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Report to Congressional Requesters

February 2017

RADIOACTIVE SOURCES

Opportunities Exist for Federal Agencies to Strengthen Transportation Security

GAO-17-58

GAO Highlights

Highlights of GAO-17-58, a report to congressional requesters

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RADIOACTIVE SOURCES

Opportunities Exist for Federal Agencies to Strengthen Transportation Security

Why GAO Did This Study

Concerns have been raised that risk-significant sources could be stolen by terrorists and used to create a "dirty bomb." NRC is responsible for licensing the possession and use of these sources. DOT regulates the transport of such sources, and DHS is responsible for securing all modes of transportation.

GAO was asked to review the security of these sources during ground transport. This report examines (1) the steps that NRC, DOT, and DHS have taken since September 11, 2001, to strengthen the security of these sources; and (2) the challenges that exist to further strengthening the security of these sources during ground transport and opportunities to address them.

GAO reviewed relevant laws and regulations, analyzed information on source shipments, and interviewed federal agency officials, officials from four motor carriers identified through interviews and research, and officials from two of the largest source manufacturers.

What GAO Recommends

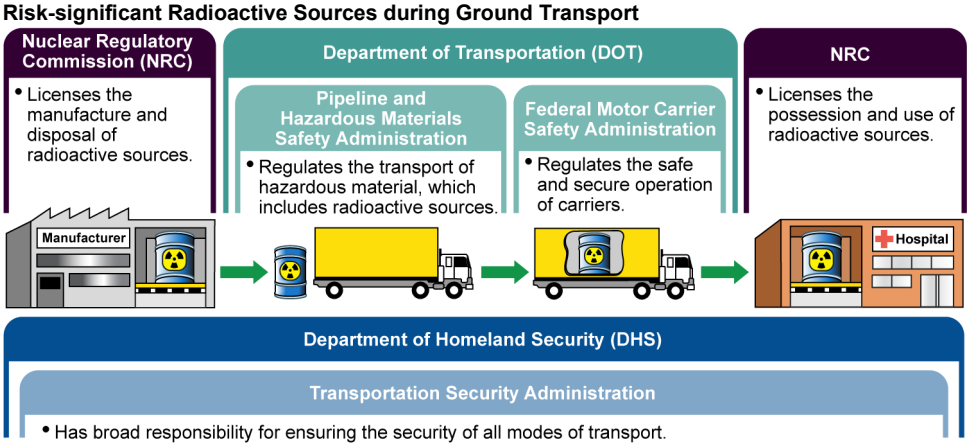
GAO is making three recommendations, including that NRC, in consultation with DOT and DHS, identify an approach to verify that carriers meet NRC requirements. NRC agreed with the recommendation. DOT agreed to consult with NRC and DHS, but did not fully concur, citing a lack of authority. GAO clarified the recommendation in response to DOT's concern.

View GAO-17-58. For more information, contact Shelby S. Oakley at (202) 512-3841 or oakleys@gao.gov.

What GAO Found

Since September 11, 2001, the three federal agencies responsible for securing risk-significant radioactive sources (those considered most dangerous) during ground transport have taken steps to strengthen the security of these sources. The Nuclear Regulatory Commission (NRC) requires source licensees to ensure that motor carriers transporting these sources have security measures, such as 24-hour monitoring of shipments of potentially fatal sources. The Department of Transportation (DOT) updated its regulations to require security plans for these sources, and the Department of Homeland Security (DHS) established security standards for commercial drivers' licenses. The agencies' participation in three collaborative mechanisms—a task force, memorandums of understanding (MOU), and coordinating councils—has also facilitated security improvements. The figure below illustrates how the agencies divide their responsibilities.

Division of Regulatory Authority among Federal Agencies Responsible for the Security of Risk-significant Radioactive Sources during Ground Transport



Sources: GAO analysis of NRC, DOT, and DHS regulations and documents. | GAO-17-58

NRC and DOT face challenges related to collecting data and ensuring compliance with NRC security requirements for ground transport of risk-significant radioactive sources, but opportunities exist to address them. For example, NRC does not directly inspect whether motor carriers contracted by licensees to transport risk-significant sources have implemented its security requirements because its regulatory authority extends only to its licensees. Instead, NRC requires licensees to ensure that carriers meet the requirements, and its inspectors are to verify that licensees do so. DOT and state officials have regulatory authority over carriers, but their inspectors do not enforce compliance with NRC security requirements because DOT does not have that authority. Thus, no federal or state agency directly inspects carriers for compliance with NRC's security requirements. Under a 2015 MOU, the three agencies committed to coordinating on inspection activities to optimize available resources. By consulting with DOT and DHS to identify an approach to verify that carriers are meeting NRC's security requirements, NRC has an opportunity to further strengthen the security of shipments of risk-significant sources, for example, by having DOT inspectors verify compliance during on-site investigations.

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Abbreviations

Ci	curie
CVSA	Commercial Vehicle Safety Alliance
DHS	Department of Homeland Security
DOT	Department of Transportation
FMCSA	Federal Motor Carrier Safety Administration
GAO	Government Accountability Office
HRCQ	Highway Route Controlled Quantity
IAEA	International Atomic Energy Agency
MOU	memorandum of understanding
mSv	millisievert
NGCC	Nuclear Government Coordinating Council
NRC	Nuclear Regulatory Commission
NSCC	Nuclear Sector Coordinating Council
NSTS	National Source Tracking System
PHMSA	Pipeline and Hazardous Materials Safety Administration
RAMQC	radioactive material in quantities of concern
RDD	radiological dispersal device
RED	radiological exposure device
SAVE	Systematic Alien Verification for Entitlements
SI	International System of Units
TBq	terabecquerel
TSA	Transportation Security Administration

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February 7, 2017

The Honorable Claire McCaskill
Ranking Member
Committee on Homeland Security and Governmental Affairs
United States Senate

The Honorable Thomas R. Carper
Ranking Member
Permanent Subcommittee on Investigations
Committee on Homeland Security and Governmental Affairs
United States Senate

Radioactive sources are commonly used in thousands of locations in the United States and many other countries for medical, industrial, and research purposes. These sources are used to, among other things, treat cancer, sterilize food and medical instruments, and detect flaws in pipelines and other types of metal welds. Since terrorists attacked the United States in 2001, concerns have grown that they could obtain and use radioactive materials to build a “dirty bomb”—a type of radiological dispersal device that uses conventional explosives to disperse radioactive material. Recent terrorist activity in the United States, Europe, and the Middle East has heightened such concerns, and protecting radioactive materials from being stolen and misused is a significant concern in the United States and other parts of the world. Most experts agree that the radioactive material dispersed by a dirty bomb would have few short-term health effects for exposed individuals and that the explosives, not the radioactive material, would likely cause the greatest immediate injuries, fatalities, and property damage. However, a dirty bomb—depending on the type, form, amount, and concentration of radioactive material used—could cause radiation exposure in individuals in close proximity to the material for an extended time and potentially increase the long-term risks of cancer for those contaminated. In addition, the evacuation and cleanup of contaminated areas after such an explosion could lead to panic and serious economic costs for the affected population as individuals with homes or businesses in that area may not be able to return for an extended period of time because of actual or feared contamination.

We have previously identified serious problems with controlling and securing radioactive sources in the United States. In July 2016, we reported that, in some cases, licenses for radioactive sources could be counterfeited and that licensees could obtain sources containing

radionuclides in quantities greater than what is allowed by their license.[1] For example, during covert testing for our July 2016 review, we were able to obtain a license and secure commitments to purchase, in multiple small quantities, enough radioactive material to be considered attractive for use in a dirty bomb. As a result, we recommended that the Nuclear Regulatory Commission (NRC) take action to better control radioactive sources. NRC neither agreed nor disagreed with the recommendation but noted that the agency had formal evaluations underway considering all three recommendations included in our report. We also found security concerns related to radioactive sources used at industrial facilities and medical facilities in June 2014 and September 2012, respectively. In June 2014, we reported that entities licensed by NRC to use industrial radioactive sources faced challenges securing and protecting the sources against insider threats (e.g., theft by individuals authorized to have unescorted access to the material).[2] In September 2012, we reported that NRC's requirements were broadly written and did not prescribe specific measures that medical facilities should take to ensure the security of equipment containing radioactive sources.[3]

[1]*GAO, Nuclear Security: NRC Has Enhanced the Controls of Dangerous Radioactive Materials, but Vulnerabilities Remain,* GAO-16-330 (Washington, D.C.: July 1, 2016). A radionuclide is an unstable, radiation-emitting nuclide. A nuclide is a particular atomic form of an element distinguished from other nuclides by its number of neutrons and protons, as well as by its energy states.

[2]*GAO, Nuclear Nonproliferation: Additional Actions Needed to Increase the Security of U.S. Industrial Radiological Sources,* GAO-14-293 (Washington, D.C.: June 6, 2014). We recommended, among other things, that NRC conduct an assessment of the trustworthiness and reliability review process—a process by which licensees approve employees for unescorted access—to determine if it provides reasonable assurance against insider threats. This recommendation remains open, and GAO reported that as of October 2016, NRC was conducting a review of its security requirements for radioactive sources and that review is expected to provide additional insights into both the trustworthiness and reliability review to mitigate insider threats and the specificity associated with NRC's guidance for conducting trustworthiness and reliability assessments.

