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Gene Aloise, GAO

TO:

Chairman Diaz

FOR SIGNATURE OF : ** PRI ** CRC NO: 05-0480

Chairman Diaz

DESC:

GAO Report, "Nuclear Security: DOE Needs Better Information to Guide Its Expanded Recovery of Sealed Radiological Sources" (GAO-05-967) (Due to Congress: 11/25/05)

DATE: 09/29/05

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The Honorable Nils J. Diaz
Chairman, Nuclear Regulatory Commission

Dear Mr. Chairman:

Enclosed is a copy of our report entitled *Nuclear Security: DOE Needs Better Information to Guide Its Expanded Recovery of Sealed Radiological Sources (GAO-05-967)*. This report discusses the status of DOE's efforts to recover unwanted greater-than-Class C (GTCC) sealed radiological sources and to develop a disposal option for GTCC waste, DOE actions taken to recover and dispose of unwanted non-GTCC sealed radiological sources, and the extent to which DOE can identify and track unwanted sealed radiological sources for recovery and disposal.

This report contains recommendations to you. As you know, 31 U.S.C. 720 requires the head of a federal agency to submit a written statement of the actions taken on our recommendations to the Senate Committee on Homeland Security and Governmental Affairs and the House Committee on Government Reform not later than 60 calendar days from the date of this letter and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 calendar days after that date. Because agency personnel serve as the primary source of information on the status of recommendations, we request that you also provide us with a copy of your agency's statement of action to serve as preliminary information on the status of open recommendations.

We appreciate the assistance and cooperation of your staff during our review.

Sincerely yours,

Gene Aloise

Gene Aloise
Director, Natural Resources
and Environment

Enclosure

United States Government Accountability Office

GAO

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

September 2005

NUCLEAR SECURITY

DOE Needs Better Information to Guide Its Expanded Recovery of Sealed Radiological Sources

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GAO-05-967

September 2005

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Highlights

Highlights of GAO-05-967, a report to the Chairman, Committee on Energy and Natural Resources, U.S. Senate

NUCLEAR SECURITY

DOE Needs Better Information to Guide Its Expanded Recovery of Sealed Radiological Sources

Why GAO Did This Study

Concerns remain over the control of sealed radiological sources, widely used in many industrial and medical devices and applications. The Nuclear Regulatory Commission (NRC), the Department of Energy (DOE), and states have responsibilities for ensuring the safe and secure use and eventual disposal of these sources as low-level radioactive wastes. DOE must ensure disposal availability for greater-than-class C (GTCC) waste; states must do so for non-GTCC waste, that is, classes A, B, and C waste. NRC and DOE also collaborate to identify and recover unwanted sources that are not safe or secure. GAO examined DOE's (1) efforts to recover unwanted sources and develop a GTCC waste disposal option, (2) actions to recover and dispose of non-GTCC source waste, and (3) ability to identify sources for recovery and disposal.

What GAO Recommends

GAO recommends that DOE and NRC evaluate and report on the cost implications of DOE's recovery and disposal of non-GTCC waste, options to recoup these DOE costs from licensees, the feasibility of using DOE disposal sites, and how a national source tracking system can be designed and implemented to improve DOE's recovery and disposal efforts. DOE generally supported GAO's recommendations. NRC found the report well written and balanced, but did not agree or disagree with GAO's recommendations.

www.gao.gov/cgi-bin/getrpt?GAO-05-967.

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

What GAO Found

DOE has increased emphasis on its source recovery project and begun the process of identifying disposal options for GTCC waste. DOE transferred project responsibilities to another office that has given the project higher priority and accelerated DOE's recovery efforts. DOE exceeded an earlier goal for recovering sources and has now collected over 10,800 of them. This recovery has been facilitated by additional project funding support and DOE's resolving a shortage of storage space for certain sources. In May 2005, DOE issued a notice of intent to prepare an environmental impact statement to assess GTCC waste disposal options; however, DOE has not yet determined when a disposal site might be made available.

DOE has expanded the scope of its recovery effort to include non-GTCC waste from sealed radiological sources, a change that could increase DOE expenditures. DOE recovered and commercially disposed of 443 of these sources from a bankrupt firm, at a cost to DOE of about $581,000. Given that unwanted sources in storage present higher vulnerabilities, DOE might need to recover more of them in the future if the commercial disposal site that currently accepts this non-GTCC waste from most states ceases to do so as planned in 2008. Lacking a commercial disposal option, DOE anticipates storing this waste, rather than disposing of it at DOE sites, because, among other reasons, it does not want to undermine the responsibility the Congress gave the states to provide disposal availability for non-GTCC waste.

DOE lacks information that would assist its efforts to identify and recover unwanted sealed radiological sources that may pose a safety and security risk. DOE has useful information on the sources in its possession, including recovered sources. However, DOE does not know how many sources might need recovery and how much disposal capacity is needed for GTCC waste. NRC is developing a national source tracking system that would not be useful for DOE's source recovery efforts because it is only designed to track individual sources with high radioactivity. According to DOE, nearly all of the sites where it has recovered sources contained individual sources with lesser radioactivity than would be tracked by NRC, but their combined radioactivity posed enough of a risk to warrant their recovery by DOE.

DOE Personnel Packaging a Sealed Radiological Source in a Disposal Drum

Source: GAO.

Pictured left to right: A sealed source being removed (in pliers) from a shielded storage container at a recovery site; the interior of a multifunction container used for transport, storage, and disposal; and the process of closing the steel pipe component after the source has been loaded into the multifunction container.

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Abbreviations

CRCPD	Conference of Radiation Control Program Directors
DOE	Department of Energy
EIS	environmental impact statement
GTCC	greater-than-class C
IAEA	International Atomic Energy Agency
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
WIPP	Waste Isolation Pilot Plant

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Accountability * Integrity * Reliability
United States Government Accountability Office
Washington, D.C. 20548

September 22, 2005

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

Dear Mr. Chairman:

The regulatory control and tracking of sealed radiological sources in the possession of academic, government, industrial, medical, and utility entities that are licensed to use them in devices and applications continues to evolve. These sources contain radioactive material encapsulated, or sealed, in metal to prevent its dispersal. The small size and portability of sealed radiological sources, however, make them susceptible to misuse, improper disposal, and theft. If some types of sealed radiological sources fell into the hands of terrorists, they could be used in fabricating crude but potentially dangerous radiological weapons, commonly called dirty bombs. In general, a dirty bomb is produced by packaging explosives, such as dynamite, with radioactive material, which would be dispersed when the bomb was activated.

There are an estimated 2 million devices containing sealed radiological sources in use throughout the United States,[1] and as many as one-quarter of them, or up to 500 thousand, may no longer be needed. However, only some of these sources are considered particularly attractive for producing dirty bombs because, among other things, they contain more concentrated amounts of certain nuclear material, such as americium-241, cesium-137, plutonium-238, and strontium-90. Depending on the type, form (e.g., solid or powder), amount, and concentration of the radioactive material dispersed in a malevolent act, the released material could cause radiation sickness for people nearby as well as significant economic costs and serious social disruption associated with the evacuation and subsequent cleanup of the contaminated area. Even without an intentional act, the inadvertent loss of a sealed radiological source can also lead to radiation exposure, high decontamination costs, and public panic. For example, in a 1983 incident, a Texas company sold a cancer treatment machine containing a sealed radioactive source to a clinic in Mexico. The device was

[1]This estimate was first in J.O. Lubenau and J.G. Yusko, "Radioactive materials in recycled metals—an update," *Health Physics*, Volume 74, No. 3 (March 1998) p. 297.

subsequently stolen, and the source was accidentally melted with other metals to form steel reinforcing rods that were imported into the United States and eventually used to build 37 homes and businesses. The steel rods were encased in concrete and thus were naturally shielded, but the incident caused public concern, costly decontamination, and increased regulatory inspections.

The Nuclear Regulatory Commission (NRC) and the Agreement States[2] are responsible for regulating the use of sealed radiological sources and other radioactive materials, from creation to disposal, in a way that ensures the public health and safety. They do so through a combination of regulatory requirements, licensing, inspection, and enforcement. Under the Atomic Energy Act of 1954, NRC also is responsible for issuing rules, regulations, or orders to promote the common defense and security. As we reported in August 2003, NRC and the Agreement States disagreed about the appropriate state role in the regulation of sealed radiological source security.[3] According to NRC, it and the Agreement States are currently working together to implement increased regulatory requirements on licensees that possess sealed radiological sources that are of security concern.

After a licensee determines that a sealed radiological source is no longer useful, the source can be returned to the manufacturer or supplier, transferred to another licensee, stored to allow for a natural decrease in radioactivity, or sent to a commercial waste disposal facility. Once the source is packaged for disposal, the disposal container is put into a waste class. NRC defines the four types of low-level radioactive waste (i.e., waste not classified as high-level waste, such as spent fuel from nuclear power plants) as classes A, B, C, and greater-than-class C (GTCC).[4] The type of radionuclide (e.g., americium-241) and the concentration of radioactivity

[2]The Agreement States system was formed by section 274 of the Atomic Energy Act of 1954, as amended (42 U.S.C. § 2021). This section of the act allows NRC to relinquish certain parts of its authority to Agreement States, of which there are 33, to license and regulate certain radioactive materials. NRC retains regulatory responsibility over licensees in the other 17 states, and over other activities, such as regulation of all nuclear power plants.

[3]GAO, *Nuclear Security: Federal and State Action Needed to Improve Security of Sealed Radiological Sources*, GAO-03-804 (Washington, D.C.: Aug. 6, 2003).

[4]10 C.F.R. § 61.55.

(often measured in curies per gram),[5] are considered in determining the waste class of the radioactive material, which carries progressively more stringent requirements for disposal from class A to GTCC waste. Non-GTCC waste, including classes A, B, and C waste (e.g., contaminated soil, laboratory equipment, exit signs containing tritium, and some sealed radiological sources) generally can be disposed of by shallow burial at existing commercial low-level radioactive waste disposal sites. However, GTCC waste (e.g., activated metals,[6] sealed radiological sources, and other highly radioactive waste) will generally require a different type of disposal. Under the Low-Level Radioactive Waste Policy Act of 1980, as amended,[7] the states and federal government were given separate responsibilities for providing disposal availability for these wastes. States were made responsible for providing disposal availability for non-GTCC waste, and the Department of Energy (DOE) was given the responsibility of providing disposal for GTCC waste. Non-GTCC waste must be disposed of in a facility licensed by either NRC or an Agreement State, but only NRC can license a facility for GTCC waste. 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 low-level radioactive waste from other compacts and unaffiliated states.[8]

Even though states have not developed any new disposal sites for low-level radioactive waste since passage of the act, we reported in June 2004,[9] that disposal availability for non-GTCC waste was adequate in the short term, but that federal oversight was needed to identify any future shortfalls.

[5]A curie is a measure of the rate of radioactive decay; it is equivalent to the radioactivity of 1 gram of radium or 37 billion disintegrations per second.

[6]As a result of reactor operations, portions of the reactor barrel and other stainless steel components near the fuel assembly become highly radioactive. The majority of this waste is generated when nuclear power plants are decommissioned, although some waste may result from maintenance activities performed before decommissioning. There are presently 103 active and 24 decommissioned nuclear power plants in the United States.

[7]Pub. L. No. 96-573, as amended by Pub. L. No. 99-240, codified at 42 U.S.C. §§ 2021b-2021j.

[8]There are 10 compacts comprised of 43 states and 7 unaffiliated states as well as the District of Columbia and Puerto Rico.

[9]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).

There are currently three commercial disposal sites that collectively serve the nation's non-GTCC waste disposal needs.[10] A shortfall in disposal availability for the higher radioactive non-GTCC waste (classes B and C waste), however, could occur by mid-2008, if South Carolina follows through with plans to restrict access to its Barnwell disposal site to only the 3 member states of the Atlantic Compact. This restriction would mean that licensees in the 36 states that are currently allowed to use this disposal site would be denied access to it, and under current conditions, they would have no alternative option to dispose of their higher radioactive non-GTCC waste. Regarding GTCC waste disposal, we reported in April 2003[11] that DOE had not made progress toward providing for the permanent disposal of GTCC waste because doing so was not a priority at the time.

Given the lack of disposal options for GTCC waste and the public health, safety, and national security concerns about unwanted sealed radiological sources at licensee sites around the country, DOE, in collaboration with NRC, has been recovering, taking title of, and storing sources—primarily at its Los Alamos National Laboratory. DOE has been taking these actions through its Off-Site Source Recovery Project, which has been operated by Los Alamos National Laboratory personnel since the late-1990s. In June 1999, NRC and DOE entered into a memorandum of understanding describing their respective roles and responsibilities for addressing the problem of unwanted and uncontrolled sealed radiological sources, often referred to as "orphan sources." This memorandum formalized agreements reached between these agencies in 1992 to have DOE begin recovering and storing unwanted sealed radiological sources because DOE had yet to develop a disposal site for GTCC waste. Since then, DOE has routinely recovered, from licensees that request such a collection, sealed radiological sources that when packaged for disposal would be classified as GTCC waste. Many of these unwanted sources, such as plutonium-239, were originally derived from defense programs and loaned to colleges and universities that no longer want them. DOE, at the request of NRC, also

[10]The commercial disposal site in Barnwell, South Carolina, is available to the 3 member states of the Atlantic Compact and 36 other states that are currently allowed to use this site for all non-GTCC waste. The commercial disposal site in Richland, Washington, serves only the 8 member states of the Northwest Compact and the 3 member states of the Rocky Mountain Compact for all non-GTCC waste. A third commercial disposal site in Utah is available to all states, except the Northwest Compact member states, for the disposal of only class A waste.

[11]GAO, *Nuclear Nonproliferation: DOE Action Needed to Ensure Continued Recovery of Unwanted Sealed Radioactive Sources*, GAO-03-138 (Washington, D.C.: Apr. 15, 2003).

recovers sources that are in the possession of licensees that are no longer able to ensure their safety and security. In our April 2003 report, we found that while DOE's source recovery project had collected more than 5,000 sources, the project faced the following three problems that could hinder future recovery efforts: questionable long-term commitment to the program of DOE's Office of Environmental Management, inadequate storage capacity that meets the higher security requirements for sealed radiological sources containing plutonium-239, and DOE's inability to store sealed radiological sources containing strontium-90 and cesium-137.

