermont).

In contrast, available disposal capacity for the nation's class A waste does not appear to be a problem in either the short or long term. Our June 2004 report noted that Energy*Solutions*' Clive facility had sufficient disposal capacity, based upon then-projected disposal volumes, to accept class A waste for at least 20 years under its current license. This facility was accepting about 99 percent of the nation's class A waste. Since our report was issued, domestic class A waste has declined from about 15.5 million cubic feet in 2005 to about 5 million cubic feet in 2007. This decline is primarily attributed to DOE's completion of several cleanup projects. DOE waste constituted about 50 percent of the total waste accepted by Energy*Solutions* in 2007. This reduction in projected class A disposal volumes will extend the amount of time the Clive facility can accept class A

waste before exhausting its capacity. According to the disposal operator, capacity for this facility has been extended another 13 years, to 33 years of capacity.

It is important to note, however, that our June 2004 analysis of available LLRW disposal capacity considered only domestically produced LLRW. We did not consider the impact of imported LLRW on available class A, B, and C waste disposal capacity at Clive, Barnwell, and Richland. Although disposal capacity at the time of our June 2004 report appeared adequate using then-projected waste disposal volumes, the impact of adding additional waste from overseas waste generators is unclear.

Most Foreign Countries Either Have Available LLRW Disposal Capacity or Plan to Develop It

While none of the foreign countries we surveyed for our March 2007 report indicated that they had disposal options for all of their LLRW, almost all either had disposal capacity for their lower-activity LLRW or central storage facilities for their higher-activity LLRW, pending the availability of disposal capacity.[5] Specifically, we surveyed 18 foreign countries that previously had or currently have operating nuclear power plants or research reactors. Ten of the 18 countries reported having available disposal capacity for their lower-activity LLRW and 6 other countries have plans to build such facilities. Only 3 countries indicated that they have a disposal option for some higher-activity LLRW. Many countries that lack disposal capacity for LLRW provide centralized storage facilities to relieve waste generators of the need to store LLRW on-site. Specifically, 7 of

[5] In general, U.S. class A, B, and most of class C waste falls into the international category of short-lived low- and intermediate-level radioactive waste (lower-activity LLRW), and the remaining 25 percent of class C waste and all GTCC waste falls into the long-lived low- and intermediate-level radioactive waste category (higher-activity LLRW).

the 8 countries without disposal facilities for lower-activity LLRW had centralized storage facilities. Eleven of the 15 countries without disposal facilities for at least some higher-activity LLRW provide central storage facilities for this waste.

Of the 18 countries we surveyed, only Italy indicated that it lacked disposal availability for both lower- and higher-activity LLRW and central storage facilities for this waste. As reported by Italy to the international Nuclear Energy Agency, in 1999, the government began to develop a strategy for managing the liabilities resulting from the country's past nuclear activities. The strategy established a new national company to shut down all of Italy's nuclear power plants and to promptly decommission them. It also created a national agency that would establish and operate a disposal site for radioactive waste. A subsequent government decree in 2001 prompted an acceleration of the process to select a disposal site, with the site to begin operations in 2010. However, the Italian government has more recently reported it has encountered substantial difficulties in locating a site for a disposal facility because local governments have rejected the potential sites. In total, Italy will have an estimated 1.1 million cubic feet of lower-activity LLRW that will result from decommissioning its nuclear facilities in addition to the 829,000 cubic feet of this waste already in storage.

Our March 2007 report identified several management approaches used in foreign countries that, if adopted in the United States, could improve the management of radioactive waste. These approaches included, among other things,

- using a comprehensive national radioactive waste inventory of all types of radioactive waste by volume, location, and waste generator;

- providing disposal options for all types of LLRW or providing central storage options for higher-radioactivity LLRW if disposal options are unavailable; and

- developing financial assurance requirements for all waste generators to reduce government disposition costs.

We also identified another management approach used in most countries—national radioactive waste management plans—that also might provide lessons for managing U.S. radioactive waste. Currently, the United States does not have a national radioactive waste management plan and does not have a single federal agency or other organization responsible for coordinating LLRW stakeholder groups to develop such a plan. Such a plan for the United States could integrate the various radioactive waste management programs at the federal and state levels into a single source document.

Our March 2007 report recommended that NRC and DOE evaluate and report to the Congress on the usefulness of adopting the LLRW management approaches used in foreign countries and developing a U.S. radioactive waste management plan. Although both agencies generally agreed with our recommendations, NRC, on behalf of itself and DOE, subsequently rejected two of the key approaches. Specifically, NRC believes that the development of a comprehensive national radioactive waste inventory and a national waste management plan would be of limited use in the United States. In a March 2008 letter to GAO on the actions NRC has taken in response to our recommendations, NRC stated that the approach used in the United States is fundamentally different from other countries. In particular, NRC argued that, because responsibility for LLRW disposal is placed with the states, the federal government's role in developing options for managing

and/or disposing of LLRW is limited. NRC also expressed concern about the usefulness and significant resources required to develop and implement a national inventory and management plan for LLRW.

We continue to believe comprehensive national radioactive waste inventory and a national radioactive waste management plan would be useful. The inventory would allow LLRW stakeholders to forecast waste volumes and to plan for future disposal capacity requirements. Moreover, the national plan could assist those interested in radioactive waste management to identify waste quantities and locations, plan for future storage and disposal development, identify research and development opportunities, and assess the need for regulatory or legislative actions. For example, there are no national contingency plans, other than allowing LLRW storage at waste generator sites, to address the impending closure of the Barnwell facility to class B and class C wastes from noncompact states. The availability of a national plan and periodic reporting on waste conditions might also provide the Congress and the public with a more accessible means for monitoring the management of radioactive waste and provide a mechanism to build greater public trust in the management of these wastes in the United States.

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Mr. Chairman, this concludes my prepared statement. I would be happy to respond to any questions that you or Members of the Committee may have at this time.

GAO Contact and Staff Acknowledgements

Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this testimony. For further information about this testimony,

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