[3]*GAO, Nuclear Nonproliferation: Additional Actions Needed to Improve Security of Radiological Sources at U.S. Medical Facilities,* GAO-12-925 (Washington, D.C.: Sept. 10, 2012). We recommended, among other things, that NRC strengthen security requirements by providing hospitals and medical facilities with specific measures they must take to develop and sustain a more effective security program, ensure inspectors receive additional training, and provide additional guidance to facility officials about how to adequately secure equipment containing high-risk radioactive sources. NRC did not implement the recommendation to provide specific measures to hospitals and medical facilities, but did take steps to ensure inspectors receive additional training and to provide additional guidance to facility officials.

The specific threat to human health posed by a radioactive source depends primarily on the radionuclide it contains, its chemical form, and its level of radioactivity. The International Atomic Energy Agency's (IAEA)[4] *Code of Conduct on the Safety and Security of Radioactive Sources* serves as a guide to define the 16 radionuclides used in radioactive sources that—in specific quantities—warrant enhanced security and protection measures beyond those that were in effect before the terrorist attacks on the United States on September 11, 2001.[5] Category 1 quantities of radioactive sources are considered the most dangerous because, if not managed safely and securely, they would be likely to cause permanent injury to a person who handled them or was otherwise in contact with them for more than a few minutes and would be potentially fatal to anyone in close contact for more than a few minutes to an hour. Category 2 quantities of radioactive sources could cause permanent injury to a person who handled them or was otherwise in contact with them for a period of minutes to hours and could be potentially fatal to a person if close to this material for a period of hours to days. NRC considers category 1 and 2 radioactive sources to be "risk-significant radioactive sources." Throughout this report, we use this term to refer to category 1 and 2 sources.

According to an IAEA document, radioactive sources are most vulnerable to sabotage or diversion during transport. NRC data indicate that from January 2010 through September 2015, there were 14 incidents involving 23 risk-significant radioactive sources that were reported lost, missing, or stolen during transport in the United States.[6] Of these, 22 sources were found within the same day, and 1 was found 5 days after it was declared missing.

NRC, the Department of Transportation (DOT), and the Department of Homeland Security (DHS) are the primary federal agencies responsible for regulating the security of risk-significant radioactive sources. Keeping

[4]The IAEA is an independent organization based in Vienna, Austria, that is affiliated with the United Nations. Its mission includes promoting the peaceful uses of nuclear energy and verifying that nuclear materials intended for peaceful purposes are not diverted to military purposes.

[5]International Atomic Energy Agency, *Code of Conduct on the Safety and Security of Radioactive Sources,* IAEA/CODEOC/2004 (Vienna, Austria: January 2004).

[6]Lost or missing licensed material means licensed material whose location is unknown. It includes material that has been shipped but has not reached its destination and whose location cannot be readily traced in the transportation system.

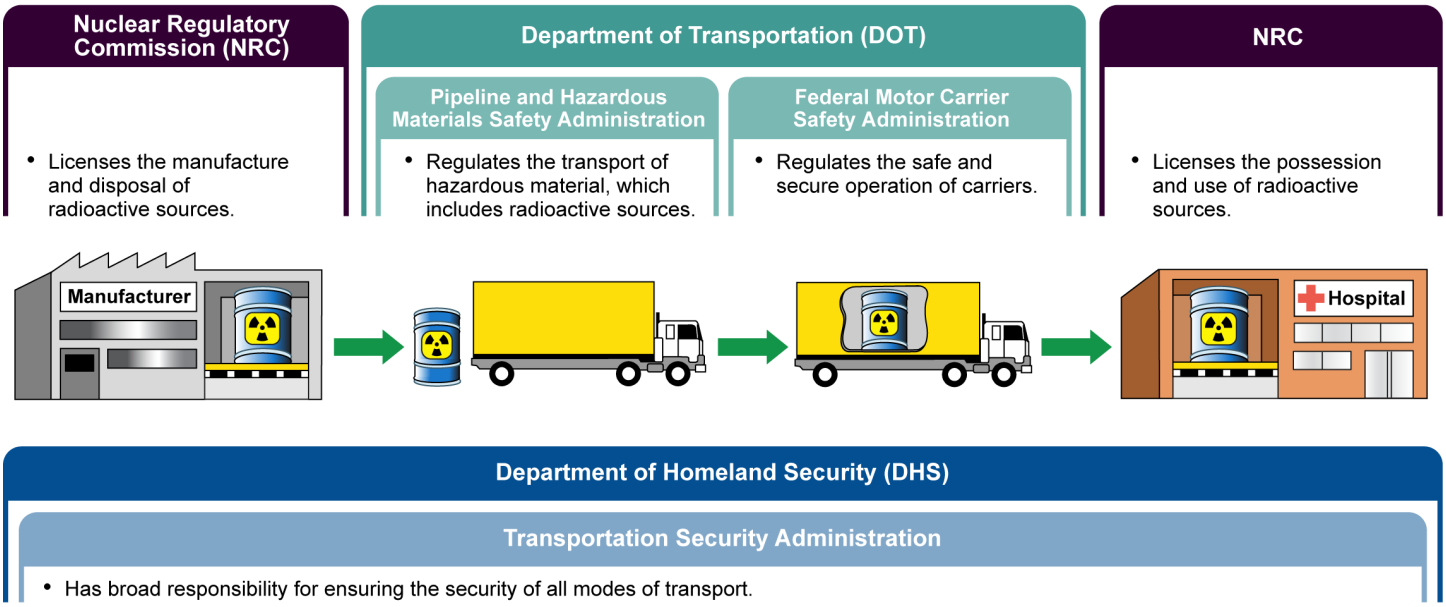
radioactive material out of the hands of terrorists is a stated top priority for NRC. NRC issues licenses to possess, use, transfer, and dispose of radioactive material, including radioactive sources, and has established security requirements for their protection. It also promulgates standards for packaging used to transport certain radioactive materials and conducts oversight of facilities—such as hospitals, industrial sites, and research facilities—that use and store radioactive sources. DOT, through its Pipeline and Hazardous Materials Safety Administration (PHMSA), issues and enforces regulations for all modes of transport (i.e., air, ground, rail, and water) of hazardous materials,[7] including safety and security regulations for the transport of risk-significant radioactive sources.[8] DOT also oversees the safe and secure operation of motor carriers—such as large trucks—through its Federal Motor Carrier Safety Administration (FMCSA). DHS, through its Transportation Security Administration (TSA), has broad responsibility for ensuring the security of all modes of transport.[9] In addition to these federal agencies, as will be discussed further in this report, state officials play a significant role in implementing NRC and DOT regulations. Figure 1 demonstrates how the federal agencies divide these responsibilities for ground transport.

[7]DOT is required to designate materials as hazardous when the Secretary of Transportation determines that transporting the material in commerce in a particular amount and form may pose an unreasonable risk to health and safety or property. 49 U.S.C. § 5103. Such substances and materials include explosives, flammable liquids, and radioactive materials.

[8]49 C.F.R. § 1.97.

[9]Aviation and Transportation Security Act, Pub. L. No. 107-71, §101 (2001), codified at 49 U.S.C. §114, and DHS Delegation Number 7060.2.

Figure 1: Division of Regulatory Authority among Federal Agencies Responsible for the Security of Risk-Significant Radioactive Sources during Ground Transport



Sources: GAO analysis of NRC, DOT, and DHS regulations and documents. | GAO-17-58

In 2006, an NRC-led task force on radioactive source security evaluated federal transport programs for radioactive material, including risk-significant sources, and concluded that safety regulations provided a "level of protection" from the security risks associated with the transport of these materials.[10] The task force report stated that considerable progress had been made to include security provisions in the safety standards or as companion documents, but that additional efforts were necessary to enhance transportation security. In response to a task force recommendation to enhance transportation security, NRC took action to strengthen regulations related to the security of ground and rail shipments of risk-significant radioactive sources.

You asked us to review the security of risk-significant radioactive sources during ground transport. This report examines (1) the steps that NRC, DOT, and DHS have taken since September 11, 2001, to strengthen the

[10]Nuclear Regulatory Commission, Radiation Source Protection and Security Task Force, *The Radiation Source Protection and Security Task Force Report* (Washington, D.C.: August 2006). The report further stated that the safety regulations are widely implemented, and the level of compliance is high.

security of risk-significant radioactive sources during ground transport and (2) the challenges, if any, that exist to further strengthening the security of these sources during ground transport and the potential opportunities to address them.

To identify what steps NRC, DOT, and DHS have taken to increase the security of risk-significant radioactive sources during ground transport, we reviewed relevant laws, regulations, and agency guidance and interviewed officials responsible for transportation and hazardous material security at NRC, DOT, and DHS. To identify steps that NRC has taken, we reviewed the agency's orders and regulations for the physical protection of category 1 and 2 radioactive material, as well as packaging and transfer reporting regulations. We also interviewed NRC officials with oversight over risk-significant radioactive sources to understand how NRC imposes and enforces Part 37 requirements. To identify steps DOT has taken, we reviewed PHMSA and FMCSA regulations and guidance, including those related to motor carrier transportation security plans. We also interviewed officials from PHMSA and FMCSA to determine how their regulatory programs have been implemented. We used data from FMCSA's Motor Carrier Management Information System to determine how many on-site investigations of motor carriers federal and state officials conducted in 2015, the most recent year for which complete data were available at the time of our review. We assessed the reliability of the Motor Carrier Management Information System data by reviewing relevant documentation and Inspector General reports, and interviewing knowledgeable officials. For DHS, we reviewed regulations and guidance issued by TSA and interviewed officials from the Office of Security Policy and Industry Engagement. In addition, we reviewed IAEA documents, including the *Code of Conduct on the Safety and Security of Radioactive Sources, the Categorization of Radioactive Sources, and Regulations for the Safe Transport of Radioactive Material*.[11] We also identified several mechanisms for inter-agency collaboration designed to improve the security of risk-significant radioactive sources—such as the Radiation Source Protection and Security Task Force—and examined whether these collaborations have resulted in security improvements. We also reviewed three memorandums of understanding (MOU) among NRC, DOT, and DHS that are related to the security of risk-significant radioactive sources.