In this context, we examined (1) the status of DOE's efforts to recover unwanted sealed radiological sources and to develop a disposal option for GTCC waste, (2) DOE actions taken to recover and dispose of non-GTCC waste from sealed radiological sources, and (3) the extent to which DOE can identify unwanted sealed radiological sources for recovery and disposal.

To conduct our work, we reviewed pertinent information in existing databases and published reports and interviewed officials from federal and state agencies, professional organizations, and representatives from entities that are licensed to possess sealed radiological sources. More specifically, we examined DOE's efforts to recover unwanted sealed radiological sources and the databases maintained by DOE and NRC to inventory some of these materials. We assessed the reliability of these data and determined that they were sufficiently reliable for the purposes of this report. We also used structured interviews of licensees and commercial waste brokers that possess unwanted sealed radiological sources and reviewed their waste forms to obtain an understanding of how these materials are classified, and what challenges might be faced if there is no disposal option availability for them in the future. We excluded some radioactive wastes from our review because the radioactive materials are already under higher security, such as at nuclear power plants and DOE facilities, or because they present a lower security risk, such as class A waste. We conducted our review between June 2004 and September 2005 in accordance with generally accepted government auditing standards. A more detailed description of our methodology is provided in appendix I.

Results in Brief

DOE has increased emphasis on its source recovery project and begun the process of identifying disposal options for GTCC waste. Specifically, DOE transferred responsibilities for source recovery from its Office of Environmental Management to its National Nuclear Security

Administration (NNSA) to better respond to both domestic and international threats posed by unwanted sealed radiological sources. DOE was able to recover 5,529 of these sources within 18 months, exceeding a recovery goal established in October 2002 and more than doubling the number of sources recovered since 1996. As of June 7, 2005, DOE had collected a total of 10,806 sealed radiological sources and plans to continue recovering sources at least until there is a permanent disposal option for GTCC waste. DOE's accelerated recovery efforts have been supported through continued annual and supplemental appropriations. The recovery of these unwanted sealed radiological sources was also facilitated by DOE's resolution of some problems with storage availability for certain types of sources. For example, DOE was able to recover and provide storage for over 260 plutonium-239 sources that licensees had registered for collection; however, some new issues have arisen that are preventing DOE from recovering the more than 100 of these sources that still remain at licensee sites. Finally, DOE has begun identifying disposal options for GTCC waste. In May 2005, DOE issued a notice of its intent to prepare an environmental impact statement assessing various disposal options for GTCC waste. In preparing this document, DOE plans to gather information on the amount of GTCC waste that might be generated over the next 30 to 50 years; however, making useful projections will be difficult because, among other things, no national database tracks the volume of GTCC materials or waste. Further, DOE has not yet determined when a permanent GTCC waste disposal site might be available because of uncertainties surrounding what alternatives will be available to DOE after it completes the assessment of the various disposal options for this waste.

DOE has expanded the scope of its source recovery project to include non-GTCC waste from unwanted sealed radiological sources—a change that could increase recovery project expenditures if DOE needs to recover and dispose of more of this waste in the future. DOE has already recovered and commercially disposed of non-GTCC waste from some licensees that could no longer ensure the safety and security of their unwanted sealed radiological sources. For example, in fiscal year 2004, at the request of NRC, DOE recovered from a bankrupt firm and commercially disposed of 443 mostly cesium-137, sealed radiological sources at a cost of approximately $581,000. Moreover, DOE may need to begin recovering greater quantities of non-GTCC waste from unwanted sealed radiological sources if licensees in most states have no access to commercially dispose of it in the future. Domestic and international experts contend that the lack of disposal availability for unwanted sealed radiological sources makes them more vulnerable to abandonment, misplacement, and theft that would

pose a safety and security risk. If DOE needs to recover more of these types of sources, source recovery project expenditures may increase unless DOE can recoup some of its costs from licensees that could otherwise pay for disposal if a commercial disposal option were available. In the absence of any commercial disposal option for the non-GTCC waste that DOE collects, the department anticipates indefinitely storing this waste. DOE's current policy is to not use its own sites for disposing of this waste because, among other reasons, it does not want to undermine the responsibility that the Congress gave to the states for providing disposal availability for non-GTCC waste. We are recommending that DOE and NRC collaborate in evaluating and reporting on the potential cost implications of expanding DOE's recovery and disposal of non-GTCC waste from sealed radiological sources, options to recoup DOE costs from licensees that may have no disposal option, and the feasibility of disposing of this waste at DOE sites.

DOE's ability to identify unwanted sealed radiological sources that may pose a safety or security risk is limited by a lack of information needed to guide its recovery and disposal efforts. DOE has useful inventory data only on the sealed radiological sources in its possession, including those recovered from licensees. This inventory captures, among other things, information on the status of each source, including whether it is in active use, is inaccessible, is in storage for potential future use, or is packaged for disposal. However, DOE does not have comparable information on the sealed radiological sources in the possession of licensees that might need recovery in the future because NRC and the Agreement States do not centrally collect this information from them. NRC has recently issued a proposed rule that will allow it to establish a national system to track the possession and movement of some individual sealed radiological sources that present a potential risk to individuals, society, and the environment because of their high levels of radioactivity. This proposed rule is consistent with the recently enacted Energy Policy Act of 2005,[12] which, among other things, requires NRC to establish a tracking system and a task force to evaluate and report on radiation source protection and security concerns. However, as presently designed, this system would only track individual sources with high radioactivity concentrations and would not include essentially all of the sources of lesser radioactivity that DOE has recovered. According to DOE, over 90 percent of the licensee sites where sources were recovered contained individual sources of lesser radioactivity than would be individually tracked by NRC, yet their combined

[12]Pub. L. No. 109-58, 119 Stat. 594 (2005).

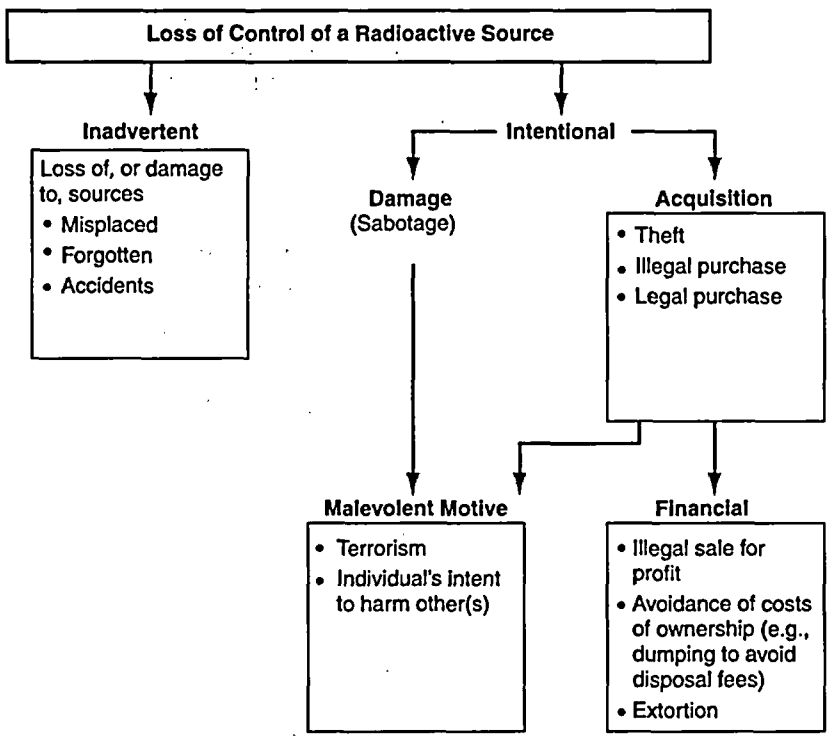
radioactivity concentration posed enough of a safety and security risk to warrant their recovery by DOE. As a result, this proposed national source tracking system would be of little use to DOE in its efforts to plan and budget for the recovery and disposal of unwanted sealed radiological sources. We are recommending that DOE and NRC collaborate on evaluating and reporting on how a national source tracking system can be designed and implemented to improve DOE's ability to identify unwanted sealed radiological sources that may need DOE recovery and disposal.

DOE and NRC provided comments on a draft of this report. DOE stated that it generally supports all of our recommendations. Moreover, DOE commented that we had correctly reported the department's position with regard to issues discussed in this report. In addition, DOE affirmed the need to improve the national source tracking system to assist the department in identifying and recovering unwanted sources from outside the department that pose a potential safety and security risk. NRC stated that overall our report was well written and balanced. NRC did not specifically agree or disagree with our recommendations. However, NRC expressed concerns that any changes to the design of its national source tracking system at this time could be extremely burdensome on licensees and the agency and would yield little, if any, practical benefit. Nevertheless, NRC stated that it will continue to seek comments on the inclusion of sources of lower radioactivity in its national source tracking system because licensees possessing large quantities of these sources could present a security concern.

Background

The loss of control of sealed radiological sources can arise from their abandonment, misplacement, or theft. In such cases, there is a risk of either the inadvertent or intentional malevolent human exposure to radioactive materials in these sources. Figure 1 shows a graphic representation of the ways in which the loss of control of sealed radiological sources can occur.

Figure 1: Loss of Control of Sealed Radiological Sources



Source: IAEA, *Strengthening Control Over Radioactive Sources in Authorized Use and Regaining Control Over Orphan Sources: National Strategies*, IAEA-TECDOC-1388 (Vienna, Austria: February 2004) p. 9.

Since September 11, 2001, international and U.S. agencies have taken additional steps to increase the safety and security of radioactive materials, particularly sealed radiological sources. Between 2002 and 2003, the International Atomic Energy Agency (IAEA)[13] held various meetings and conferences to discuss how the agency's *Code of Conduct on the Safety and Security of Radioactive Sources* might be revised in light of new security concerns. One result of these gatherings was the development of a categorization scheme for sealed radiological sources in terms of the

[13]IAEA was established within the United Nations in 1957. IAEA works with its member states; 138 countries, including the United States; and multiple other partners to promote safe, secure, and peaceful nuclear technologies.

potential risks associated with their malevolent uses.[14] The first three of the five source categories identified by IAEA, which are considered to pose the most significant risk to individuals, society, and the environment, are listed in an annex to the *Code of Conduct*. The *Code of Conduct* recommends that IAEA member states establish a national registry that tracks, at a minimum, the first two source categories. Table 1 contains a listing of the radionuclides and their curie levels that are presented in the IAEA *Code of Conduct*.

Table 1: IAEA High-risk Categories of Sealed Radiological Sources

Radionuclide	Category 1 (curies)[a]	Category 2 (curies)[a]	Category 3 (curies)[a]
Americium-241	2,000	20	2
Americium-241/Beryllium	2,000	20	2
Californium-252	500	5	0.5
Cesium-137	3,000	30	3
Cobalt-60	800	8	0.8
Curium-244	1,000	10	1
Gadolinium-153	30,000	300	30
Iridium-192	2,000	20	2
Plutonium-238	2,000	20	2
Plutonium-239/Beryllium	2,000	20	2
Promethium-147	1,000,000	10,000	1,000
Radium-226	1,000	10	1
Scandium-75	5,000	50	5
Selenium-75	5,000	50	5
Strontium-90	30,000	300	30
Thulium-170	500,000	5,000	500
Ytterbium-169	8,000	80	8

Source: IAEA, *Code of Conduct on the Safety and Security of Radioactive Source* (Vienna Austria: January 2004) Annex I, Table 1, p. 16.

[a]A curie is a measure of the rate of radioactive decay; it is equivalent to the radioactivity of 1 gram of radium or 37 billion disintegrations per second.

[14]IAEA, *Categorization of Radioactive Sources*, TECDOC-1344 (Vienna, Austria: July 2003). IAEA defined five categories of radioactive sources in this 2003 document. The agency based its categorization framework on the health effects of exposure to the radioactive materials in the sources and did not fully take into account the range of impacts that could result from accidents or malicious acts involving radioactive sources.

In May 2003, a DOE/NRC interagency working group—which was formed to address security concerns over the radioactive materials that could be used in a radiological dispersal device—issued a report that, among other things, recommended that actions be taken to develop a national threat policy based on vulnerability assessments, a national source tracking system, and an integrated national strategy for disposing of unsecured sealed radiological sources.[15] Following this DOE/NRC report, NRC adopted the nonlegally binding IAEA *Code of Conduct* as a basis for (1) determining which licensees may need additional protective measures for the sealed radiological sources in their possession and (2) defining the scope of a national source tracking system. NRC found that the curie thresholds for radionuclides in the sources identified by the DOE/NRC interagency working group were similar enough to the *Code of Conduct* categories to warrant adoption of the IAEA source categorization scheme to better align domestic and international efforts to increase the safety and security of sealed radiological sources.

NRC and DOE have since engaged in separate efforts to (1) assess the vulnerability of facilities that contain sealed radiological sources within their jurisdictions, (2) promulgate new security measures, and (3) begin systematically tracking some of these sources. According to NRC officials, NRC has been working with the Agreement States since January 2002, and with licensees since September 2002, using a risk informed approach to enhance the regulatory requirements applicable to high-risk radioactive material. In June 2003 and January 2004, NRC issued its first set of protective measures to large irradiators and device manufacturers and distributors, respectively. In January 2004, NRC and the Agreement States began to consider the need for additional protective measures for other licensees. This process has involved several iterations of vulnerability assessments of licensee sites that have devices or use applications containing IAEA categories 1 and 2 sources, such as teletherapy, gamma knife, well-logging devices, and self-shielded irradiators. On September 6, 2005, NRC announced that over approximately the next 90 days, affected licensees will receive orders from the agency spelling out increased controls for certain radioactive materials. Over the same period, individual Agreement States will issue their licensees legally binding requirements essentially identical to NRC's orders. Materials covered by these

[15]DOE/NRC Interagency Working Group on Radiological Dispersal Devices, *Radiological Dispersal Devices: An Initial Study to Identify Materials of Greatest Concern and Approaches to Their Tracking, Tagging and Disposal* (May 2003).

requirements will be consistent with the IAEA *Code of Conduct.* Regarding source tracking, in November 2003, NRC, with the assistance of the Agreement States, identified and initially surveyed approximately 2,600 entities licensed to possess IAEA categories 1 and 2 sources. The resulting interim inventory will supplement other information NRC intends to use in developing a national source tracking system. Regarding DOE efforts, DOE officials told us that various department offices have been involved in developing, reviewing, and issuing domestic and international guidance related to the security of sealed radiological sources. Moreover, DOE has established its own source tracking system—that is, the Radioactive Source Registry and Tracking System—which, among other things, includes the unwanted sealed radiological sources that DOE has recovered from licensees.