[11]International Atomic Energy Agency, *Code of Conduct*; *Categorization of Radioactive Sources*, No. RS-G-1.9 (Vienna, Austria: July 2005); and *Regulations for the Safe Transport of Radioactive Material*, 2012 Edition, No. SSR-6 (Vienna, Austria: 2012).

To determine what challenges, if any, exist to further strengthening the security of risk-significant radioactive sources during ground transport and opportunities to address them, we reviewed NRC, DOT, and DHS laws, regulations, and procedures and interviewed officials from these agencies involved in inspecting risk-significant sources to determine how these laws, regulations, and procedures are implemented. We also interviewed representatives from four motor carrier companies that transport risk-significant radioactive sources, which we identified through interviews and research and which responded to our request for an interview, and two source manufacturing licensees that NRC officials identified as the largest manufacturers to obtain their perspectives on how relevant regulations are implemented. We visited one of these manufacturers to observe how radioactive sources are manufactured and packaged and observed a safety inspection for a shipment of radioactive material. During this visit, we also met with federal and state law enforcement officials, as well as state officials responsible for securing risk-significant sources to understand how NRC and DOT regulations are implemented at the state level.[12] We also interviewed officials from the Commercial Vehicle Safety Alliance (CVSA), to determine how the motor carrier inspection program is implemented.[13] While the views of these individuals provided relevant insights, they are not representative of the universe of licensee, motor carrier, or law enforcement representatives with responsibility for the security of radioactive sources during transport and therefore do not represent all views on the topic. Additionally, we reviewed a non-generalizable sample of inspection records provided by NRC for 21 separate inspections of risk-significant source licensees to obtain examples of how NRC inspectors are inspecting for compliance with Part 37 requirements.[14] We also analyzed data from NRC's National Source Tracking System (NSTS) database for 2013 through 2014, the 2 most recent years for which complete data were available at the time of our review, to determine the extent to which NRC has information about the number of sources transported annually, and the mode by which they are

[12]We selected officials from the state in which the manufacturer was located.

[13]The CVSA is a nonprofit association comprised of local, state, provincial, territorial and federal commercial motor vehicle safety officials and industry representatives that promotes motor carrier safety.

[14]NRC provided these 21 inspection records based on our request for examples of 3-4 inspection records for each NRC region. Because this was a non-generalizable sample, the information collected cannot be generalized to all inspection records of risk-significant source licensees, although it provides examples of how NRC inspectors are inspecting for compliance with the agency's security regulations.

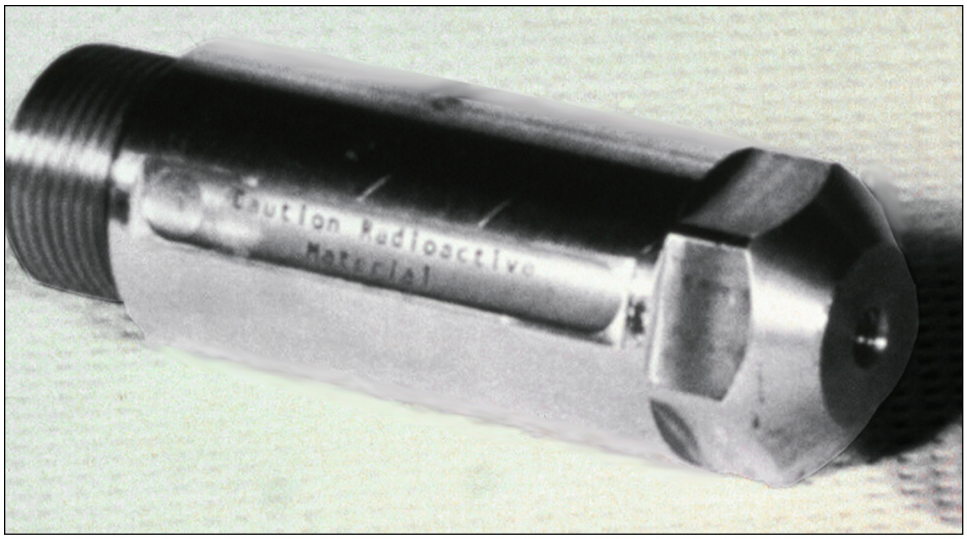
transported. To assess the reliability of data from the NSTS database, we reviewed relevant documentation and interviewed NRC officials. We found NSTS data to be sufficiently reliable to report on the number of risk-significant source transfers from 2013 through 2014. We also obtained and analyzed data from NRC's radioactive material in quantities of concern (RAMQC) database from 2013 through 2014, the 2 most recent years for which complete data were available at the time of our review, to determine the extent to which NRC has information about the number of domestic category 1 shipments. To assess the reliability of data from the RAMQC database, we reviewed relevant documentation, interviewed NRC officials, and reviewed the data for errors. While NRC officials stated that manual data entry may result in errors in the database, we determined these data to be sufficiently reliable to report on the number records it contained for domestic category 1 shipments and shipments that occurred from 2013 through 2014. Further, we also reviewed federal regulations and interviewed NRC and DOT agency officials to determine the extent to which DOT and NRC had assessed whether additional level VI safety inspections could enhance the security of shipments of risk-significant radioactive sources that would not otherwise undergo such inspections. Appendix I presents a more detailed description of our scope and methodology.

We conducted this performance audit from April 2015 to February 2017, in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Radioactive sources are used throughout the world for medical, industrial, and research purposes. Sources containing radioactive material—such as cesium-137, cobalt-60, and iridium-192—are produced artificially in nuclear reactors and accelerators, and are available in the United States and other countries. To prevent their dispersal, radioactive materials are typically sealed in a metal capsule made of stainless steel, titanium, or platinum. The radioactive material used in sealed sources can be found in various forms, such as metals or powders, and is measured by its level of radioactivity. Radioactive sources vary in size from a grain of rice to rods several inches in length. Figure 2 provides an image of a radioactive source.

Figure 2: Radioactive Source for Well Logging



Source: Nuclear Regulatory Commission. | GAO-17-58

Note: Well logging is a process that uses sealed sources and/or unsealed radioactive materials to determine whether a well, drilled deep into the ground, contains minerals, such as coal, oil, and natural gas.

The United States has endorsed IAEA's *Code of Conduct*, which established thresholds for classifying the quantities of 16 radionuclides used in radioactive sources into categories 1 and 2, which NRC considers to be risk-significant. NRC uses these thresholds as a basis for requiring licensees to implement additional security protections for risk-significant radioactive sources. These radionuclides and the quantities that qualify them as category 1 or 2 radioactive sources are shown in table 1.

Table 1: Nuclear Regulatory Commission (NRC) Thresholds for Classifying Quantities of Radionuclides as Category 1 and Category 2 (Risk-Significant)

Radionuclides	Category 1 quantities (in terabecquerels)	Category 2 quantities (in terabecquerels)
Americium-241	60	0.6
Americium-241/ Beryllium	60	0.6
Californium-252	20	0.2
Cesium-137	100	1.0
Cobalt-60	30	0.3
Curium-244	50	0.5
Gadolinium-153	1,000	10.0
Iridium-192	80	0.8
Plutonium-238	60	0.6
Plutonium-239/ Beryllium	60	0.6
Promethium-147	40,000	400.0
Radium-226	40	0.4
Selenium-75	200	2.0
Strontium-90	1,000	10.0
Thulium-170	20,000	200.0
Ytterbium-169	300	3.0

Source: NRC | GAO-17-58.

Note: The greater the activity level of radioactive decay—measured in terabecquerels (TBq)—the more radiation emitted, which increases the potential risk to the public if the radioactive materials are lost or stolen. The becquerel is a unit of measurement of radioactivity under the International System of Units (SI), and represents one disintegration per second. A TBq is the equivalent of one trillion (10^{12}) becquerels and is NRC's regulatory standard. The curie (Ci) is a non-SI unit still in wide use. One becquerel equals 2.7×10^{-11} curies.

The Atomic Energy Act of 1954 gives NRC primary responsibility for regulating most domestic industrial, medical, and research uses of radioactive materials to protect public health and safety. NRC issues licenses to companies, organizations, institutions, and other entities to possess, use, transfer, and dispose of radioactive sources for these purposes; NRC refers to these entities as licensees. NRC conducts typically unannounced, periodic inspections to ensure that licensees meet NRC's regulatory requirements. The type and frequency of inspections vary on the basis of the type and amount of material the licensee possesses, according to NRC inspectors. The act authorizes NRC to relinquish primary regulatory authority over radioactive materials to states

(called “agreement” states) that agree to certain conditions. To date, NRC has relinquished regulatory authority to 37 states.[15]

DHS and DOT share responsibility for the security of the transportation sector. DHS is broadly responsible for protecting the nation from terrorism.[16] Within DHS, TSA has responsibility for securing the nation’s transportation systems and is the lead agency responsible for the security of commercial vehicles.[17] DOT—through PHMSA and FMCSA—maintains a prominent regulatory role with respect to the transportation of hazardous materials by motor carriers, including risk-significant radioactive sources, and has multiple sets of regulations pertaining to highway transportation of hazardous materials.[18] Specifically, PHMSA is responsible for issuing and enforcing regulations governing the safe transportation of hazardous materials.[19] PHMSA has also issued regulations for the packaging and transportation of radioactive materials.[20]

- **Packaging Regulations.** PHMSA regulations generally govern the type of packaging that is to be used to transport radioactive material. PHMSA has established thresholds to determine the type of packaging that should be used to transport radioactive sources that are based on the quantity of radioactivity contained in each source. According to PHMSA, these thresholds are based on IAEA safety standards.[21]

[15]42 U.S.C. § 2021(b). These states have entered into an agreement with NRC to adopt and ensure licensee compliance with state regulations that are generally compatible with, and at least as stringent as, NRC regulations. The states have assumed regulatory authority over certain types and quantities of radioactive material. Agreement states typically oversee radioactive security through their state health or environment departments.

[16]Pub. L. No. 107-296, § 2135 (2002).

[17]See Pub. L. No. 110-53, § 1310, (2007); Pub. L. No. 107-71 (2001); HSPD-7; Exec. Order No. 13,416, 71 Fed. Reg. 71,033 (2006).

[18]49 U.S.C. § 5103.

[19]49 C.F.R. § 1.97(b).

[20]49 C.F.R. Part 173, Subpart I.

[21]International Atomic Energy Agency, *Regulations for the Safe Transport of Radioactive Material*, 2009 Edition, Safety Requirements, No. TS-R-1 (Vienna, Austria: 2009).

- **Type A package.** Radioactive material in quantities that are below PHMSA's threshold, including some category 2 sources, are authorized for shipment in a Type A package. PHMSA requires these packages to maintain their integrity under conditions of normal transport and meet certain design requirements.[22]
- **Type B package.** Radioactive material in quantities that meet or exceed PHMSA's threshold, including all category 1 quantities of radioactive sources and most quantities of category 2 radioactive sources, must be transported in a Type B package.[23] NRC defines the performance requirements that Type B packages must be designed to meet. NRC requires that these packages be able to survive serious accident tests and prevent dispersal of radioactive material. NRC also specifies the tests that these packages must undergo to demonstrate that they meet NRC performance requirements, which include withstanding (1) a free fall drop of 30 feet, (2) a puncture test drop of 40 inches onto a 6-inch diameter vertical steel peg at least 8 inches long, (3) immersion in a fire burning at least 1,475 degrees Fahrenheit for 30 minutes, and (4) water immersion at a depth of at least 50 feet.[24] Type B packaging must be designed and constructed to meet NRC requirements.[25]

- **Transport Control Regulations.** According to PHMSA documentation, proper packaging is the primary means of ensuring the safety of transported radioactive materials, but transport controls provide additional levels of safety. Transport controls include limits on the amount of radiation that can be emitted from Type A or B packages that may be safely aggregated on a single vehicle or in a storage area—PHMSA refers to these limits as the transport index. The transport index is based on the largest measure of radioactivity at

[22]See 49 C.F.R. §§ 173.410 and 173.412. For example, Type A packaging must be designed so that the outside of the packaging incorporates a feature, such as a seal, that is not readily breakable, and that, while intact, is evidence that the package has not been opened.

[23]Under the regulations, Type B packaging is required to transport greater than A_1 or A_2 quantities of radioactive material. See 49 C.F.R. § 173.416.

[24]10 C.F.R. § 71.73.

[25]49 C.F.R. § 173.413.

1 meter from the surface of a package.[26] For motor carriers transporting multiple packages, no single package may exceed a transport index of 10, and a single vehicle may not exceed a combined transport index of 50 (e.g., five packages each with a transport index of 10). In cases where an individual package has a transport index greater than 10 or the combined index is greater than 50, the vehicle must be used exclusively to transport only those packages. There is no limit on the transport index for a vehicle used exclusively to transport packages of radioactive material.

- **Highway Route Controlled Quantity (HRCQ).** PHMSA has established a threshold to determine which shipments of radioactive material transported in a single package warrant additional safety measures. Shipments of radioactive material that exceed this threshold are defined as HRCQ. For example, a shipment of a radioactive source containing 1,000 TBq or more of cobalt-60 would exceed the threshold and would be considered an HRCQ shipment. As discussed below, FMCSA has established additional safety measures that apply to HRCQ shipments.

DOT's FMCSA regulates motor carrier safety, including vehicles and drivers. FMCSA's regulations address, among other things (1) standards for commercial drivers' licenses; (2) proper use and operation of commercial motor vehicles; (3) adequate inspection, repair, and maintenance of vehicles; (4) the transportation of hazardous materials, including HRCQ shipments; and (5) hazardous materials safety permits.[27]

For HRCQ shipments of radioactive materials, FMCSA regulations require that carriers apply the following safety measures:

- undergo a level VI vehicle safety inspection;[28]

[26]The transport index is calculated by multiplying the maximum radiation level in millisieverts (mSv) per hour at 1 meter (3.3 feet) from the external surface of a package by 100—equivalent to the maximum radiation level in millirem per hour at 1 meter (3.3 feet). An mSv is one thousandth of a sievert. The sievert is the SI unit for dose, and it is defined as 1 joule/kilogram. One mSv is approximately 32 percent of the average accumulated background dose an individual in the United States receives over 1 year.

[27]49 C.F.R. Part 383, 49 C.F.R. Part 392, 49 C.F.R. Part 396, 49 C.F.R. Part 397, 49 C.F.R. Part 385.

[28]49 C.F.R. § 385.415(b).

- operate the vehicle over state-designated routes, interstate system highways and bypasses or beltways around cities, and select the most expedient preferred routes; [29]
- prepare a written route plan that must be provided to both the driver and licensee and submitted to FMCSA, along with other documentation, within 90 days following the acceptance of a package for shipment by the motor carrier;[30] and
- require drivers to carry proof that, within the preceding 2 years, the driver has received training on handling and transporting hazardous materials, the properties and hazards of the material being transported, and relevant emergency procedures.[31]

FMCSA enforces regulations through on-site investigations and roadside vehicle inspections, which are primarily conducted by state law enforcement agencies. Investigations are conducted to review identified areas of noncompliance and safety concerns, with a focus on carriers previously identified by FMCSA as high-risk; to investigate complaints; or in response to other safety and compliance concerns. A FMCSA on-site investigation is conducted by either federal or state officials according to federal safety fitness standards and takes place at a carrier's place of business.[32] These investigations involve reviewing records, interviewing personnel, analyzing practices, and identifying any necessary corrective actions. According to FMCSA officials, FMCSA employs a risk-based approach to identify carriers for investigation. In 2015, according to FMCSA's *Pocket Guide to Large Truck and Bus Statistics*, there were 84,741 hazardous materials motor carriers operating in the United States.[33] FMCSA and state inspectors conducted 617 on-site investigations of these motor carriers, according to FMCSA data.

[29]49 C.F.R. § 397.101(b).

[30]49 C.F.R. § 397.101(d),(g). The route plan must contain, among other things, origin and destination points; the route selected, including planned stops and estimated departure and arrival times; and emergency telephone numbers for responsible officials in each state through which the shipment will be transported.

[31]49 C.F.R. § 397.101(e).

[32]49 C.F.R. § 385.

[33]Federal Motor Carrier Safety Administration, *Pocket Guide to Large Truck and Bus Statistics* (Washington, D.C.: May 2016).

FMCSA also provides grants to state transportation and law enforcement officials to conduct vehicle inspections of drivers and motor vehicles, the majority of which are conducted roadside or at weigh stations during transit. A roadside inspection is an examination of a commercial motor vehicle and/or driver by an authorized safety inspector. According to a FMCSA's *Pocket Guide*, state inspectors conduct approximately 95 percent of inspections, with the remainder conducted by federal inspectors. The inspection is to determine whether the vehicle and/or the driver is in compliance with federal safety regulations and, if applicable, hazardous material regulations.

The procedures for these inspections were developed by CVSA and are updated periodically, according to DOT officials. There are seven levels of inspections—starting with the most comprehensive, level I, which evaluates both the driver and vehicle, to inspection levels that are focused on specific areas, such as the level VI inspection for hazardous materials or dangerous goods. A level I inspection examines, among other things, the driver's license; medical examiner's certificate; record of duty status; hours of service; and a check of the vehicle for the presence of alcohol or drugs. A level I inspection also includes an examination of the vehicle's inspection report, brake system, coupling devices, exhaust system, frame, fuel system, turn signals, brake and head lamps, steering mechanism, suspension, tires, wheels and rims, and windshield wipers. The inspection also calls for an examination of hazardous material and dangerous goods requirements, as applicable.[34] If a critical violation of the operating criteria for the driver, vehicle, or cargo is identified, the inspector is to place the driver or vehicle out-of-service until the violation is addressed. Levels II, III, IV, V, and VII are inspections that examine a limited set of inspection topics, such as vehicle safety and driver credentials. A level VI inspection applies to carriers transporting shipments of HRCQ and transuranic waste.[35] FMCSA requires that all vehicles transporting HRCQ shipments undergo a level VI safety inspection prior to departure.[36] In addition, officials in other states may

[34]These requirements include verification of shipping papers, vehicle placarding, marking, and labels, as well as inspection for any leaks or spills, or unsecured cargo.

[35]Transuranic waste is a specific type of nuclear waste that is generated by the Department of Energy's nuclear weapons research, production, and cleanup activities at sites across the country.

[36]49 C.F.R. § 385.415.

choose to conduct an additional en route inspection.[37] A level VI safety inspection consists of a level I inspection with more stringent vehicle safety standards, and a radiation survey of the vehicle and package. One example of the stricter standard is that under the level I inspection standard, if 20 percent or more of the brakes on a vehicle are out of adjustment, an inspector is to place the vehicle out of service, but under the level VI inspection standard, the inspector places the vehicle out of service if any of its brakes are out of adjustment.