In addition to securing and tracking sealed radiological sources, IAEA and NRC support the disposal of unwanted sources and other radioactive waste. IAEA contends that although waste may be safely stored for decades, as long as institutional controls are maintained, progress must be made toward permanent disposal. According to the Director General for Energy and Transport, European Commission, "the sources at greatest risk of being lost from regulatory control are disused (unwanted) sources held in local storage at the user's premises waiting for final disposal or return to manufacturer."[16] In response to an international joint convention addressing spent nuclear fuel and radioactive waste management,[17] IAEA set forth the elements of an effective national legal and organizational structure that would provide for the safe and secure management of radioactive waste by appropriate national authorities. One of the key indicators of such a structure is that "the amount of waste in storage awaiting disposal should depend only upon operational considerations...and should not include a backlog due to an inability (technical, financial, organizational, etc.) to reduce the backlog."[18] NRC also supports the disposal of low-level radioactive waste but has placed no time limits on storage, as long as the radioactive material is safe and

[16]IAEA, Proceedings of an international conference on security of radioactive sources, held March 10-13, (Vienna, Austria: 2003).

[17]A Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, signed by Member States of the IAEA, entered into force on June 18, 2001.

[18]IAEA, *Radioactive Waste Management: Status and Trends*—Issue No. 2 (Vienna, Austria: September 2002) p. 16.

secure. NRC contends that it is acceptable to allow some licensees to store a backlog of sources in instances where a disposal option for this waste is not available to them.

In August 2005, the President signed into law the Energy Policy Act of 2005, which, among other things, addressed the safe disposal of GTCC waste and nuclear facility and materials security. The act requires DOE to prepare plans for the continued recovery of sealed radiological sources and to report on its efforts to develop a GTCC waste disposal site. Other provisions call for NRC to issue regulations establishing a mandatory tracking system for radiation sources in the United States and to chair a task force on radiation source protection and security. The task force, comprised of NRC, DOE and other federal agencies, in consultation with other groups, is to evaluate and provide recommendations relating to the security of radiation sources in the United States from potential terrorist threats, including acts of sabotage or theft or the use of radiation sources in a radiological dispersal device.

DOE Has Increased Emphasis on Its Source Recovery Project and Begun Assessing Options for Disposing of GTCC Waste

DOE has placed increased emphasis on its source recovery project and has begun to assess disposal options for GTCC waste. DOE has realigned its source recovery project within NNSA to more effectively respond to both domestic and international threats posed by unwanted sealed radiological sources. Further, DOE has accelerated its recovery efforts, surpassing an earlier source recovery goal, and has made progress in resolving a storage space shortage at its facilities that has slowed the recovery of certain unwanted sealed radiological sources. Finally, DOE has begun preparing an environmental impact statement to assess possible disposal options for GTCC waste. However, difficulties in estimating current GTCC waste storage and future waste volumes, especially from sealed radiological sources, will complicate this effort. Further, DOE has not yet determined when a permanent GTCC waste disposal facility will be available.

DOE Transferred Responsibility for the Source Recovery Project to NNSA

To better respond to the security threats posed by unwanted sealed radiological sources both within the United States and abroad, in October 2003, DOE realigned management responsibilities for its source recovery

project from the Office of Environmental Management to NNSA.[19] This realignment was, in part, a response to a recommendation to the Secretary of Energy that we made in our April 2003 report that the priority given to its Off-Site Source Recovery Project be commensurate with the threat posed by some unwanted sealed radiological sources. Subsequently, NNSA established the Nuclear and Radiological Threat Reduction Task Force, under the Office of Defense Nuclear Nonproliferation, to unite all of the department's radiological threat reduction efforts. One of the principal missions of this task force is to identify; secure; and store, on an interim basis, radioactive materials that could be used as a radiological weapon. In May 2004, DOE announced the creation of the Global Threat Reduction Initiative, which further elevated the importance of the task force and DOE's recovery of sealed radiological sources. This initiative was later institutionalized in the Office of Global Radiological Threat Reduction, with a domestic component, the U.S. Radiological Threat Reduction Program, and an international component, the International Radiological Threat Reduction Program. The Off-Site Source Recovery Project was subsumed under the U.S. Radiological Threat Reduction Program, but the program retained Los Alamos National Laboratory personnel to continue the source recovery effort.

DOE Accelerated Its Efforts to Recover Unwanted Sealed Radiological Sources

DOE accelerated the recovery of unwanted sealed radiological sources beginning in late 2002. As we reported in April 2003, DOE's ability to meet planned recovery activities was largely facilitated by supplemental congressional funding and by the urging of NRC to accelerate recovery efforts in light of the events of September 11, 2001. In August 2002, the Congress provided an additional $10 million to DOE's Off-Site Source Recovery Project to recover 5,000 unwanted sealed radiological sources over the following 18 months.[20] Between October 1, 2002, and March 31, 2004, DOE recovered 5,529 of these sources, exceeding its recovery goal and more than doubling the number of sources previously recovered since 1996. As of June 7, 2005, DOE had recovered 10,806 of these sources. According to the source recovery project leader, the bulk of the remaining

[19]This realignment did not include transferring responsibilities for the long-term storage and disposal of the recovered sources.

[20]H.R. Rep. No. 107-593, at 142 (2002), conference report accompanying Pub. L. No. 107-206, *Making Supplemental Appropriations for Further Recovery From and Response to Terrorist Attacks on the United States for the Fiscal Year Ending September 30, 2002, and for Other Purposes.*

excess and unwanted sealed radiological sources in the United States should be recovered in the next 2 years. Table 2 contains a summary of DOE-recovered sealed radiological sources, by radionuclide, as of June 7, 2005.

Table 2: Summary of DOE-Recovered Sealed Radiological Sources, by Radionuclide, as of June 7, 2005

Radionuclide	Number of sources	Percentage of total sources	Curies[a]	Percentage of total curies[a]
Americium-241/Beryllium	5,222	48.33%	11,657.48	7.77%
Plutonium-238	1,907	17.65	7,040.66	4.70
Americium-241	1,900	17.58	464.07	0.31
Americium-241/Berylllium/ Cesium-137	552	5.11	26.48	0.02
Cesium-137Cs	363	3.36	1,621.65	1.08
Plutonium-239Pu/Beryllium	255	2.36	543.42	0.36
Colbalt-60	197	1.82	42,602.21	28.41
Plutonium-238/Beryllium	169	1.56	2,186.87	1.46
Plutonium-239	99	0.92	5.48	0.00
Neptunium-237	25	0.23	0.01	0.00
Americium-241/Cerium	24	0.22	51.00	0.03
Americium-241/Lithium	22	0.20	437.00	0.29
Curium-244	18	0.17	7.51	0.01
Radium-226	17	0.16	0.05	0.00
Plutonium-238/Lithium	16	0.15	255.50	0.17
Strontium-90	10	0.09	82,958.85	55.33
Plutonium-238/Lithium/ Cesium-137	7	0.06	66.10	0.05
Uranium-235	2	0.02	0.00	0.00
Americium-241/Boron	1	0.01	15.00	0.01
Total	**10,806**	**100.00%**	**149,939.34**	**100.00%**

Source: DOE source recovery project inventory database.

[a]A curie is a measure of the rate of radioactive decay; it is equivalent to the radioactivity of 1 gram of radium or 37 billion disintegrations per second.

DOE has maintained its source recovery project efforts through annual and supplemental appropriations. In our April 2003 report, we recommended that the Secretary of Energy ensure that adequate resources be devoted to

covering the costs of recovering and storing unwanted sealed radiological sources as quickly as possible. In a September 2004 congressional hearing, the director of DOE's Office of Global Radiological Threat Reduction testified that the department had increased funding for the source recovery project and had committed funds for continuing these efforts.[21] The director stated that the fiscal year 2004 program budget was $1.96 million, not including about $3.49 million that was added to the budget to respond in part to unexpected requests from NRC to recover sources of security concern.[22] In fiscal year 2005, the source recovery project budget was increased to $5.6 million; for fiscal year 2006, DOE has requested $12.8 million, in part, to better fund the expanded scope of the U.S. Radiological Threat Reduction Program. The source recovery project leader has estimated an average recovery cost of $3,000 per source, on the basis of the initial 10,000 sources recovered, not including commercial disposal costs for certain sources.

DOE plans to continue recovering unwanted sealed radiological sources, at least until a GTCC waste disposal site is available. In our April 2003 report, we recommended that the Secretary of Energy develop a plan to ensure the continued recovery and storage of unwanted sealed radiological sources until a GTCC waste disposal site is available. We reported that DOE used several sources of information and made three key assumptions when projecting the anticipated need to recover 14,309 sources between fiscal years 1999 and 2010. The assumptions were that (1) a permanent disposal site for the sources would be available by fiscal year 2007; (2) the Off-Site Source Recovery Project would continue to recover sources from certain holders of sources during a transition period from fiscal years 2007 through 2010; and (3) after fiscal year 2010, all unwanted sealed radiological sources would be shipped by their owners to a disposal site, and the Off-Site Source Recovery Project would cease operations. However, according to the manager of DOE's U.S. Radiological Threat Reduction Program, these assumptions are no longer used by the department because the lack of a firm date for when a GTCC waste disposal site will be available means that DOE cannot determine when it will cease recovering unwanted sealed radiological sources from licensees. The Energy Policy Act of 2005 requires

[21]Statement of Edward G. McGinnis, Director, Office of Global Radiological Threat Reduction, National Nuclear Security Administration, Department of Energy, before the United States Senate, Energy and Natural Resources Committee, September 30, 2004.

[22]According to NRC, funding to support its request represented about $500,000 of the additional $3.49 supplemental funding for the source recovery project in fiscal year 2004.

DOE to submit a plan to the Congress that ensures the continued recovery and storage of unwanted sealed radiological sources that pose a security threat until a permanent GTCC waste disposal facility is available. Further, this DOE manager told us that source recovery project personnel may still be needed to help some licensees to meet the packaging requirements of any future GTCC waste disposal facility.

DOE Has Made Progress in Resolving a Storage Space Shortage That Has Slowed Recovery of Some Sealed Radiological Sources

DOE has taken actions to address the storage space shortage that has prevented the recovery of certain types of unwanted sealed radiological sources. We reported in April 2003 that DOE had inadequate storage capacity to meet the higher security needs for recovered sealed radiological sources containing plutonium-239, and lacked a means for temporarily storing sources containing strontium-90 and cesium-137. We recommended, among other things, that the Secretary of Energy take immediate action to provide storage space for these sources at a secure DOE facility. According to the director of DOE's Office of Global Radiological Threat Reduction, as of September 2004, DOE had developed sufficient storage space at the Los Alamos National Laboratory and the Nevada Test Site to recover more than 260 plutonium-239 sealed radiological sources registered by licensees for collection. According to the source recovery project team leader, DOE's plan has been to recover over 100 remaining plutonium-239 registered sources, representing approximately 60 drums of waste;[23] ship them to the Nevada Test Site; and then incrementally transfer them to the Los Alamos National Laboratory as space is made available from the shipment of the existing stored plutonium-239 sources to the Waste Isolation Pilot Plant (WIPP) in New Mexico.[24] WIPP will only accept sources that are shipped from Los Alamos. Implementation of this plan, however, has been delayed pending final approvals to ship these sources between locations.

[23]As a comparison, according to the source recovery project team leader, the Los Alamos National Laboratory is currently storing 21,000 55-gallon drums of DOE- or defense-related nuclear waste destined for disposal at WIPP.

[24]WIPP, operated by DOE and licensed by the Environmental Protection Agency, is an underground repository for defense-generated transuranic waste. Transuranic waste refers to man-made radioactive wastes that have particles whose atoms are heavier than uranium; are alpha particle-emitting, with a half-life longer than 20 years; and have a concentration greater than 100 nano-curies per gram of waste. These wastes include radionuclides, such as americium-241, plutonium-238, and plutonium-239, that are generated by nuclear weapons production and the reprocessing of spent nuclear fuels.

Additional progress has been made in addressing the storage issues that relate to unwanted strontium-90, cesium-137, and some cobalt-60 sealed radiological sources. According to the source recovery project team leader, DOE has recovered a strontium-90 radioisotopic thermoelectric generator that was owned by the department and used as a remote power supply and disposed of the generator at the Nevada Test Site. DOE also has recovered six of these devices that were commercially owned and is storing them at the Los Alamos National Laboratory, pending approval for disposal as waste. Regarding the cesium-137 sealed radiological sources, the source recovery project has recycled 5 large cesium-137 irradiators to commercial firms. DOE has also contracted to recover the remaining 14 registered irradiators by the end of fiscal year 2005. Moreover, the team leader told us that the source recovery project plans to collect 221 cobalt-60 sources from a university this summer and to dispose of them at the Nevada Test Site as DOE-owned nuclear material.

DOE Is Preparing an Environmental Impact Statement for GTCC Waste Disposal Options, but Estimating Storage and Future Waste Volumes Will Be Difficult

DOE has begun to take action to identify a suitable location for the disposal of GTCC waste, but producing useful estimates of the current storage and future generation of this waste will be difficult. We reported in April 2003 that DOE had not made progress toward providing for a permanent disposal facility for the nation's GTCC waste, and that it was unlikely to provide such a facility by fiscal year 2007 because developing a disposal site for this waste was considered a low priority within the department. We recommended that the Secretary of Energy initiate a process to develop a permanent disposal facility for GTCC waste, including empowering an office to take on this responsibility. In September 2004, DOE took a first step in this direction by transferring responsibility for assessing disposal options for GTCC waste from its Office of Environment, Safety, and Health to its Office of Environmental Management. With this authority and the heightened need to take action, on May 11, 2005, the Office of Environmental Management published an advance notice in the *Federal Register* of its intent to prepare an environmental impact statement (EIS) for GTCC waste disposal.[25] DOE now anticipates that the actual notice of intent to prepare the EIS will be issued in the fall of 2005, followed by public meetings to further define the scope of the EIS and to identify significant issues to be addressed. The DOE document manager for the EIS told us that after the notice of intent is issued, the process of preparing the

[25] 70 *Fed. Reg.* 24775 (May 11, 2005).