According to FMCSA's *Pocket Guide*, in 2015, federal and state officials conducted a total of 3,378,172 roadside inspections, of which 191,355 were of carriers transporting hazardous materials. Of the total roadside inspections, violations serious enough to place a driver out-of-service occurred in approximately 5 percent of inspections, and violations serious enough to place a vehicle out of service occurred in approximately 20 percent of inspections. Violations serious enough to take a vehicle transporting hazardous materials out of service occurred in about 4 percent of inspections. During this same period, according to FMCSA's *Pocket Guide*, state officials conducted 226 level VI inspections of HRCQ and transuranic shipments.[38] Of these 226 inspections, 2 inspections found vehicle or driver violations serious enough to take the vehicle or driver out of service.

In 1979, NRC and DOT signed an MOU delineating each agency's respective responsibilities to regulate the safe transport of radioactive materials.[39] One of the general principles of the MOU is that the agencies will strive to avoid duplication of inspection and enforcement actions regarding shippers and carriers of radioactive material. The MOU delineates responsibilities between NRC and DOT in several areas, including the following.

- **Development of safety standards.** Among other things, DOT is responsible for the design specifications and safety standards for

[37]States may also choose to require a security escort for these shipments.

[38]FMCSA officials we interviewed said that DOT data on HRCQ inspections did not distinguish between inspections of carriers transporting risk-significant radioactive sources and carriers transporting other types of radioactive materials, such as radioactive waste.

[39]*Transportation of Radioactive Materials;* Memorandum of Understanding between the U.S. Nuclear Regulatory Commission and the Department of Transportation, 44 FR 38690 (Washington, D.C.: July 2, 1979).

Type A packages and NRC is responsible for the specifications and standards for Type B packages.

- **Package review.** Among other things, NRC is responsible for approving designs for Type B packages.
- **Inspection and enforcement.** NRC will assist DOT, as appropriate, in inspecting shippers of, among other things, radioactive materials in quantities that require the use of Type B packages, and NRC and DOT will consult each other on the results of their respective inspections in areas where the results are related to the other agency's requirements, and each will take enforcement action as it deems appropriate within the limits of its authority.
- **Accidents and incidents.** Among other things, consistent with its jurisdiction, DOT will require all carriers to promptly notify it of accidents, incidents, and instances of actual or suspected leakage involving radioactive material packages if such an event occurs during transit, and DOT will promptly notify NRC of such events. NRC will require its licensees to notify it of accidents, incidents, and instances of actual or suspected leakage involving radioactive material packages if such an event occurs prior to delivery or after receipt of the package.

Agencies Have Taken Steps Since 2001 to Strengthen the Security of Risk-Significant Radioactive Sources during Ground Transport

Since September 11, 2001, NRC, DOT, and DHS have taken steps to strengthen the security of risk-significant radioactive sources during ground transport by, among other things, issuing or updating their respective regulations. The agencies have also worked to strengthen security through participation in a congressionally mandated task force, additional MOUs, and coordinating councils to facilitate interagency collaboration.

NRC, DOT, and DHS Have Taken Steps to Increase Security for Risk-Significant Radioactive Sources during Ground Transport

All three agencies have taken steps to increase the security for the ground transport of risk-significant radioactive sources since 2001.

NRC

NRC has taken steps to increase the security of risk-significant radioactive sources by issuing security orders that were ultimately codified in security regulations and by establishing new information management systems.

Security Orders Codified in New Security Regulations

Following the terrorist attacks on September 11, 2001, NRC determined that certain licensed radioactive materials, including risk-significant radioactive sources, should be subject to additional security requirements. As a result, NRC issued a series of orders and guidance documents directing licensees that manufacture or possess certain materials, including risk-significant radioactive sources, to implement enhanced security measures. In 2013, NRC replaced most of the orders and guidance documents applicable to risk-significant sources by amending Title 10 of the U.S. Code of Federal Regulations to add Part 37.[40] Part 37 established physical security requirements for the use and transport of risk-significant sources with the intent of providing reasonable assurance of preventing theft or diversion of these sources.[41]

Under NRC Part 37 security requirements, licensees are to implement access controls, including fingerprint and background checks for personnel with unescorted access to risk-significant radioactive sources, and adopt measures to ensure the physical protection of such sources

[40]One order issued to licensees regarding trustworthiness and reliability requirements for unescorted access to radioactive materials for service providers that are not manufacturers or distributors was not rescinded pending further outreach by NRC regarding the applicability of 10 C.F.R. Part 37 requirements to service providers.

[41]Physical Protection of Byproduct Material, 78 Fed. Reg. 16922 (2013). NRC's security requirements for risk-significant sources went into effect on May 20, 2013 and compliance with the final rule was required on March 19, 2014 for states where NRC retains regulatory authority. According to NRC, it confirmed the Agreement States' adoption of adequate and compatible Part 37 requirements by the deadline of March 19, 2016.

during their use and transport via motor carrier or rail. In addition, licensees must establish, implement, and maintain a security program that includes a written security plan for the protection of risk-significant sources. This plan must include, among other things, the measures and strategies used to implement NRC Part 37 security requirements and must identify the security resources being used to meet the requirements. The licensees' overall security program must also include measures and procedures to train employees, the establishment of security zones, protection of sensitive information, coordination with local law enforcement authorities, testing and maintenance of security equipment, and periodic program reviews.

NRC Part 37 security requirements also require licensees to undertake specific preplanning and coordination measures for shipments of risk-significant sources. For example, before they can ship category 1 sources, shipping licensees must pre-plan and coordinate expected departure and arrival times of a shipment with the receiving licensee. The shipping licensee must also pre-plan and coordinate shipment information with relevant officials from each state through which the shipment will pass. This planning and coordination must include a discussion of whether the state intends to provide law enforcement escorts and the identification of safe havens, which are readily recognizable and accessible sites at which security is present or from which, in the event of an emergency, the driver(s) can notify and wait for law enforcement. Representatives of motor carriers we interviewed identified truck stops, weigh stations, and police or military barracks as potential safe havens. Before the shipping licensees can ship category 2 sources, they must, among other things, coordinate with the receiving licensee regarding an expected arrival time and a "no-later-than" arrival time.

In addition, NRC Part 37 requires that licensees who transport sources using their own vehicles, or deliver sources to a carrier for transport, take specific measures to ensure that category 1 radioactive sources are adequately protected while being transported. Specifically, licensees shipping category 1 quantities of radioactive sources by road must

- ensure that movement control centers are established with 24-hour position monitoring and the ability to immediately contact law enforcement in an emergency;
- ensure that shipments are continuously and actively monitored by a telemetric position monitoring system or an alternative tracking system (such as, but not limited to, a global positioning system);

- ensure that redundant communications are established between the vehicle driver and the movement control center (and escort vehicle, when used);
- develop contingency procedures, including protocols for the loss of communications, and responses to an actual or attempted theft or diversion of a shipment; and
- provide an individual—such as a second driver—to accompany the primary driver for shipments exceeding the maximum number of driving service hours as established by FMCSA.

For shipments of category 2 quantities of radioactive sources, licensees must use carriers that have established

- a package tracking system (e.g., a system that requires an authorized signature prior to package release); and
- a means to maintain constant control and/or surveillance during transit, including the ability for the carrier to immediately summon the appropriate law enforcement response or emergency assistance.

While the shipping licensee is generally responsible for ensuring these measures are implemented by the carrier, the receiving licensee may choose to accept the coordination and protection responsibilities of the shipping licensee.

In December 2014, Congress enacted legislation directing NRC to evaluate the effectiveness of the Part 37 regulations and determine whether the regulations are adequate to protect "high-risk radiological material."[42] In response to this mandate, the agency implemented a retrospective program review to provide an objective assessment of the Part 37 security requirements and associated implementation guidance related to risk-significant sources. NRC provided Congress a report based on their review in December 2016.

Information Management Systems

NRC established several information management systems to improve the security of risk-significant radioactive sources by verifying licenses and tracking radioactive source transactions. Specifically, NRC established the Integrated Source Management Portfolio which consists

[42]Consolidated and Further Continuing Appropriations Act, 2015, Pub. L. No. 113-235, div. D, tit. IV, § 403 (2014).

of three systems: the NSTS, the Web-Based Licensing System, and the License Verification System. In 2009, in response to IAEA guidance in its *Code of Conduct* and requirements of NRC in the Energy Policy Act of 2005, NRC implemented the NSTS to provide an accounting function for risk-significant radioactive sources. Under NRC regulations, licensees are required to enter a transaction report into the NSTS, or provide a transaction report to NRC for entry into the NSTS, no later than 1 business day following manufacturing, transferring, receiving, disassembling, or disposing of a risk-significant radioactive source.[43] Transaction reports include information such as shipping and receiving licensee numbers, the radioactive material in the source, and the activity level of the source being transferred. In 2012, NRC implemented the Web-Based Licensing System to allow NRC and agreement states to manage license applications, issuances, amendments, reports, and terminations. In 2013, NRC implemented the License Verification System, which allows a shipping licensee to verify that a receiving licensee is authorized to receive the type, form, and quantity of radioactive material being transferred.

In addition to its Integrated Source Management Portfolio, in 2003, NRC created the RAMQC database. According to NRC, the original purpose of the RAMQC database was to have an awareness of shipments of large quantities of radioactive material transiting the United States. NRC regulations require that licensees provide NRC, and the governor of any state through which the shipment travels, with advance notification of any domestic shipments of category 1 sources.[44] NRC uses the RAMQC database to document information on these advance notices of category 1 sources—such as the name of the motor carrier transporting the shipment, locations through which the shipment will be routed, and whether the shipment is classified as HRCQ. NRC officials with responsibility for the RAMQC database explained that it may contain errors stemming from a lack of controls over manual data entry. Specifically, these officials explained that there may be errors in the total radioactivity of a shipment and variances in company names. According to these officials, while they conduct a weekly audit of information in the system, the agency is not required to maintain data in the RAMQC

[43]10 C.F.R. § 20.2207.

[44]10 C.F.R. § 37.77. The Part 37 requirements related to transporting category 1 and 2 sources, including the advance notification requirement, also apply to imports and exports of radioactive material during the domestic portion of the transport. 10 C.F.R. § 37.3(b)(2).

database as a historical record. NRC uses information from the database to generate daily reports of planned and active shipments. According to NRC officials, NRC also sends the reports to other federal agencies, including PHMSA, U.S. Customs and Border Protection, and the Federal Bureau of Investigation. Customs and Border Protection officials that we interviewed stated that RAMQC database reports are a critical part of their efforts to determine the legitimacy of risk-significant radioactive material shipments crossing the border to enter or leave the United States, or transiting through the United States.

DOT

Since 2001, DOT's PHMSA and FMCSA have taken actions to improve how motor carriers ensure the security of hazardous materials—including shipments of risk-significant radioactive sources—by updating transportation security regulations and establishing new oversight and enforcement activities, respectively.

PHMSA

PHMSA has taken steps to improve the security of risk-significant radioactive sources by requiring motor carriers that transport such material to have transportation security plans and security training for motor carrier employees. Specifically, in March 2003, DOT began requiring carriers of certain types and quantities of hazardous materials to have a transportation security plan.[45] Hazardous materials covered under the requirement included, among other things, certain types and quantities of explosive materials, flammable materials, and HRCQ shipments, which included only those shipments of risk-significant sources that met or exceeded HRCQ thresholds. In March 2010, PHMSA—in consultation with TSA—revised its requirement for which shipments require a transportation security plan to include all shipments of risk-significant sources rather than just those that met or exceeded the

[45]Hazardous Materials: Security Requirements for Offerors and Transporters of Hazardous Materials, 68 Fed. Reg. 14510 (2003) (codified at 49 C.F.R. Part 172). The regulation was issued by DOT's Research and Special Program Administration. The Norman Y. Mineta Research and Special Programs Improvement Act of 2004 established PHMSA and transferred regulatory authority for hazardous materials safety to PHMSA. Pub. L. No. 108-426, § 2 (2004).

HRCQ threshold.[46] Under PHMSA regulations, a transportation security plan must address, at a minimum, the following elements.[47]

- **Personnel security.** Measures to confirm information provided by job applicants hired for positions that involve access to and handling of the hazardous materials covered by the security plan.
- **Unauthorized access.** Measures to address the risk that unauthorized persons may gain access to the hazardous materials or the vehicles being used to transport the hazardous materials covered by the plan.
- **En route security.** Measures to address the security risks of shipments of hazardous materials covered by the security plan during transportation from the shipment's origin to its final destination.

According to DOT officials, PHMSA provides motor carriers with a booklet that outlines general security elements they should include in a transportation security plan. To encourage motor carriers to adopt carrier-specific plans that address the distinct risks associated with their operations, as identified by the motor carriers, PHMSA does not provide specific guidance for developing the individual components of a plan. Under PHMSA regulations, transportation security plans must be in writing and must be retained by the motor carrier company for as long as the plan remains in effect. Copies of the most recent transportation security plans, or portions thereof, must be available to the motor carrier employees who are responsible for implementing the plan, consistent with personnel security clearance or background investigation restrictions and a demonstrated need to know. Transportation security plans must be revised and updated by the motor carrier as necessary to reflect changing circumstances. When a security plan is updated or revised, all copies of the plan must be maintained as of the date of the most recent revision. According to an interagency report, PHMSA does not approve transportation security plans. However, a FMCSA official we interviewed stated that FMCSA officials review the transportation security plans as part of FMCSA's on-site investigations.

[46]Hazardous Materials: Risk-Based Adjustment of Transportation Security Plan Requirements, 75 Fed. Reg. 10974 (2010); 49 C.F.R. Part 172.800(b)(15).

[47]49 CFR § 172.802(a)(1)-(3). According to PHMSA regulations, specific measures may vary commensurate with the level of threat at a particular time. See 49 C.F.R. §§ 173.403, 173.22(c).

As part of PHMSA's transportation security plan requirements, PHMSA regulations also require that all employees who directly affect hazardous materials transportation safety receive safety training, function-specific training, and security awareness training.[48] Safety training must include training concerning methods and procedures for avoiding accidents, such as proper procedures for handling packages containing hazardous materials. Security awareness training must provide an awareness of security risks associated with hazardous material transportation and methods to enhance transportation security; it must also include a component on how to recognize and respond to security threats. Certain employees, including those who handle hazardous materials or who are responsible for the implementation of transportation security plans, must receive additional, in-depth security training on their company's security procedures and employee responsibilities for security.[49] Employees must receive the required training at least once every 3 years.[50]

FMCSA

FMCSA has taken steps to enhance the security of radioactive materials shipments by implementing a security review program and requiring that motor carriers obtain a permit to transport certain highly hazardous materials. Specifically, in 2003, FMCSA established the Security Contact Review Program as a stand-alone visit to evaluate the security posture of a motor carrier company that transports hazardous materials. According to FMCSA officials, these security contact reviews are performed only when a carrier has not undergone a FMCSA on-site investigation in several years.

In addition, in January 2005, at the direction of Congress, FMCSA established the Hazardous Materials Safety Permit Program, which requires motor carriers to obtain a permit to transport certain types of highly hazardous materials, such as explosives, methane, and HRCQ shipments.[51] According to a FMCSA guide, 1,394 motor carriers

[48]49 C.F.R. § 172.704(a)((1)-(4).

[49]49 C.F.R. § 172.704(a)(5).

[50]49 C.F.R. § 17.704(c).

[51]49 U.S.C. § 5109. FMCSA's Hazardous Materials Safety Permit regulations are codified at 49 C.F.R. Part 385, Subpart E.

maintained a safety permit in 2015. To obtain a safety permit, motor carriers must have, among other things,

- a vehicle crash rate under a certain threshold—currently 0.136 crashes per vehicle;
- driver, vehicle, and hazardous material out-of-service rates below the respective threshold for each area—9.68 percent, 33.33 percent, and 6.82 percent;
- a satisfactory transportation security program—including a transportation security plan—and associated training, as required by PHMSA;
- a communication system that enables drivers to contact their motor carrier company during the course of transportation and that maintains records of any such communication; and
- a written route plan for HRCQ shipments and certain types of explosives.

For transportation of hazardous material for which a permit is required, FMCSA requires that

- the vehicle carry a copy of the safety permit, a copy of the route plan, and the telephone number of the motor carrier or its representative who is familiar with the routing of the material and is available at all times while the material is in transit[52] and
- drivers communicate with their carrier company when the driver begins and ends work each day and when the driver picks up and delivers a shipment that requires a safety permit.[53]

As previously discussed, additional protections are added to shipments designated as HRCQ, such as the need for a level VI safety inspection.

DHS

DHS's TSA has broad responsibility for ensuring the security of all modes of transport, though DOT continues to issue and enforce regulations governing the safe transportation of hazardous material, such as radioactive sources.[54] However, TSA has established a regulatory

[52]49 C.F.R. § 385.415(a).

[53]49 C.F.R. § 385.415(c).

[54]Aviation and Transportation Security Act, Pub.L. No. 107-71, § 101 (2001), codified at 49 U.S.C. §114) and DHS Delegation Number 7060.2.

program to ensure that commercial drivers transporting hazardous materials, including risk-significant radioactive sources, undergo security threat assessments and has issued guidance on voluntary security measures for motor carriers. Specifically, in May 2003, TSA amended its transportation security regulations to establish security threat assessment standards for determining whether an individual poses a security threat that warrants the denial of a commercial driver's license that includes an authorization for the driver to transport hazardous materials.[55] These regulations implemented a provision in the USA PATRIOT Act that prohibits states from issuing a license to operate a motor vehicle transporting a hazardous material unless the Secretary of Transportation has first determined that the individual does not pose a security risk that warrants denial of the license.[56] Under TSA's regulations, generally, individuals pose a security threat and cannot receive an authorization to operate a motor vehicle transporting hazardous materials if they (1) have committed a disqualifying criminal offense; (2) do not meet immigration status requirements; (3) do not satisfy TSA analyses of particular databases, such as Interpol and terrorist watch lists; or (4) have been adjudicated as lacking mental capacity or have been committed to a mental hospital.[57] These TSA regulations require a fingerprint-based criminal history records check, an intelligence-related background check, and a final disposition.[58]

Additionally, in June 2008, TSA provided motor carriers with voluntary security measures—referred to by the agency as security action items—for certain especially-hazardous materials that have the potential to cause significant fatalities and injuries or significant economic damage if released or detonated during a transportation incident.[59] In 2012, TSA expanded these voluntary measures to include risk-significant radioactive sources to align with DOT's list of materials requiring a transportation

[55]Security Threat Assessment for Individuals Applying for a Hazardous Materials Endorsement for a Commercial Driver's License, 68 Fed. Reg. 23,852, (May 5, 2003) (codified at 49 C.F.R. Parts 1570 and 1572).

[56]Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act of 2001 (USA Patriot Act) Pub. L. No. 107-56, § 1012 (2001).

[57]49 C.F.R. § 1572.5(a).

[58]49 C.F.R. § 1572.15(a).