EIS could take 2 years. The Energy Policy Act of 2005 requires that, within 1 year, DOE report to the Congress on the estimated costs and a proposed schedule to complete both the EIS and a record of decision for a permanent disposal facility for GTCC waste. Moreover, before DOE makes a final decision on the long-term disposal alternative or alternatives to be implemented, this act requires DOE to prepare a report to the Congress describing all alternatives under consideration, including recommendations for ensuring the safe disposal of GTCC waste, and then to await action by the Congress. Therefore, it is not possible for DOE to determine when a permanent disposal facility will be available for GTCC waste.

In his September 2004 congressional testimony, the director of DOE's Office of Global Radiological Threat Reduction, stated that the EIS for GTCC waste disposal will include an analysis of waste inventories, long-term disposition alternatives, and resource requirements—as well as an assessment of legislative, regulatory, and licensing requirements. According to the director, the broad scope of the EIS should enable DOE to consider any new or existing site, facility, and disposal method for GTCC waste. Possible locations and disposal options include commercial, DOE, or other governmental facilities and private land. The disposal methods examined will range from deep geologic disposal to enhanced near-surface disposal, depending on the type of GTCC waste.

In completing the EIS, DOE plans to inventory the GTCC waste in storage at licensee and DOE facilities as well as estimate the waste expected to be generated in the future. According to the DOE document manager for the EIS, the department will obtain information on nuclear utility and DOE GTCC waste that is currently in storage and will estimate future volumes over the next 30 to 50 years on the basis of a representative sample of some nuclear power plants that are being decommissioned, and from existing DOE databases. For nonutility licensees, the information on the storage and projected generation of GTCC waste will be more speculative. This official said that DOE has selected a contractor to update the estimates made in a 1994 DOE report that the department now considers outdated.[26] DOE asked the contractor to begin with the methodology used in the 1994 report to estimate current GTCC waste storage and to project future

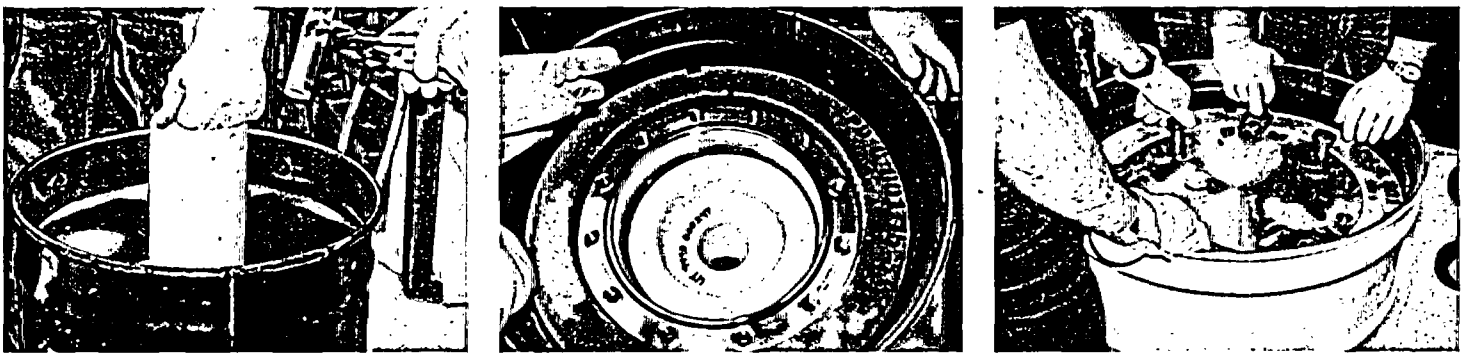
[26]Idaho National Engineering Laboratory, *Greater-Than-Class C Low Level Radioactive Waste Characterization: Estimated Volumes, Radionuclides and Other Characteristics*, DOE/LLW-114, Revision 1 (Idaho Falls, ID: September 1994).

generation of these wastes by nonutility licensees, rather than attempt to survey all NRC and Agreement State licensees that might possess these radioactive materials.

Attempting to obtain information on nonutility licensee storage of GTCC waste that can be used to estimate future generation of GTCC waste from sealed radiological sources will be especially difficult. Of the three types of GTCC waste, the second largest volume behind activated metals is from sealed radiological sources. Uncertainties surround producing these estimates, such as (1) how to determine the quantities of unwanted sealed radiological sources in storage and (2) how much waste and what class of waste might be generated once these sources are packaged for disposal. One estimating problem is that there is currently no standard process by which licensees declare their sealed radiological sources as disused (unwanted). According to an NRC official, sealed radiological sources would not be considered waste, even if they are stored unused by a licensee, until the licensee has determined that they are no longer useful. In addition, sealed radiological sources that are no longer useful may be returned to the source manufacturer or allowed to decrease in radioactivity concentration while in storage so that they can be disposed as a lower level waste class. Because licensees typically do not declare their disused (unwanted) sources as waste until they are packaged and ready for shipment to a waste broker or disposal site, it will be difficult for DOE to project when this type of waste might need disposal in a GTCC waste disposal facility.

Another uncertainty in estimating the future quantities of GTCC waste is that the volume of waste generated by a small sealed radiological source is determined by the size of its disposal container and not by the size of the source or number of sources in the container. Disused sources are typically placed in 30-gallon or 55-gallon disposal drums. The number of sources put into one drum and the packing materials used are affected by the acceptance criteria of the disposal site. Figure 2 shows a sequence of photographs depicting source recovery project personnel removing a 5-curie, plutonium-239/beryllium source and repackaging it into a 55-gallon drum especially designed to meet the acceptance criteria at WIPP. Source recovery project personnel told us that these drums cost between $5,000 and $6,000 each. The sealed radiological source held in pliers in the first photograph is clearly a fraction of the size of the 55-gallon disposal drum.

Figure 2: Source Recovery Project Personnel Remove a Sealed Radiological Source and Repackage It into a WIPP-Acceptable Disposal Drum

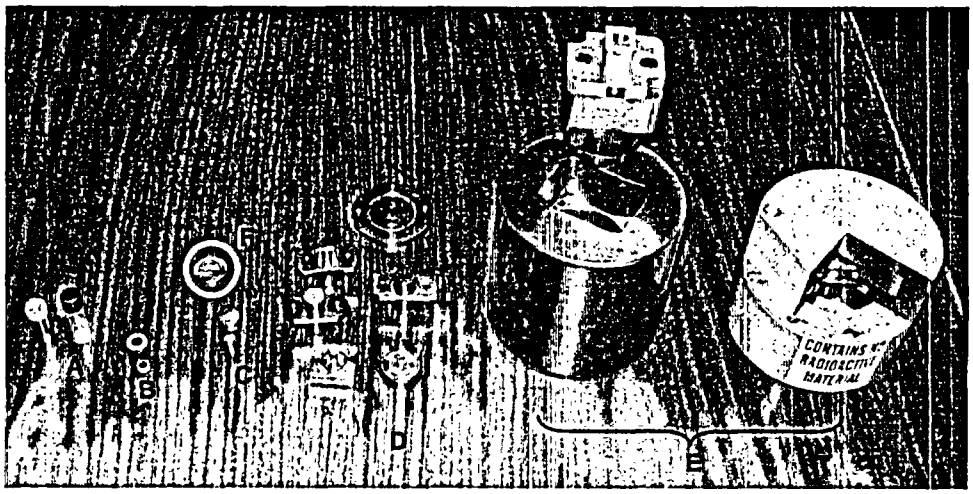


Source: GAO.

Pictured left to right: A sealed source being removed (in pliers) from a shielded storage container at a recovery site; the interior of a multifunction container used for transport, storage, and disposal; and the process of closing the steel pipe component after the source has been loaded into the multifunction container.

Figures 3 through 5 show photographs that illustrate the scale of sealed radiological sources relative to their devices as well as how the sources or their devices are packaged into more traditional disposal drums.

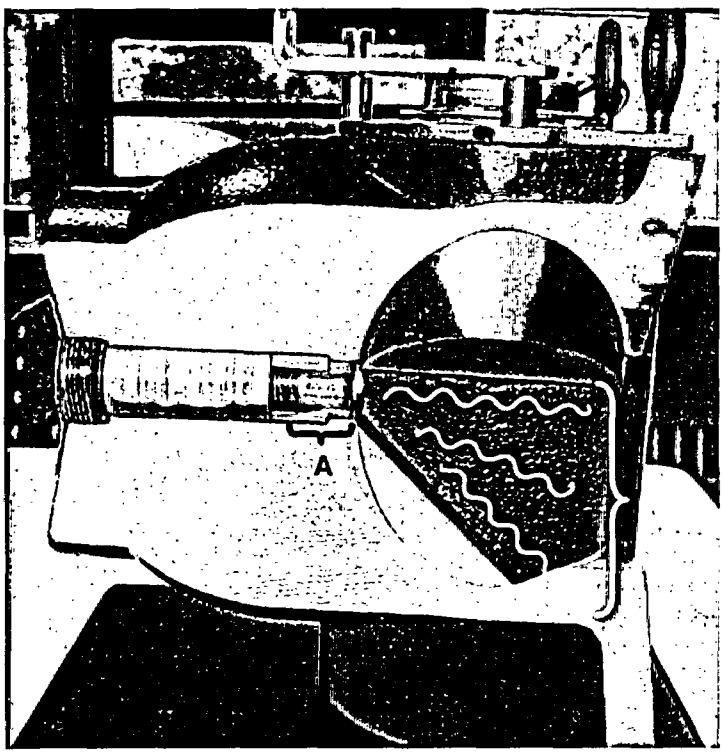
Figure 3: Relative Size of a Sealed Radiological Source and Typical Disposal Drums



Source: GAO.

A display of sealed radiological source components: (A) radioisotopes in powder or ceramic pellet form within glass vials, (B) solidified radioactive material, (C) metal cells with lid to hold the radioactive material, (D) completed sealed radiological sources, and (E) two types of protective metal holders. Note the nickel (F) for scale.

Figure 4: A Cross Section of a Nuclear Gauge, and Leveling Gauges Returned to a Manufacturer



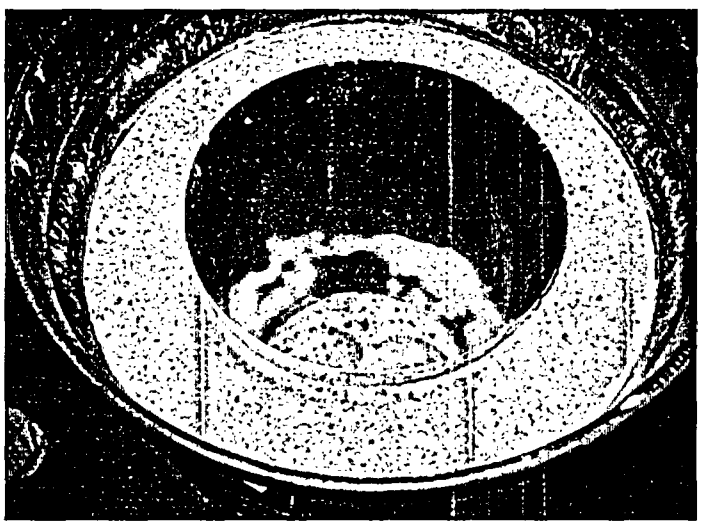
Source: GAO.

A cross section of a nuclear gauge for level or density measurement that relies on a cesium-137 sealed radiological source, as shown in the middle of the gauge (A).

Source: GAO.

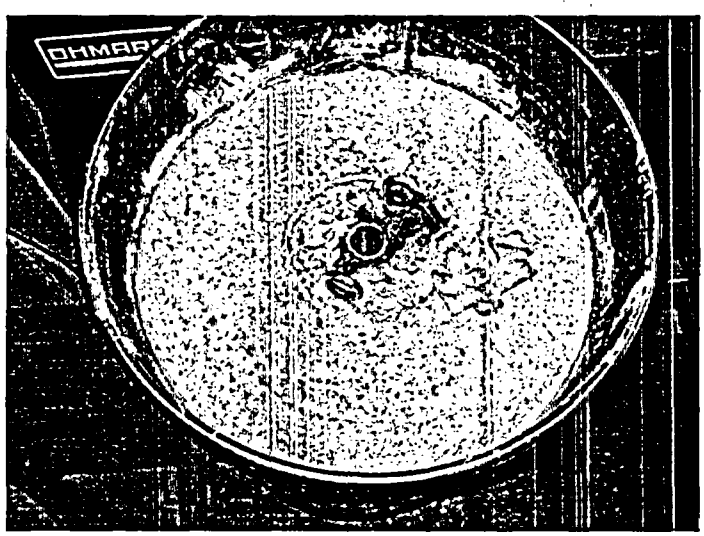
Leveling gauges returned to a manufacturer, each containing a sealed radiological source. Most sealed source manufacturers state that these types of devices have 15 years of working life.

Figure 5: Interior Views of Two 55-Gallon Disposal Drums, One with a Large Opening for an Entire Disused Device and the Other with a Narrow Pipe Opening for Only Sources



Source: GAO.

Interior view of a 55-gallon disposal drum with a large opening, surrounded by concrete, that will hold a disused leveling gauge device from which the sealed radiological source could not be safely removed.



Source: GAO.

Interior view of a 55-gallon disposal drum with a narrow pipe opening, surrounded by concrete, in which sealed radiological sources will be placed.

Yet another uncertainty in projecting the future volume of GTCC waste from sealed radiological sources is that different types of radionuclides can comprise the sources used in a device, and, depending on the radionuclide used, the age of the source, and how the source is packaged for disposal, the device can fall into different classes of waste. For example, as shown in table 4 in appendix II, six different radionuclides can be used as the source in an industrial radiography device. Further, the sources that can be used in this industrial radiography device can produce non-GTCC and GTCC waste, depending in part on how much radioactivity remains in the source when it is disposed of and how the source is packaged. For example, a 5-curie, cesium-137 sealed radiological source that is used in a device might fall into a GTCC waste class when packaged if little of the source is depleted; but once it becomes unwanted and then packaged in a 55-gallon disposal drum with nonradioactive filler material, it might fall into the non-GTCC waste class because its radioactivity, as averaged over the entire volume of the drum, would be lower.