[59]These hazardous materials include certain types of explosives, flammable gases, toxic gases, flammable liquids, and corrosive materials.

security plan. In a letter to motor carriers, TSA stated that these measures were developed in consultation with PHMSA and FMCSA, and, while similar, are not intended to supersede any existing regulatory requirements. TSA has also recommended measures beyond NRC Part 37 security requirements for shipments of risk-significant radioactive sources, such as having a means for the driver to transmit an emergency alert notification via a "panic button" and requiring driver identification by login and password or biometric data to operate a vehicle. According to TSA officials, these voluntary measures are printed in pamphlets and promoted to motor carriers through major professional associations. TSA officials we interviewed stated that many of their agency's recommendations and voluntary measures have been adopted by motor carriers.

Agencies' Participation in Interagency Collaboration Mechanisms Has Helped Strengthen the Security of Risk-Significant Sources

Since September 11, 2001, NRC, DOT, and DHS have participated in three mechanisms for collaboration—an interagency task force, MOUs, and coordinating councils—that are intended to facilitate, and in some cases have facilitated, security improvements for risk-significant sources.[60]

Radiation Source Protection and Security Task Force

The 2005 Energy Policy Act directed NRC, along with DOT, DHS, nine other federal agencies, and an organization representing agreement states, among others, to form a task force to evaluate and provide recommendations related to the security of risk-significant sources every 4 years.[61] Since 2006, the task force has issued three reports—in 2006, 2010, and 2014—and has made 19 recommendations related to improving the security of risk-significant radioactive sources during

[60]We have previously reported that agencies frequently use more than one collaboration mechanism to address an issue. See *Managing for Results: Key Considerations for Implementing Interagency Collaborative Mechanisms,* GAO-12-1022 (Washington, D.C.: Sept. 27, 2012).

[61]Pub. L. No. 109-58, § 651(d) (2005). NRC also invited the Department of Health and Human Services and the Office of Science and Technology Policy to participate.

ground transport.[62] According to the 2014 task force report, 15 of the 19 recommendations were completed; we determined that 1 additional recommendation was completed in 2015.

In general, the 19 recommendations related to the ground transport of risk-significant radioactive sources have resulted in direct enhancements and changes to the security of these sources. Specifically, the task force made five recommendations to NRC in 2006, all of which the task force reported as completed by 2014, and one additional recommendation was made in 2014. For example, the 2006 task force report recommended that NRC implement fingerprint and background checks and consider additional measures to verify the validity of licenses. NRC addressed this recommendation by requiring fingerprint and background checks in its Part 37 security requirements and adopted the License Verification System to verify the validity of licenses. The agency evaluated, but ultimately decided not to fully implement, other recommendations—such as for NRC to consider establishing a database of individuals granted unescorted access to material—because of privacy concerns or industry opposition, according to the 2010 and 2014 task force reports. The task force made two recommendations related to the security of risk-significant sources during ground transport to DOT in 2006 and reported in the 2010 report that both were complete. For example, one recommendation directed DOT to consider the use of thresholds from IAEA's *Code of Conduct* in its domestic transportation regulations. As previously discussed, PHMSA implemented this recommendation as part of its March 2010 transportation security plan regulations requiring a security plan for risk-significant sources. The task force also directed 11 recommendations to the U.S. government, multiple agencies, and states related to the security of risk-significant sources, and, according to the 2014 report, 8 were complete; since this report was issued, an additional recommendation has been completed. The 2006 report, for example, recommended that NRC, DOT, and DHS develop an MOU to serve as a foundation for a transport security program for risk-significant sources. This MOU was completed by the agencies in January 2015. The 2014

[62]Radiation Source Protection and Security Task Force, *The Radiation Source Protection and Security Task Force Report*, (Washington, D.C.: August 2006); *The 2010 Radiation Source Protection and Security Task Force Report* (Washington, D.C.: August 2010); *The 2014 Radiation Source Protection and Security Task Force Report* (Washington, D.C.: August 2014). The 2006 report included both recommendations and action items. However, starting with the 2010 report, the task force began referring to all actions to be taken as recommendations. Consequently, we refer to the 2006 action items as recommendations.

report noted that two recommendations to agencies and the U.S. government were not yet complete and that actions to implement them were ongoing. See appendix II for a description of each of the 19 recommendations and the status of implementation for each.

MOUs

Federal agencies have signed two interagency MOUs since 2001 that include provisions to address the security of risk-significant radioactive sources during ground transport—one was signed in 2004 by DOT and DHS,[63] and the other was signed in 2015 by NRC, DOT, and DHS.[64]

The 2004 MOU between DOT and DHS was intended to facilitate the development and deployment of transportation security measures, and to develop procedures by which the two departments could continue to improve their cooperation and coordination in promoting the safety, security, and efficiency of the transportation system. For example, the MOU stated that DOT will take steps to secure its critical infrastructure and key resources, such as DOT facilities, personnel, operations, and information systems. DHS will establish transportation security performance goals, in consultation with DOT and affected stakeholders, and will identify, prioritize, and coordinate the protection of critical infrastructure related to transportation security. DHS, among other things, will set appropriate transportation security standards, taking DOT comments into consideration, and ensure the execution of those standards. DOT will collaborate with DHS in the implementation of such standards.

The 2015 MOU signed by NRC, DOT, and DHS established a framework to allow the agencies to coordinate their respective responsibilities and activities related to the secure transportation of radioactive materials within the United States and across U.S. borders. The goals of the MOU are to, among other things, enhance collaborative exchanges, reduce duplication of effort, and promote the standardization of approach and

[63] *Roles and Responsibilities;* Memorandum of Understanding between the Department of Homeland Security and the Department of Transportation, (Washington, D.C.: Sept. 28, 2004).

[64] *Cooperation on Radioactive Materials Transportation Security*, Memorandum of Understanding among the Department of Homeland Security, the Department of Transportation, and the U.S. Nuclear Regulatory Commission, 80 FR 41097 (Washington, D.C.: July 14, 2015). As previously discussed, a 1979 MOU between NRC and DOT delineated the respective responsibilities of these agencies for the regulation of safety in transportation of radioactive materials. This 1979 MOU remains in effect.

policy. The MOU defined "risk-significant material" as any radioactive material that requires security measures to be applied to it above prudent management practices. An enclosure to the MOU states that the agencies will promote coordination among themselves and their component agencies regarding inspection and enforcement activities, with the objective of optimizing available resources and maximizing communications on areas of mutual interest. The MOU also specified that the agencies will establish the working arrangements between NRC and the relevant component agencies within DOT and DHS.

Consistent with the MOU, according to NRC officials, an interagency working group comprising over 25 staff members from the three agencies was formed. In January 2016, the working group presented a draft of a multiyear action plan that included how to address the 12 topical areas described in the MOU, including risk assessments, strategic planning, inspections and enforcement, and intelligence and information sharing. According to an NRC official, the plan was approved by the working group in September 2016. The plan describes the implementation strategy for the 12 topical areas. For example, the strategy for the inspections and enforcement area is to develop working arrangements among the three agencies to coordinate inspection activities and communication protocols. These arrangements will allow the agencies to inform each other of inspection events and findings—and may allow them to identify systemic deficiencies. According to the multi-year action plan, the initial draft of the working arrangements for this topical area is to be developed by April 2017, approved by December 2017, and implemented by April 2018.

Nuclear Government Coordinating Council and Nuclear Sector Coordinating Council

Beginning in 2006, DHS established two councils—one consisting of federal agencies and one consisting of industry stakeholders—to facilitate interaction between governmental entities and industry representatives of critical infrastructure owners and operators of nuclear reactors, materials, and waste management firms.[65] The federal council—the Nuclear Government Coordinating Council (NGCC)—is chaired by DHS, and its agency membership includes NRC, DOT, and the Department of Energy. The industry stakeholder council—the Nuclear Sector Coordinating Council (NSCC)—is chaired by the Nuclear Energy Institute, and has a membership that includes companies operating commercial nuclear power plants in the United States, radioisotope manufacturers and

[65]Homeland Security Presidential Directive-7. This directive was replaced in 2013 by Presidential Policy Directive-21 *Critical Infrastructure Security and Resilience*.

suppliers, and nuclear waste management and transportation firms.[66] The NGCC and NSCC both meet four times annually. NRC officials told us that NRC has benefitted from participation in the NGCC and the NSCC, which has helped to identify and resolve areas of regulatory overlap and duplication of effort and provided a forum for industry input. According to one DHS official we interviewed, the NGCC meetings touched on a range of issues and were often used by NRC to gain early input from the members on proposed regulations—including its Part 37 security requirements.

In 2009, the NGCC and NSCC jointly established the Transportation of Radioactive Materials Focus Group to, among other things, clarify the potential national security concerns from transporting risk-significant radioactive sources and analyze the overlaps, gaps, and inconsistencies identified during a public and private sector sealed source security workshop.[67] Issued in November 2010, this focus group's report found that, among other things, overlaps and gaps in federal transportation security regulations exist in some areas.[68] For example, the report found that NRC, DOT, and TSA all require that personnel responsible for implementing transportation security receive in-depth training on developing and implementing transportation security plans, but only NRC requires that personnel with access to these plans be screened by measures such as a background and fingerprint check. The report stated that regulations should be consistent and mutually reinforcing without placing undue burden on the private sector. Additionally, the report stated that efficiencies should be sought where doing so would not negatively impact overall regulatory objectives. The report further stated that the Radiation Source Protection and Security Task Force is a viable forum to continue efforts to synchronize transportation security requirements.

[66]The Nuclear Energy Institute represents the commercial nuclear industry and promotes the beneficial uses of nuclear energy.