DOE Expanded the Scope of Its Source Recovery Project to Include Non-GTCC Waste, Which Could Increase Project Expenditures

DOE has expanded its source recovery efforts to include all sealed radiological sources that could present a threat, a change that could increase project expenditures. DOE's source recovery project now includes, among other activities, the recovery and commercial disposal of non-GTCC waste from unwanted sealed radiological sources that pose a health, safety, security, or environmental threat. The recovery and commercial disposal of more of these types of sealed radiological sources from licensees that cannot afford to dispose of them today, in addition to the recovery of higher radioactive sources, is likely to increase DOE project expenditures. Further, DOE may need to recover even more non-GTCC waste from unwanted sealed radiological sources in the future if licensees in many states lose access to the only commercial low-level radioactive waste disposal site where they can currently dispose of higher radioactive non-GTCC waste (classes B and C waste). This increased recovery of non-GTCC waste from sealed radiological sources will place greater demands on source recovery project expenditures because of impediments to DOE's recouping recovery costs from licensees that could otherwise cover their source disposal costs if there were disposal availability. In the absence of access to commercial disposal, DOE anticipates the need to indefinitely store the recovered non-GTCC waste until a commercial disposal option becomes available. DOE's current policy does not include using DOE sites to permanently dispose of this waste because, among other reasons, it does not want to undermine the authority the Congress gave to the states to provide disposal availability for non-GTCC waste.

DOE Has Recovered and Commercially Disposed of Some Non-GTCC Waste

The expanded scope of the source recovery project now includes, among other activities, the collection and commercial disposal of non-GTCC waste from unwanted sealed radiological sources that pose a health, safety, security, or environmental threat.[27] Responsibility for the safe management and disposal of these radioactive materials is normally held by those entities that NRC or the Agreement States license to possess and use these materials. However, in some cases, licensees are unable to (1) ensure the safe and secure use of these materials or (2) cover the disposal costs of their unwanted sealed radiological sources. For example, according to the

[27]The other activities of the source recovery project include recovering from other countries sealed radiological sources that were previously owned by the U.S. government, cooperating with IAEA, and working with the Department of Homeland Security.

source recovery project leader, at the request of NRC, DOE commercially disposed of its first significant quantities of non-GTCC waste during fiscal year 2004. Source recovery project personnel collected 443 unwanted sealed radiological sources (containing cesium-137, cobalt-60, or radium-226) from a bankrupt firm in Pennsylvania and commercially disposed of most of them at the Barnwell, South Carolina, disposal site. In commenting on a draft of this report, DOE provided examples of other non-GTCC waste from sealed radiological sources that it had recovered.

Under the expanded scope of the source recovery project, DOE has developed a priority scheme for deciding which sources to recover and when to do so. According to the director of DOE's Office of Global Radiological Threat Reduction, DOE has been working with the Department of Homeland Security and other agencies, in addition to NRC, to determine the sources that should receive the highest priority for recovery, including those that when disposed of would not be considered GTCC waste. In addition, the manager of DOE's U.S. Radiological Threat Reduction Program told us that DOE and NRC are also in the process of revising the 1999 memorandum of understanding that defined the responsibilities of each agency with respect to the problem of unwanted and uncontrolled sealed radiological sources to better reflect current DOE recovery practices. The source recovery project leader provided us with an initial priority ranking scheme for recovering sources that is used by DOE, as well as some other factors that DOE considers. The initial ranking involves combining three factors into an overall risk ranking for each licensee site that contains sealed radiological sources. These factors include the level of security over the source at a licensee site, the total quantity of radioactive material present, and the quantity of radioactive material in any single sealed radiological source to a licensee site. Other factors that DOE considers when prioritizing sources at recover include the opportunity of recovering additional unwanted sealed radiological sources that source recovery personnel may discover during their visit at a licensee site. For example, the source recovery project leader told us that if team members come across vulnerable sealed radiological sources of lesser radioactivity at a location where they are recovering higher radioactive sources, they will collect them as well.

Recovery of More Non-GTCC Waste from Sealed Radiological Sources Could Increase Project Expenditures Because DOE Cannot Recoup Recovery Costs

DOE has already incurred additional expenses to recover and commercially dispose of non-GTCC waste from unwanted sealed radiological sources. It cost DOE approximately $581,000 to recover hundreds of these sources that had accumulated at a bankrupt firm in Pennsylvania and to commercially dispose of them. The Barnwell disposal site received 15 of the 16, 55-gallon and 30-gallon drums of this non-GTCC waste and charged DOE a $1,650 per-cubic-foot disposal fee. For example, the disposal fee and container cost for just 1, 55-gallon disposal drum holding 130 of the recovered cesium-137 sealed radiological sources cost DOE about $21,000, not including labor, transport, and other costs. Additional DOE recovery of non-GTCC waste from licensees that currently need to store their sources and other waste because they do not want to or cannot pay these high disposal fees may be necessary in the future. According to the deputy director of DOE's Office of Global Radiological Threat Reduction, because of the cost involved, encouraging those licensees that have sealed radiological sources to dispose of them properly has proven difficult, particularly with entities that only have a few sources. NRC can impose fines as high as three times the cost of commercial disposal on a licensee that fails to properly dispose of radioactive material.[28] However, a senior NRC official has publicly acknowledged the difficulty that licensees with only a few unwanted sources have in finding a cost-effective means for disposing of them.

DOE is currently impeded from recouping more of its recovery and storage costs for GTCC waste as well as any non-GTCC wastes that it may need to recover. Regarding GTCC waste, since DOE issued its 1987 report on how it planned to address its responsibilities under the Low-Level Radioactive Waste Policy Act of 1980, as amended, no specific action has been taken to identify a different method of funding the source recovery project, other than through the appropriations process. According to the manager of DOE's U.S. Radiological Threat Reduction Program, DOE has been unable to establish a standard fee for recovering unwanted sealed radiological sources from licensees because existing cost recovery mechanisms require the department to know both the number of years that these sources will be stored and the cost of their disposal before setting a fee, which is not currently possible. Regarding non-GTCC waste, the sources recovered to date were primarily from a commercial firm that had gone bankrupt and

did not have the necessary funds to cover the cost of disposing of its sources. DOE had to cover the recovery and commercial disposal costs because there was no other source of funding. One of the reporting requirements for the task force on radiation source protection and security, required under the Energy Policy Act of 2005, is to provide recommendations for appropriate regulatory and legislative changes for the establishment of, or modification to, a national system (including user fees and other methods) to provide for the proper disposal of sealed radiological sources under the act.

DOE May Need to Recover and Dispose of More Non-GTCC Waste If Licensees Have No Disposal Option, Further Increasing Demands on Project Expenditures

In the future, DOE may have to recover more non-GTCC waste from sealed radiological sources if licensees that are forced to store their unwanted sources because they have no access to a disposal site. As we reported in June 2004, if South Carolina follows through with plans to restrict access to the Barnwell disposal site to only the three member states of the Atlantic Compact by mid-2008, and if no disposal alternative for the more highly radioactive non-GTCC waste (classes B and C waste) is developed, licensees in 36 states that are presently allowed to use this site will need to store more of their unwanted radioactive materials. Although NRC does not place time limits on the storage of radioactive materials as long as they are safe and secure, greater quantities and longer periods of storage, particularly of unwanted sealed radiological sources, will likely increase safety and security risks. In January 2002, NRC sent a letter to DOE requesting that the source recovery project take actions to recover registered unwanted sealed radiological sources because the possession and storage of these sources with no GTCC waste disposal outlet represented a potential health and safety threat. Regarding non-GTCC waste from unwanted sealed radiological sources, the manager of DOE's U.S. Radiological Threat Reduction Program told us that DOE will likely need to increase the recovery of these sources if licensees have no commercial disposal option for this waste. Domestic and international experts contend that the lack of disposal availability for unwanted sealed radiological sources can increase their risk of abandonment, misplacement, and theft. For example, the Health Physics Society[29] stated

[29]The Health Physics Society is a nonprofit, scientific professional organization whose mission is to promote the practice of radiation safety. The society has approximately 6,000 scientists, physicians, engineers, lawyers, and other professionals representing academia, industry, government, national laboratories, the Department of Defense, and other organizations.

that the lack of a GTCC and non-GTCC waste disposal option for unwanted sealed radiological sources that pose security and public health concerns will continue to increase the number of orphan sources. Further, IAEA has reported that disused (unwanted) sources represent the largest pool of vulnerable and potential orphan sources.[30] If DOE were to begin recovering more non-GTCC waste from unwanted sealed radiological sources, even greater demands will be placed on DOE recovery project resources if DOE cannot recoup some of its recovery costs from licensees. While DOE is justified in covering the recovery and commercially disposal cost of the non-GTCC waste it has collected from licensees that could not afford to dispose of it themselves, the department may be able to recoup some of its costs in the future from licensees that could afford the cost of disposal if it were commercially available.

It is difficult to estimate the budgetary impact on DOE if there were a need to increase the recovery of unwanted sealed radiological sources from licensees that have no access to a commercial disposal site for their higher radioactive non-GTCC waste. One reason for this situation is the lack of information on the number of sources in storage that might need DOE recovery. As we reported August 2003, there is no national database on the quantities of sealed radiological sources in storage. Moreover, there is no national database that tracks the storage of any low-level radioactive waste. Given the lack of national data on how much waste is generated annually, the disposal data from low-level radioactive waste disposal operators can only provide an indication of the quantity of disused or unwanted sealed radiological sources and other waste that might need storage each year in the absence of disposal availability. Nevertheless, we found that between 2001 and 2004, the Barnwell disposal site disposed of, on average, 31,150 cubic feet of the higher radioactive non-GTCC waste (classes B and C waste), of which about 588 cubic feet, or about 2 percent of the total, was derived from disused sealed radiological sources.[31] Approximately one-half of the sealed radiological source waste (about 56 percent) came from private industry, followed by government agencies (about 25 percent), colleges and universities (about 11 percent), and

[30]IAEA, *Strengthening Control Over Radioactive Sources in Authorized Use and Regaining Control Over Orphan Sources: National Strategies*, IAEA-TECDOC-1388 (Vienna, Austria: February 2004) p. 54.

[31]Between 2001 and 2004, the other low-level radioactive waste disposal site in Washington only received an average of 155 cubic feet of classes B and C waste comprised of sealed radiological sources.

medical waste (about 4 percent). If DOE recovered, took title of, and commercially disposed of all non-GTCC waste from sealed radiological sources that are sent to the Barnwell disposal site annually, it might cost DOE approximately $1 million a year just to cover the disposal cost at the current $1,700 cubic foot disposal fee rate. However, until DOE has better information on the number of sources that may need to be recovered and future disposal costs, including recovery, packaging, transport, and other costs, it will be difficult to accurately estimate future costs of recovering non-GTCC waste.

Lack of Commercial Disposal Availability Could Heighten Interest in Using DOE Sites for Disposal

If licensees lose access to commercial disposal sites for their higher radioactive non-GTCC waste in the future, DOE will likely have to recover more of this waste from unwanted sealed radiological sources, which could heighten interest in using DOE sites for disposal of these wastes. The manager of DOE's U.S. Radiological Threat Reduction Program told us that although DOE is not legally prohibited from permanently disposing of, at DOE sites, the recovered non-GTCC waste for which it has taken title, it would not want to do so. This DOE manager said that on the basis of current policy, DOE would indefinitely store any recovered non-GTCC waste from unwanted sealed radiological sources at its sites until commercial disposal is available or DOE receives other congressional guidance. The DOE manager provided three reasons to justify this current policy. First, DOE does not want to undermine the responsibility given by the Congress to the states to provide disposal availability for non-GTCC waste under the Low-Level Radioactive Waste Policy Act of 1980, as amended. Second, DOE is not allowed to compete with commercial waste companies for the disposal of non-GTCC waste. Finally, DOE does not want to dispose of the relatively small quantity of recovered non-GTCC waste at its sites because this might set a precedent for disposing of all non-GTCC waste that does not have a commercial disposal pathway. However, in lieu of storing this non-GTCC waste, this DOE manager suggested that DOE could, under emergency access provisions, approach the regulatory bodies that have jurisdiction over commercial disposal sites to obtain disposal access. Despite DOE's current policy regarding what it would do in the future with recovered non-GTCC waste if there were no commercial disposal availability, there have been calls to consider using DOE sites for the disposal of this waste. Our June 2004 report[32] discussed some issues

[32]GAO-04-604.

that would need to be resolved to use DOE sites for this waste, including the feasibility of DOE's accepting all non-GTCC waste, the responsibility for paying for the disposal of this waste, and the licensing and regulatory responsibilities covering its disposal.

DOE Lacks Information to Better Identify Unwanted Sealed Radiological Sources That May Need Recovery

DOE lacks information that would assist in its efforts to identify and recover unwanted sealed radiological sources that pose a safety or security risk. Although DOE maintains an inventory of recovered sealed radiological sources and sources registered for future recovery, neither DOE nor any other government agency has centrally tracked the number of sources in the United States or the number of unwanted sources in storage at licensee sites across the country. Under the current regulatory structure, NRC and Agreement states only know the authorized uses and maximum quantities allowed for each licensee, not what they actually possess. As a result, DOE has no means of determining the actual number of sealed radiological sources that may require recovery in the future. NRC is currently developing a national source tracking system to, among other things, identify the possession and movement of some high-risk sealed radiological sources. However, as presently designed, this tracking system lacks information that DOE might find useful in planning and budgeting for the recovery of unwanted sealed radiological sources and their eventual disposal.

DOE Has Information on Sealed Radiological Sources Already Recovered and Limited Information on Those to Be Recovered

The source recovery project maintains its own inventory of sealed radiological sources that have been recovered and are in storage, and those that licensees or NRC have asked DOE to recover. According to the source recovery project team leader, the accuracy of the information on a sealed radiological source in this inventory improves from when a licensee initially registers the source; to when source recovery personnel have follow-up conversations with the licensee to clarify the recovery request for the source; to when the source recovery project team actually visits the site to physically inspect the source, record its serial number, and package it for disposal. The source recovery project team leader told us that the information on sources initially registered is less accurate because the licensee may not know anything about their source, or a licensee might inadvertently provide incorrect information about the source, such as its radionuclide and radioactivity concentration. Once recovered, the information in the source recovery project inventory includes the type of radionuclide, serial number, size, radioactivity concentration, and method

of packaging for storage or disposal. The source recovery project team leader told us that this inventory is designed to assist in administrative planning, scheduling and prioritizing recoveries, tracking shipments, and documenting storage or disposal locations.

Information on the recovered sealed radiological sources in DOE's possession is then integrated into DOE's Radiological Source Registry and Tracking System. This departmentwide inventory system was established in November 2003, in response to a recommendation of the DOE/NRC Interagency Working Group on Radiological Dispersal Devices. The tracking system is managed by DOE's Office of Plutonium, Uranium, and Special Materials Inventory and maintained at Sandia National Laboratories. DOE designed its system to help (1) monitor the safety and security of all DOE-owned sealed radiological sources that meet a certain threshold size and radioactivity concentration and (2) provide information on the potential threat they pose. In addition to descriptive information on the type of sealed radioactive source and its location within the DOE complex, this tracking system also records data on the source's status—such as whether the source is in active use; is inaccessible and, thus, not being used; is in storage for potential future use; or is packaged and awaiting final disposal.

DOE Cannot Determine How Many Unwanted Sealed Sources May Need Recovery

Because neither DOE nor any other government agency has centrally tracked the number of sealed radiological sources in the United States at any given time or the number of unwanted sources held by NRC and Agreement States licensees, DOE has few available means of estimating the quantities of sources that may need recovery in the future. Under the current regulatory structure, NRC and the Agreement States only have information on the authorized uses and maximum quantities of radioactive materials licensees are allowed to possess, although each licensee is responsible for maintaining inventories of its individual sources. Further, the source recovery project inventory contains only information that licensees have voluntarily provided to DOE on their unwanted sealed radiological sources and more limited voluntary registration of sources that may require recovery in the future. The information on sealed radiological sources that NRC provides to DOE for scheduling recovery only captures those sources that NRC or Agreement States are aware of that need recovery and does not include sources that licensees may possess that are unwanted. Consequently, neither of these methods for obtaining information provides the kind of data that DOE can use to estimate future quantities of sealed radiological sources that may need recovery. According

to the manager of DOE's U.S. Radiological Threat Reduction Program, because the source recovery project has no information on the number of sources in current use or in storage, DOE is limited in its ability to provide useful estimates of the quantities of sealed radiological sources that DOE might need to recover in the future.

The Proposed National Source Tracking System Is Not Designed to Collect Some Information That Could Be Useful to DOE

NRC plans to develop a national source tracking system that will register certain sealed radiological sources possessed by licensees and/or DOE. In November 2003, NRC, in cooperation with the Agreement States, contacted 2,600 entities licensed to possess IAEA categories 1 and 2 sources in an effort to capture for the first time national data on the actual type, quantities, and current ownership of these sources. Over 99 percent of these licensees voluntarily reported information back to NRC, but only about one-half of them reported that they possessed these sources. NRC has already conducted a follow-up survey of a portion of these licensees, and other surveys are planned leading up to an implementation of the national source tracking system in 2007. Although licensees are requested to volunteer information for these interim surveys, NRC issued a proposed rule in July 2005[33] that would, among other things, require licensees to provide an inventory of their sealed radiological sources; annually verify and reconcile their actual inventory with the information registered in the system; and report certain transactions, such as the date of manufacture, transfer, or disposal of their sealed radiological sources. The Energy Policy Act of 2005 requires that NRC issue regulations, within 1 year, establishing this mandatory tracking system that shall be coordinated with systems established by the Department of Transportation to track the shipment of radiation sources. Such a tracking system must, among other things, provide for the reporting of required information through a secure Internet connection.

As presently designed, NRC's national source tracking system will inventory and monitor primarily IAEA categories 1 and 2 sources—the minimum required under the 2004 IAEA *Code of Conduct*—despite support from IAEA and DOE for tracking additional source categories and other

[33] 70 *Fed. Reg.* 43646 (July 28, 2005).

information.[34] In its July 2003 technical document detailing the methodology behind the IAEA source categorization scheme, IAEA suggested that member states consider the combined radioactivity of aggregated sealed radiological sources in one location for the purpose of categorizing these sources on the basis of their potential to cause harm to human health.[35] Using this methodology, the accumulation of enough individual IAEA category 3 sources in close proximity to one another would yield concentrations of radioactive material equivalent to a single IAEA category 2 source. For example, storing 15 well-logging devices in close proximity (each well-logging device typically contains a 2-curie, cesium-137 source, which is an IAEA category 3 source) would be equivalent to having a 30-curie, cesium-137 source in this location, which is an IAEA category 2 source.

Almost all of the unwanted sealed radiological sources recovered by DOE would fall into categories below IAEA categories 1 and 2 and, therefore, would not have been registered in the national source tracking system as presently designed. According to the manager of DOE's U.S. Radiological Threat Reduction Program, over 90 percent of the sites where DOE has recovered sealed radiological sources had quantities of lesser radioactive sources that when aggregated were equivalent to an individual IAEA category 2 source and, thus, posed enough of a safety and security risk to warrant their recovery. This recovery has been justified despite the fact that the total curie level of all the recovered IAEA category 3 sources was only about 15 percent of the curie level of the relatively few recovered categories 1 and 2 sources, and without regard to whether the sources might or might not have been located in close proximity at each of the licensee sites. In a 2004 technical document, IAEA suggested that it would be beneficial from both a safety and security viewpoint for all disused or unwanted sealed radiological sources to be identified and to undergo proper disposition.[36] According to IAEA, the quality of a country's national registry of radioactive sources will be a prime indicator of the probability of there being vulnerable and orphan sources. History has shown that many

[34]NRC has added seven radionuclides not recommended for tracking by the IAEA *Code of Conduct*, including actinium-227, polonium-210, plutonium-236, plutonium-239, plutonium-240, thorium-228, and thorium-239. Although these radionuclides are not prevalently used by licensees, they are used at DOE facilities.

[35]IAEA, *Categorization of Radioactive Sources*, p. 9.

[36]IAEA, *Strengthening Control Over Radioactive Sources*, pp. 39, 54.

accidents involving orphan sources come about because sources that are no longer in use are eventually forgotten, with subsequent loss of control years later. Table 3 shows a breakdown of the sealed radiological sources that DOE has recovered, by their IAEA source category, as of June 7, 2005. As shown in the table, about 98.5 percent of these sources fall below category 2 and, therefore, would not have been tracked in the proposed national source tracking system.

Table 3: DOE-Recovered Sealed Radiological Sources, by Their IAEA Source Category, as of June 7, 2005

IAEA source category	Number of sources	Percentage of total sources	Curies[a]	Percentage of total curies[a]
Category 1	37	0.34%	78,984.07	52.68%
Category 2	129	1.19	50,181.55	33.47
Category 3	4,941	45.73	19,540.26	13.03
Categories 4 and 5	5,672	52.49	1,233.43	0.82
Uncategorized[b]	27	0.25	0.01	0.00
Total	**10,806**	**100.00%**	**149,939.32**	**100.00%**

Source: DOE source recovery project inventory database.

[a]A curie is a measure of the rate of radioactive decay; it is equivalent to the radioactivity of 1 gram of radium or 37 billion disintegrations per second.

[b]Uncategorized sources contain radionuclides that are not covered by an IAEA source category.

In the proposed rule to implement a national source tracking system, NRC states that it does not plan to include IAEA category 3 sources in the registry at this time, but that it may consider doing so in the future because licensees possessing a large quantity of IAEA category 3 sources could present a security concern. Although NRC contends that reliable tracking of the accumulation of IAEA category 3 sources will be difficult and might pose a potential burden on licensees, NRC is seeking comments on the inclusion of these sources in its tracking system. NRC stated in its notice of intent that one way to address the accumulation of sources of concern would be to lower the threshold for source tracking to include all IAEA category 3 sources, since a source level tracking system cannot include aggregation of sources because the sources may move in and out of the tracking system with the change of ownership. However, in commenting on a draft of this report, NRC stated that in lieu of the inclusion of category 3 sources in the proposed national source tracking system at this time, its new security orders for licensees possessing IAEA categories 1 and 2

sources do, where appropriate, address aggregation of any sources below these two categories, such that the net result could reach the category 2 threshold in a given physical location. Nevertheless, it does not appear that these new security orders would apply to licensees that do not possess IAEA categories 1 and 2 sources but still have large accumulations of IAEA category 3 or lesser source categories.

The national source tracking system, as designed, also would not collect other information that DOE might find useful in budgeting and planning for source recovery and future disposal needs for GTCC waste. Recent IAEA technical guidance states that it is important to capture information on the frequency of use of the source in a national registry of sealed radiological sources—for example, whether the source is actually being used or whether it is being stored securely.[37] DOE already inventories such information on sources in its possession in its Radioactive Source Registry and Tracking System. DOE initially requested that NRC collect information on licensees' disposal plans in its interim survey, including whether the licensees were planning to have DOE recover their sources. NRC included this question in its first survey of licensees but has decided to drop it in subsequent surveys and in the design of the tracking system, because of the low response rate to this question and because its security regulations currently do not require licensees to report this information. However, NRC is contemplating adding a feature to the design of its anticipated national source tracking system that would capture information on the long-term storage of some sealed radiological sources, although it would be voluntary for licensees to provide this information.

The Energy Policy Act of 2005 requires NRC to chair an interagency task force on radiation source protection and security. Within 1 year of its creation, the task is to prepare a report to the Congress and the President providing recommendations for a list of additional radiation sources that should be required to be secured as well as any necessary modifications to the national source tracking system. In addition, the task force is also charged with making recommendations in this report regarding the creation of, or modification to, procedures for improving, among other things, the security of stored sources, including periodic audits or investigations by NRC to ensure that these sources are properly secured and can be fully accounted for.

[37]IAEA, *Strengthening Control Over Radioactive Sources*, p. 55.

Conclusions

DOE and NRC have important roles and responsibilities in ensuring the safety and security of radiological sealed sources. The recently enacted Energy Policy Act of 2005, among other things, adds new requirements for both agencies, including the creation of a task force on radiation source protection and security, chaired by NRC, and continued recovery by DOE of unwanted sources until it provides a disposal site for GTCC waste. The responsibilities for DOE may expand further if licensees in most states lose access to the only disposal site for their higher radioactive non-GTCC waste by mid-2008. Specifically:

- Loss of access would increase the quantities of non-GTCC waste in storage that could necessitate more recovery of this waste by DOE. This, in turn, might lead to increased costs for DOE's source recovery efforts. However, how much additional funding will be necessary for this effort would be difficult to ascertain for several reasons, including uncertainties regarding the quantity of non-GTCC waste that might need collection.

- These increased recovery and disposal costs will be incurred by DOE unless other mechanisms are adopted to recoup these costs, especially from those licensees that would be able to cover them if commercial disposal were available.

- The increasing quantities of non-GTCC waste that will not have a commercial disposal pathway could heighten interest in using DOE sites for the disposal of this waste.

- The lack of information to track the number and status of sealed radiological sources that may require recovery and disposal in the future, limits DOE's ability to effectively plan and budget for its recovery and disposal efforts and to monitor the performance of its source recovery project.

Recommendations for Executive Action

We recommend that the Secretary of Energy and the Chairman of the Nuclear Regulatory Commission, in collaboration with the Task Force on Radiation Source Protection and Security, evaluate and report on

- the cost implications of a potential expansion of DOE's recovery and disposal of non-GTCC waste from sealed radiological sources,

- options for DOE to recoup these costs from licensees that may have no commercial waste disposal options,
- the feasibility of disposing of this waste at DOE sites, and
- how a national source tracking system can be designed and implemented to improve DOE's ability to identify and track sealed radiological sources that may need DOE recovery and disposal.

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 III. DOE stated that it generally supports the recommendations contained in this report. More specifically, DOE commented that we had correctly reported the department's position with respect to recouping recovery and disposal costs; however, the department expressed some concern that charging fees or recouping costs from licensees may inhibit them from registering sources, leaving these excess sources at risk. We acknowledge in the report that DOE should cover the recovery, storage, and disposal costs of unwanted sealed radiological sources that were previously owned by DOE. We also acknowledge the need for DOE to cover these costs in cases where sources posing a health, safety, security, or environmental threat are recovered from licensees that do not have the financial means to ensure their proper disposal. Nevertheless, given the possibility that, in most states, there may not be a commercial disposal option available to licensees for their higher radioactive non-GTCC waste after mid-2008, we continue to believe that DOE and NRC should evaluate approaches to recoup recovery and disposal costs from licensees that could otherwise afford to cover these costs if a commercial disposal option were available. DOE also stated that, in addition to the non-GTCC sealed source waste that we stated it recovered and disposed, it had also recovered other sources that fall into this waste class. We added a reference to these other sources in the report. Regarding using DOE sites for non-GTCC waste disposal, the department commented that we appropriately noted its current policy and statutory responsibilities that prohibit the use of department facilities for this purpose. DOE stated that it would continue to identify potential commercial treatments or disposal options for any additional non-GTCC waste that is recovered. Finally, DOE concurred with our assessment that the proposed national source tracking system should be improved to assist the department in identifying and recovering unwanted sources from outside the department that pose a potential safety and security risk. DOE stated that its Office of Security is working with other elements of the

department and NRC in developing requirements to ensure that these unwanted sources are adequately tracked.

NRC also provided written comments to a draft of this report, which are reproduced in appendix IV. NRC stated that overall our report was well written and balanced. While NRC did not specifically agree or disagree with our four recommendations, its letter raised seven issues regarding the proposed national source tracking system.

1. NRC stated that its tracking system would provide some information useful to DOE. We agree that the national source tracking system might provide some information useful to DOE in its recovery of IAEA categories 1 and 2 sources. However, since we found that only 1.5 percent of the sources recovered by DOE as of June 7, 2005, were in these two categories, it appears that the national source tracking system would yield little, if any, practical benefits to DOE.

2. NRC stated that requiring the reporting of certain information that our report asserts DOE would find useful, such as frequency of source use, could be extremely burdensome on licensees and NRC and would yield little, if any, practical benefits. NRC provided no support for this contention or for why it cannot overcome these burdens as it has done in justifying the reporting requirements proposed for licensees possessing IAEA categories 1 and 2 sources. In addition, NRC stated in its notice of proposed rulemaking for the national source tracking system that most licensees already have systems in which information on sources is maintained, and that NRC's tracking system is designed to ease the reporting burden for these licensees. As to the comment on the practical benefit of tracking the use of high-risk radioactive materials, our report notes that the most vulnerable sources to abandonment, misplacement, and theft are those that are unwanted and in storage. Therefore, it seems reasonable to attempt to collect some information on frequency of source use, particularly if the storage of sources were to increase in the future in the absence of a commercial disposal option for the higher radioactive non-GTCC waste.

3. NRC commented that our report did not accurately characterize some issues involving IAEA category 3 sources, mainly regarding our claim that IAEA-TECDOC-1388 suggested that category 3 sources be tracked. NRC claimed that the IAEA document did not make this suggestion and provided some passages from the document to support its position. We believe that NRC's comments in this regard reflect a narrow view of the

guidance provided by IAEA. For example, in IAEA's discussion of disused (unwanted) sources in this technical document, it clearly suggests a need to identify these sources and to gather information on their frequency of use.

"Disused sources represent the largest pool of vulnerable and potential orphan sources. History has shown that many accidents involving orphan sources come about because sources that are no longer in use are eventually forgotten, with subsequent loss of control years later. To this end, it is beneficial from both a safety and security viewpoint for all disused sources *to be identified* [emphasis added] and to undergo proper disposition.... Licensees are discouraged from proper disposal of disused sources by the cost involved, by the bureaucracy of doing so, or by the lack of an available disposal option.... It is clear that information needs to be gathered by those developing a national strategy regarding *the status of at least all* [emphasis added] Category 1, 2 and 3 sources on the licensee's inventory or national registry so that appropriate decisions can be made regarding them. Generally, this will involve asking the licensee or owner of the source about its *frequency of use* [emphasis added]."

4. In support of its decision not to track IAEA category 3 sources at this time, NRC drew attention to its other regulatory efforts, especially its new security orders for some licensees that possess IAEA categories 1 and 2 sources. NRC stated that, where appropriate, these security orders address aggregation of any sources (IAEA category 3 sources and below) such that the net result could reach the category 2 source threshold in a given physical location. Despite these security orders, NRC's source tracking system would not include IAEA category 3 sources and below. However, NRC stated in its notice of proposed rulemaking for the national source tracking system, that it is seeking comments on the inclusion of IAEA category 3 sources in the registry because licensees possessing large quantities of these sources could present a security concern.

5. NRC pointed out that, as we reported, the actions it is taking to track IAEA categories 1 and 2 sources are consistent with the IAEA *Code of Conduct* and the Energy Policy Act of 2005. However, NRC failed to mention, as we do in our report, that this legislation also directs NRC to chair an interagency task force to provide a report, within 1 year, to the Congress and the President with recommendations for, among other things, additional radiation sources that should be required to be secured as well as any modifications necessary to the national source tracking system. We believe that our report provides ample support for areas where NRC, in collaboration with DOE and other federal agencies, might consider modifying the design of the national source

tracking system to better assist DOE in planning and budgeting for the recovery and disposal of unwanted sealed radiological sources.

6. NRC commented that it does not matter that almost all of the sources that DOE has recovered are below IAEA categories 1 and 2 sources because, according to NRC, the greatest risk from a source is its radioactivity level. The radioactivity of an individual source is clearly one measure of its potential safety and security risk. However, as our report notes, DOE's recovery efforts, often at the request of NRC, are not solely dictated by the radioactivity of an individual source, but more broadly the health, safety, security, or environmental threat posed by the aggregated radioactivity of many unwanted sources that are typically in storage at licensee sites around the country. Our report also notes that unwanted sources in storage tend to be the most vulnerable to abandonment, misplacement, and theft despite requirements that licensees keep track of the radioactive materials they possess. Some of the lesser radioactive sources are frequently found by DOE to be kept in quantities where their aggregated radioactivity would be equivalent to an IAEA category 2 source that would present a security concern. These lesser radioactive sources also may be more susceptible to inadvertent loss, which has already led in some cases to radiation exposure, high decontamination costs, and public panic. IAEA acknowledged in its *Code of Conduct* that its categorization of high-risk radiological sources is based on health effects and does not fully take into account the range of impacts that could result from accidents or malicious acts involving radioactive sources.

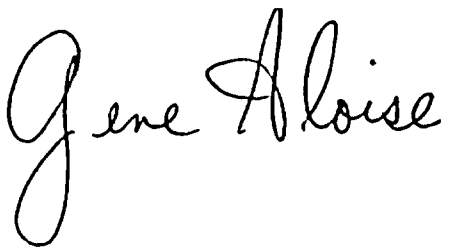
7. NRC stressed in its comments that DOE, through its representatives on NRC working groups and committees developing the national source tracking system, has had the opportunity to provide input on the design of the system and the potential usefulness of the system to assist its source recovery efforts. Regardless of DOE's opportunities to provide input to NRC, DOE officials raised concerns to us during the course of our work about the usefulness of NRC's source tracking system. Furthermore, in commenting on our draft report, DOE stated that there is a need for a more rigorous national-level tracking capability to assist the department in identifying and recovering unwanted sources.

We incorporated technical changes in this report, where appropriate, on the basis of detailed comments provided by both agencies.

We will send copies of this report to the appropriate congressional committees. We will make copies 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 at aloisee@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix V.

Sincerely yours,



Gene Aloise, Director
Natural Resources and Environment

Scope and Methodology

In our review, we examined (1) the status of the Department of Energy's (DOE) efforts to recover unwanted sealed radiological sources and develop a disposal option for greater-than-class C (GTCC) waste, (2) DOE actions taken to recover and dispose of unwanted non-GTCC waste from sealed radiological sources, and (3) the extent to which DOE can identify and track unwanted sealed radiological sources for recovery and disposal. To better understand these issues, we met with officials at DOE, the National Nuclear Security Administration, and the Nuclear Regulatory Commission (NRC), and we visited the office of DOE's source recovery project at Los Alamos National Laboratory and observed laboratory personnel recovering unwanted sealed radiological sources from a university. We also interviewed officials at nonfederal organizations, including the Health Physics Society, the Organization of Agreement States, and the Conference on Radiation Control Program Directors (CRCPD), as well as some recognized experts in the field. We also met with representatives from commercial entities that are licensed to possess high-risk radioactive sources and state regulatory officials in California and Ohio.

More specifically, to examine the status of DOE efforts to recover unwanted sealed radiological sources and develop a disposal option for GTCC waste, we interviewed DOE officials from the U.S. Radiological Threat Reduction Program, Office of Environmental Management, and Office of Security. We reviewed applicable statutes, regulations, and agency guidance as well as relevant DOE and NRC studies, reports, documents, and agency plans. We obtained information from the source recovery project inventory database to determine the number and type of sources recovered as of June 7, 2005. To determine the reliability of these data, we first asked officials a series of data reliability questions that addressed areas such as data entry, data access, quality control procedures, and data accuracy and completeness. We also inspected data records, reviewed manuals and documents relating to DOE data collection and verification methods, and interviewed DOE officials. We asked follow-up questions as necessary. In consultation with a GAO expert in research methodology, we analyzed the officials' responses for relevant weaknesses in data reliability that would make their data unusable for our analysis and reporting purposes. On the basis of these efforts, we determined that these data were sufficiently reliable for summarizing volumes of recovered sealed radiological sources.

We also sought a better understanding of how sealed radiological sources are classified as waste. We developed a structured interview guide to collect information from commercial waste brokers that possess GTCC and

non-GTCC waste from sealed radiological sources. This interview guide asked questions on areas such as the wastes these brokers often collect and the potential waste classes of common types of sealed radiological source devices. Because the practical difficulties of developing and administering a structured interview guide may introduce errors—resulting from how a particular question is interpreted, for example, or from differences in the sources of information available to respondents in answering a question—we included steps in the development and administration of the structured interview guide for the purpose of minimizing such errors. We pretested the instrument with three commercial waste brokers by telephone and modified it as appropriate to reflect questions and comments received during the pretests.

To determine which commercial waste brokers to interview, we first used a list of commercial waste brokers compiled by CRCPD's National Orphan Radioactive Material Disposition Program. This list contained 18 waste brokers that met the CRCPD criteria of being in good standing with CRCPD and serving more than 1 million customers, serving non-DOE customers, or serving more than one state. However, because this list is not comprehensive and there is no single source listing of commercial waste brokers, we also asked each broker we interviewed for the names of additional brokers who could provide useful information or insights into these issues. We continued this expert referral technique until the references we received became repetitive. In all, we used our structured interview guide to interview a nonprobablility sample of 12 commercial waste brokers in various geographical locations.[1] We then used the results of these structured interviews to create a table summarizing common sealed radiological sources devices and their potential waste class (see app. II). We shared preliminary drafts of this table with experts at DOE and NRC and with leading scientists in the field of sealed radiological source security from nonfederal organizations, such as the Monterrey Institute of International Studies and the Low-Level Waste Forum. We received and incorporated their comments as appropriate on the structure and contents of the table. On the basis of this process, we determined that these data were sufficiently reliable for the purposes of this report.

[1]Results from nonprobability samples cannot be used to make inferences about a population because in a nonprobability sample, some elements of the population being studied have no chance or an unknown chance of being selected as part of the sample.

To examine the actions DOE has taken to recover and dispose of unwanted sealed radiological sources, we interviewed source recovery project personnel and officials from the U.S. Radiological Threat Reduction Program. We also conducted interviews with representatives from nonfederal entities, including the Monterrey Institute of International Studies, the Health Physics Society, CRCPD, the National Research Council, and the Council on Foreign Relations. We discussed with these agency officials and representatives the likelihood of DOE's needing to recover more non-GTCC waste from unwanted sealed radiological sources in the future if the Barnwell, South Carolina, disposal site restricts access for licensees in 36 states by mid-2008 as planned. To obtain a better understanding of how much non-GTCC waste might be stored if licensees in these states are denied disposal access for this waste, we gathered information on the quantity of non-GTCC waste disposed at the two commercial disposal sites that can accept classes B and C waste in Richland, Washington, and Barnwell, South Carolina, between 2001 and 2004. To determine the reliability of these data, we first asked disposal operators a series of data reliability questions that addressed specific areas, such as data entry, data access, quality control procedures, and data accuracy and completeness. We added follow-up questions as necessary. In consultation with a GAO expert in research methodology, we analyzed their responses for relevant weaknesses in data reliability that would make their data unusable for our analysis and reporting purposes. On the basis of these efforts, we determined that these data were sufficiently reliable for summarizing volumes of disposed waste at these disposal sites.

To determine the extent to which DOE can identify and track unwanted sealed radiological sources for recovery and disposal, we interviewed DOE and NRC officials regarding the scope, capabilities, and limitations of their existing databases for tracking these sources. We reviewed past estimates of the number of sealed radiological sources in the United States, including the scope and methodologies used to create these estimates. To examine NRC efforts to develop a national source tracking system for certain sealed radiological sources, we interviewed NRC and DOE officials who participated in the system's initial formulation. We reviewed planning and management documents, including related NRC submissions to the Office of Management and Budget, NRC's business case analyses, and the proposed rule for implementing a national source tracking system. We also reviewed the survey instrument NRC used to populate the interim database. Finally, we interviewed state officials from Illinois, New York, Ohio, and Oregon to determine whether any states currently track sealed

radiological sources and gathered these officials' views on the need for a national source tracking system.

We conducted our review between June 2004 and September 2005 in accordance with generally accepted government auditing standards.

Selected Sealed Radiological Source Devices and Their Potential Waste Classes

Table 4 presents selected common devices that utilize sealed radioactive sources and the NRC waste classes in which sources from these devices might be disposed. This table shows the variability in the possible sources used in devices, their relative risks according to the International Atomic Energy Agency (IAEA) categorization scheme, and the range of waste classes associated with the sources that could be used in these devices. The radionuclides and the ranges of radioactivity listed next to each device are presented for illustrative purposes—each device might use one of these radionuclides in one or more sources. The IAEA source category corresponds to each radionuclide and radioactivity range, based on an IAEA technical document, as noted. The potential waste classes are associated with each device and not with the specific radionuclides that might be in these devices. In other words, not all radionuclides that could be used in a source within a device produce the range of waste classes associated with the device.

Table 4: Selected Sealed Radiological Source Devices and Their Potential Waste Classes

Device	Radionuclide	Approximate initial curie[a] range of radioactivity per device or application	IAEA source category[b]	Potential NRC waste class[b] when disposed
Radioisotopic thermoelectric generators	Strontium-90	9,000 - 680,000	1,2	B/C, GTCC
	Plutonium-238	28 - 280	2	
Panoramic irradiators[c]	Cobalt-60	500,000 - 5,000,000	1	A, B/C
Self-shielded irradiators[c]	Cesium-137	2,500 - 42,000	1,2	B/C, GTCC
	Cobalt-60	1,500 - 50,000	1	
Blood-tissue irradiators[c]	Cesium-137	1,000 - 12,000	1,2	B/C, GTCC
	Cobalt-60	1,500 - 3,000	1	
Gamma knife (fixed, multibeam teletherapy)[c]	Cobalt-60	4,000 - 10,000	1	B/C
Teletherapy	Cobalt-60	1,000 - 15,000	1	B/C
	Cesium-137	500 - 1,500	2	
Calibration sources	Cobalt-60	.55 - 16,000	1,2,3,4	A, B/C, GTCC
	Cesium-137	1.5 - 14,000	1,2,3,4	
	Americium-241	1 - 25	2,3,4	
	Plutonium-239/Beryllium	2 - 25	2,3	
	Strontium-90	0.05 - 2	4	

(Continued From Previous Page)

Device	Radionuclide	Approximate initial curie[a] range of radioactivity per device or application	IAEA source category[b]	Potential NRC waste class[b] when disposed
Industrial radiography	Cobalt-60	11 - 330	2	A, B/C, GTCC[d]
	Iridium-192	5 - 290	2,3	
	Cesium-137	5 - 12	3	
	Selenium-75	80	2	
	Ytterbium-169	2.5 - 20	3,4	
	Thulium-170	20 - 200	4	
Fixed industrial gauges (level, dredger, conveyor, blast furnace, and spinning pipe)	Cesium-137	0.1 - 40	2,3,4	A, B/C, GTCC
	Cobalt-60	0.1 - 20	2,3,4	
	Californium-252	0.037	4	
Well-logging sources	Americium-241/Beryllium	0.5 - 70	2,3,4	A, B/C, GTCC
	Radium-226	20	2	
	Cobalt-60	0.2 -10	2, 3	
	Plutonium-238/Beryllium	5 - 70	2, 3	
	Tritium	1 - 20	5	
	Cesium-137	0.5 - 20	3,4	
	Californium-252	0.027 - 1.61	3,4	
Brachytherapy (high/medium and low dose rate)	Cobalt-60	1 - 20	2,3	A, B/C, GTCC
	Cesium-137	0.01 - 8	3,4,5	
	Iridium-192	0.02 - 15	3,4,5	
	Radium-226	0.005 - 0.05	4,5	
	Iodine-125	0.005 - 1.3	4,5	
	Gold-198	0.08	4	
	Californium-252	0.083 - 0.54	3,4	
	Strontium-90	0.02 - 0.12	4,5	
	Ruthenium/Rhodium-106	0.00022 - 0.0006	5	
	Palladium-103	0.03 - 0.056	5	
Pacemakers	Plutonium-238	2.9 - 8	3	B/C, GTCC
Research reactor startup source	Americium-241/Beryllium	2 - 5	3	B/C, GTCC
Portable gauges (moisture detectors, density and moisture/density)[c]	Americium-241/Beryllium	0.01 - 3	3,4,5	A, B/C, GTCC
	Cesium-137	0.008 - 0.011	5	
	Radium-226	0.002 - 0.005	5	
	Californium-252	0.00003 - 0.00007	5	

(Continued From Previous Page)

Device	Radionuclide	Approximate initial curie[a] range of radioactivity per device or application	IAEA source category[b]	Potential NRC waste class[b] when disposed
Static eliminators	Americium-241	0.03 - 0.11	4	A, B/C, GTCC
	Polonium-210	0.03 - 0.11	4	
Thickness/fill-level gauges	Krypton-85	0.05 - 1	5	A, B/C, GTCC
	Strontium-90	0.01 - 0.2	5	
	Americium-241	0.012 - 0.6	4,5	
	Cesium-137	0.05 - 0.065	4	
	Promethium-147	0.05	5	
	Curium-244	0.2 - 1	4	
Bone densitometry	Cadmium-109	0.02	5	B/C, GTCC
	Gadolinium-153	0.02 - 1.5	4,5	
	Iodine-125	0.04 - 0.8	4,5	
	Americium-241	0.027 - 0.27	4	
X-ray fluorescence analyzers	Iron-55	0.003 - 0.14	5	A, B/C, GTCC
	Americium-241	0.004 - 0.20	4,5	
	Cadmium-109	0.005 - 0.15	5	
	Cobalt-57	0.005 - 0.04	5	
Electron capture detectors	Nickel-63	0.005 - 0.50	5	A, B/C
	Tritium	0.05 - 1.0	5	
Lightning preventers	Americium-241	0.0013 - 0.013	5	A, B/C, GTCC
	Radium-226	0.000007 - 0.00008	5	
	Tritium	0.2	5	
PET checking	Germanium-68	0.001 - 0.01	5	A, B/C
Mossbauer spectrometry	Cobalt-57	0.005 - 0.1	5	A, B/C

Sources: See the note below.

Note: The primary source for the first four columns is IAEA, *Categorization of Radioactive Sources*, TECDOC-1344 (Vienna, Austria: July 2003). The primary sources for the waste classification column are interviews we conducted with commercial low-level radioactive waste brokers. We received comments and suggestions on drafts of this table from nine scientists and regulators in the field and accepted revisions as appropriate. These revisions affected roughly 30 percent of the fields in the table, primarily those in the range of radioactivity and waste classification columns.

[a]A curie is a measure of the rate of radioactive decay; it is equivalent to the radioactivity of 1 gram of radium or 37 billion disintegrations per second

[b]See 10 C.F.R. part 61 for the NRC waste classification system.

[c]A device may utilize multiple sealed radiological sources. The range of radioactivity per use for these devices reflects the aggregate activity.

[d]There was unresolved disagreement between the waste brokers and some of the regulators regarding whether industrial radiography sources could be GTCC.

Comments from the Department of Energy

Department of Energy
National Nuclear Security Administration
Washington, DC 20585

SEP 01 2005

Mr. Gene Aloise
Director
Natural Resources and Environment
Government Accountability Office
Washington, DC

Dear Mr. Aloise:

The National Nuclear Security Administration (NNSA) appreciated the opportunity to have reviewed the Government Accountability Office's (GAO) draft report, GAO-05-967, "NUCLEAR SECURITY: DOE Needs Better Information to Guide Its Expanded Recovery of Sealed Radiological Sources." We understand that the Chairman, Senate Committee on Energy and Natural Resources requested you to examine (1) our efforts to recover Greater-Than-Class-C (GTCC) sources and develop a disposal option; (2) actions to recover and dispose of non-GTCC sources; and (3) ability to identify sources for recovery and disposal.

Recovery of excess and unwanted radioactive sources is accomplished through the Office of Defense Nuclear Nonproliferation's Office of Global Threat Reduction. Their mission is to reduce the threat domestically posed by a dirty bomb, or Radiological Dispersal Devices (RDD). As the draft notes, this program has recovered over 11,000 sealed sources since 1997, including recovering 5,529 sources in 18 months from October 2002 to March 2004, as directed by Congress. Additionally, as GAO stated, the Office of Environmental Management (EM) has initiated actions to prepare an environmental impact statement to assess disposal options for GTCC sealed sources and other GTCC waste.

GAO is recommending that the Nuclear Regulatory Commission (NRC) and the Department evaluate and report on cost implications of DOE's recovery and disposal of non-Greater Than Class C (GTCC) sources, options to recoup these DOE costs, feasibility of using DOE disposal sites, and how a national source tracking system can be designed and implemented to improve DOE's recovery and disposal efforts. NNSA generally supports the recommendations contained in the draft report. Addressing each in turn:

- ***The NRC and DOE evaluate and report on cost implications of DOE's recovery and disposal of non-GTCC sources, options to recoup these DOE costs, feasibility of using DOE disposal sites.***

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NNSA collects, stores, and disposes unwanted non-GTCC sealed sources when warranted. However, NNSA believes that charging fees or recouping costs from licensees may inhibit licensees from registering their sources leaving these excess sources at risk.

NNSA has experience in recovering non-GTCC sources and has been able to plan for these activities. In addition to the recovery of sources mentioned in the draft report, the NNSA program that recovers excess, unwanted sealed sources – the Office of Global Threat Reduction's U.S. Radiological Threat Reduction Program (USRTR) – has recovered over 1,100 curies of cobalt-60, a non-GTCC radionuclide, from a university irradiator. These sources were originally loaned to the university by the DOE and are the property of DOE. The sources were recovered and shipped to DOE low-level waste disposal. USRTR has also performed a number of recoveries of non-GTCC sources where these sources were sent to commercial disposal. In addition, in 2004, NNSA began aggressively removing excess and unwanted gamma irradiators from 19 institutions, including high schools and colleges, throughout the United States. This work will be completed this summer.

With respect to charging a fee to recoup costs for non-GTCC sources, the draft report correctly states that the Department is prohibited from charging fees for services it cannot define or provide – specifically a fee cannot be charged for an undetermined length of storage time, nor can a fee be charged for disposal if such disposal is not available to determine a cost, without specific legislation establishing such a fee mechanism, which does not exist for the program. USRTR was transferred from the Office of Environmental Management to the National Nuclear Security Administration in 2003, and a result is that the USRTR is approaching the recovery of sealed sources as a national security issue. The USRTR ensures that excess and unwanted sources that are of sufficient type and quantity to be a threat for use in a dirty bomb are securely stored or disposed. USRTR depends on licensees to voluntarily register their sources with the program for recovery. As far as the disposal of non-GTCC sources at a Departmental site, the draft report appropriately notes that the current policy and statutory responsibilities do not provide for the permanent disposal of such waste at a Department facility. However, NNSA and EM, as appropriate will continue to work with the commercial industry to identify potential commercial treatment or disposal options for non-GTCC sealed sources recovered by the Department.

- ***How a national source tracking system can be designed and implemented to improve DOE's recovery and disposal efforts.***

USRTR has a secure web-based system for licensees to register their excess and unwanted sources and provide detailed information about the sources. The

USRTR has successfully used this system for several years, and licensees use it. This system is an integrated tool used for many aspects of the program.

Additionally, Department's Office of Security (the departmental office with responsibility for the National Source Tracking Database) recognizes the need for a more rigorous national-level tracking capability to assist in identifying and recovering unwanted sources from outside the Department that pose a potential safety and security risk. They are working with other elements of the Department and NRC in developing requirements to ensure that these unwanted sources are adequately tracked.

Should you have any questions related to this response, please contact Richard Speidel, Director, Policy and Internal Controls Management. He may be contacted at 202-586-5009.

Sincerely,

Michael C. Kane
Associate Administrator
for Management and Administration

cc: Assistant Secretary for Environmental Management
Deputy Administrator for Defense Nuclear Nonproliferation
Senior Procurement Executive
Director, Service Center

Comments from the Nuclear Regulatory Commission

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

September 6, 2005

Mr. Eugene E. Aloise
Director, Natural Resources
and Environment
U.S. Government Accountability Office
441 G Street, NW
Washington, D.C. 20548

Dear Mr. Aloise:

Thank you for the opportunity to review and submit comments on the U.S. Government Accountability Office (GAO) draft report, "Nuclear Security: DOE Needs Better Information to Guide Its Expanded Recovery of Sealed Radiological Sources" (GAO-05-967). The U.S. Nuclear Regulatory Commission (NRC) appreciates the time and effort you and your staff have taken to review this important topic.

Overall, the NRC believes the report to be well written and balanced. One general point I would like to make is that the proposed National Source Tracking System (NSTS) will provide information on sealed sources which the draft report notes is currently lacking (e.g., on page 32 of the draft report, the number of covered sources manufactured and actually possessed by licensees, the distribution of the sources, and their disposal). Knowing this information could permit the U.S. Department of Energy (DOE) to at least approximate the number of sources that DOE potentially may need to recover. On the other hand, requiring the reporting of certain information which the draft report asserts DOE would find useful (e.g., frequency of source use) could be extremely burdensome on licensees and the NRC, and would yield little, if any, practical benefit.

As written, the report does not accurately characterize a number of issues involving category 3 sources. For example, on page 34 of the draft report, the first paragraph states, "In a subsequent 2004 technical document, IAEA suggested that category 3 sources be included in a national registry of sealed radiological sources" and references "IAEA, Strengthening Control Over Radioactive Sources in Authorized Use and Regaining Control Over Orphan Sources: National Strategies, IAEA-TECDOC-1388 (Vienna, Austria: Feb. 2004, p. 5)." This reference does not suggest that category 3 sources must be tracked by a national system. Instead, the reference states that category 3 sources should be part of the national strategy for improving control over sources. The Code of Conduct recommends a minimum of category 1 and 2 sources to be included in a national source registry. On page 5, IAEA-TECDOC-1388 states:

> *The objective of this report is to provide practical guidance to States on the development of a national strategy for improving control over radioactive sources, particularly dangerous sources (categories 1-3). Part of this process involves the determination of the magnitude of the potential problem with orphan and vulnerable sources and indeed, whether or not a national strategy is needed.*

E. Aloise -2-

The ultimate objective is that States will use this report to develop and then implement a plan of action that will result in all significant sources being managed in a safe and secure manner.

The NRC regulatory framework addressed all sources regulated by the NRC before the adoption of the International Atomic Energy Agency (IAEA) Code of Conduct, and it continues to do so today. The national strategy being implemented by the NRC is a risk-informed approach that also includes an evaluation of the adequacy of existing regulations to provide appropriate control of sources. Based on this risk-informed approach and regulatory review, the NRC issued orders requiring additional security measures, particularly for the higher risk sources in categories 1 and 2. Where appropriate, these security orders did address aggregation of any sources (category 3 and below) such that the net result could reach the category 2 threshold in a given physical location.

On page 34 of the draft GAO report, it states that the NSTS will only address the IAEA Code of Conduct category 1 and 2 sealed sources. Although this action is consistent with the IAEA Code of Conduct and the Energy Policy Act of 2005, limiting the NSTS to category 1 and 2 sources raises concerns by some individuals who believe that at least category 3 sources should be included as well. For the initial NSTS program, NRC decided not to include category 3 sources, at this time, based on (1) an assessment that category 3 sources represent a limited hazard as a radiological dispersal or exposure device and (2) a potential disproportionate burden of including category 3 sources on both the regulatory bodies and licensees. It is also important to note that, although the NSTS will provide a national tracking system for some sealed sources, licensees are responsible for appropriate tracking of all sources in their possession under their licenses. However, the notice of proposed rulemaking for the NSTS published on July 28, 2005 (70 FR 43646) acknowledged that the aggregation of category 3 sources could present a security concern. For this reason, the notice of proposed rulemaking specifically invites comments on including category 3 sources in the NSTS in the future. The public comment period is still open for this proposed rule. The Commission will evaluate the public comments received on this rulemaking, and will factor in comments from other Federal agencies and our international contacts, before deciding what additional action, if any, may be warranted for category 3 sources and below.

GAO is also concerned because category 3 and below sources account for over 98.5 percent of the total number of sources recovered to date by DOE but would not be covered by the NSTS. The DOE source recovery program includes orphaned sources determined to represent a risk to public health and safety. Focusing solely on the number of sources recovered is not a risk informed approach. The activity level of the sources provides a measure of the greatest risk. The category 1 and 2 sources recovered by the DOE program to date account for approximately 86 percent of the total activity recovered.

I would also like to stress that DOE, through its representatives on NRC working groups and committees developing the proposed NSTS, has had the opportunity to provide input on the design of the system and the potential usefulness of the system to assist it in its source recovery program. DOE and other stakeholders will have an additional opportunity to comment on these and other issues raised in the notice of proposed rulemaking published July 28, 2005 (70 FR 43646).

E. Aloise -3-

As you are aware, the NRC and GAO staffs have had multiple exchanges regarding the report's contents and context. These exchanges have been very beneficial. The enclosure provides specific comments on the draft report in addition to the matters discussed above. Should you have questions about these additional comments or the issues raised in this letter, please contact Ms. Melinda Malloy at (301) 415-1785, or Mr. Lance Rakovan at (301) 415-2589.

Sincerely,

Luis A. Reyes
Executive Director
for Operations

Enclosure: Additional NRC Comments on Draft GAO-05-967

GAO Contact and Staff Acknowledgments

GAO Contact

Gene Aloise (202) 512-3841

Staff Acknowledgments

In addition to the person named above, Casey Brown, Ryan Coles, John Delicath, Daniel Feehan, Doreen Feldman, Susan Iott, Thomas Laetz, Cynthia Norris, Anthony Padilla, Judy Pagano, Leslie Pollock, and Barbara Timmerman made key contributions to this report.

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