[67]In addition to the Transportation of Radioactive Materials Focus Group, the NGCC and NSCC established focus groups to study the tracking of radioactive materials and the removal and disposition of disused sources.

[68]*Transportation of Radioactive Materials*, Transportation of Radioactive Materials Focus Group, Radioisotopes Subcouncil of the Nuclear Government and Sector Coordinating Councils (Washington, D.C.: Nov. 22, 2010).

Agencies Face Challenges to Strengthening the Security of Radioactive Sources during Ground Transport, but Opportunities Exist to Address Them

NRC and DOT face challenges to strengthening the security of the ground transport of risk-significant radioactive sources, but opportunities exist to address these challenges. Specifically, one challenge is that NRC does not directly inspect whether motor carriers have implemented the agency's Part 37 security requirements. In addition, NRC does not collect information about the number of shipments of risk-significant radioactive sources and the modes of transportation for all such shipments. Furthermore, differences between NRC and DOT security and safety thresholds allow many shipments of category 1 sources to be transported without the benefit of the additional protections that result from an HRCQ designation.

NRC Does Not Directly Inspect Whether Carriers Have Implemented NRC Security Requirements

NRC does not directly inspect whether motor carriers contracted by licensees to transport risk-significant sources have implemented Part 37 requirements. NRC Part 37 regulations require that licensees shipping risk-significant radioactive sources ensure that they use carriers that have implemented specific security measures for risk-significant sources. As previously discussed, these security measures include establishing 24-hour movement control centers for category 1 shipments and maintaining constant control and surveillance during transit for category 2 shipments. However, because NRC's regulatory authority extends only to its licensees, NRC does not have the authority to inspect whether motor carriers that are not licensees meet Part 37 security requirements. In addition, according to DOT officials, DOT and state inspectors with regulatory authority for carriers do not currently inspect for compliance with NRC's Part 37 requirements because NRC requirements are not a part of DOT inspections. As a result, no federal or state agency directly inspects motor carriers to ensure that they meet these requirements.

To determine whether motor carriers are complying with its Part 37 requirements, NRC requires licensees to ensure that the motor carriers they use to transport risk-significant radioactive sources meet Part 37 requirements, and its inspectors are to verify that licensees are in compliance. NRC officials stated that NRC regional offices have asked carriers, as part of their security inspections of licensees, to provide information about the security of their shipments. Because NRC has no authority to inspect motor carriers, motor carriers that are not licensees are under no obligation to respond to these requests, and NRC officials told us these requests are rare and seldom generate a useable response.

NRC inspectors we interviewed stated that they review licensee documentation and conduct interviews with selected licensees to determine whether carriers used by licensees meet Part 37 requirements. These inspectors provided some examples of how they try to make these determinations. According to two NRC inspectors we interviewed, some licensees have incorporated Part 37 requirements into their contracts with motor carriers, and these inspectors reviewed these contracts for evidence of whether these carriers meet Part 37 requirements. Another NRC inspector told us that one carrier was sufficiently well known that inspectors did not always assess whether the licensee had documented that the carrier had measures in place to meet Part 37 requirements. This inspector explained that the carrier had provided sufficient evidence in the form of a letter to NRC asserting that its processes and procedures complied with Part 37. NRC headquarters officials told us that they also viewed the letter as sufficient evidence of compliance. These headquarters officials provided us with a copy of a letter from a carrier that they viewed as evidence of how the carrier met NRC's Part 37 requirements. However, our review of the letter found that it was a generic letter from the carrier addressed to its customers that stated it had developed policies and programs to comply with all applicable federal and state laws, but it did not provide details about the specific measures the motor carrier had in place to meet NRC Part 37 security requirements. In addition, our review of a non generalizable sample of inspection records for 21 inspections from 2014 through 2015 found that NRC inspectors did not consistently document whether they had reviewed evidence that licensees had taken measures to ensure carriers met Part 37 security requirements. One NRC official stated that inspection records in his region were intended to serve as representative documentation of an inspector's efforts and may not always reflect all of the requirements that were inspected.

Some licensees, motor carrier representatives, and an industry stakeholder we interviewed told us that licensees may face challenges in gathering documentation to determine whether motor carriers meet Part 37 security requirements. For example, according to an industry stakeholder with expertise in how motor carriers comply with radioactive source regulations and representatives from two motor carrier companies, some licensees may be permitted to visit a motor carrier's facility to assess whether the motor carrier meets Part 37 security requirements. One motor carrier company representative and an industry stakeholder we interviewed told us that the willingness of a motor carrier to allow a licensee inspection largely depends on the relative value of the licensee's business to the carrier. For example, a valued customer may be allowed

to tour a motor carrier's facility and discuss how the motor carrier meets Part 37 requirements, but a less valued customer may not be given the same opportunity. Representatives from three motor carrier companies told us that they allowed their major customers to conduct on-site inspections, and representatives from one of the motor carrier companies said that, upon request, they had completed a checklist provided by the licensee to certify that the carrier met Part 37 requirements. Representatives from a licensee stated that they conducted biennial inspections of their motor carriers to ensure that they were in compliance with all applicable regulations, including Part 37 requirements. Representatives of a motor carrier stated that, during NRC's most recent inspection, the licensee invited the motor carrier to participate via telephone to discuss how it meets Part 37 security requirements.

DOT is the federal entity tasked with statutory oversight of motor carriers. FMCSA and state officials inspect motor carriers during on-site investigations and roadside inspections; however, FMCSA does not have the authority to enforce motor carriers' compliance with NRC's Part 37 security requirements. NRC's Part 37 security requirements are not a part of FMCSA's regulations or procedures, according to FMCSA officials. Because no federal or state entity directly inspects motor carriers to verify whether motor carriers are meeting Part 37 requirements, NRC cannot be assured that carriers are meeting Part 37 requirements. NRC and DOT may have an opportunity to work together to identify an approach to verify that carriers are meeting NRC requirements and further strengthen the security of shipments of risk-significant sources. Such an approach could allow NRC to save resources by leveraging DOT's existing processes and would be consistent with the 1979 MOU between NRC and DOT and the 2015 MOU between DOT, NRC, and DHS. The 1979 MOU states that NRC and DOT will conduct an inspection and enforcement program within each agency's jurisdiction to assure compliance with that agency's requirements, consult with each other on the results of inspections, and take enforcement actions as appropriate within the limits of each agency's authority. The 2015 MOU built on the foundation of the 1979 MOU, and states that NRC, DOT, and DHS will promote coordination on enforcement and inspection activities with the objective of optimizing available resources and maximizing communications on areas of mutual interest. By identifying the extent of each agency's jurisdiction, areas of overlap as well as any gaps, the agencies may be able to develop an approach to verify that carriers are meeting NRC's Part 37 security requirements. DOT officials we interviewed stated that they would be willing to explore the feasibility of working with NRC to consider ways to incorporate Part 37 security requirements into their inspections or

investigations. According to DOT officials, however, DOT would likely need to revise PHMSA regulations setting forth safety and security requirements. NRC officials we interviewed stated that on occasion the Department of Energy inspects NRC licensees on NRC's behalf, and provides the agency with information that it uses to determine whether the licensee is in compliance with NRC regulations. These officials said that they would be willing to explore the option of having DOT verify whether carriers are meeting NRC's Part 37 security requirements.

NRC Does Not Collect Information about the Number and Mode of Transport for All Shipments of Risk-Significant Sources

NRC does not collect information on the number of all shipments of risk-significant sources (i.e., category 1 and 2 radioactive sources) and the mode by which they are transported. As previously discussed, NRC requires licensees to record transfers between licensees of category 1 and 2 sources in NRC's NSTS database. However, this database includes no information on the number of shipments or the mode of transport involved in completing these transfers, according to NRC officials. Also, as previously discussed, NRC requires licensees to provide advance notification for shipments of category 1 sources, including information that would indicate the mode of transport, which NRC documents in its RAMQC database. As a result, NRC collects information on transfers of category 1 and 2 sources in NSTS and on the number of shipments and mode of transport for category 1 sources in the RAMQC database, but it does not collect information on shipments of category 2 sources or the mode by which these sources are transported. Our analysis of NSTS data from 2013 through 2014 identified 54,855 transfers of risk-significant radioactive sources between NRC licensees, nearly all of which were cobalt-60 or iridium-192.[69] Of these transfers, 5,768 involved category 1 sources, and 49,087 involved category 2 sources. However, the number of transfers does not equate to the number of shipments, since a shipment may include one or more sources. Our analysis of RAMQC data from 2013 through 2014 identified 351 shipments of category 1 material for all domestic licensees and an NRC licensee based in Canada.[70] As a result, while NRC has information about

[69]Cobalt and iridium are radioactive sources commonly used in a variety of industries. Cobalt-60 is commonly used for irradiating food, sterilizing medical products, and measuring thickness and density in industrial processes. Iridium-192 is used in industrial radiography.

[70]According to NRC officials, this Canadian licensee is the sole NRC licensee outside the United States and it ships and receives a significant number of category 1 radioactive sources to and from the United States.

the number of transfers of sources between licensees that occur each year through NSTS and information about the number of category 1 shipments that occur each year through the RAMQC database, it does not have information on the number of category 2 shipments that occur each year or the mode by which these sources are transported.

Not having information on all shipments of risk-significant sources or the mode by which they were transported could, in certain situations, complicate NRC's efforts to secure risk-significant sources and efforts to have an awareness of shipments of large quantities of radioactive material being transported in the United States. For example, it is possible that a motor carrier could make multiple stops and aggregate multiple category 2 shipments on a single truck in quantities that exceed the category 1 threshold. In this scenario, according to NRC documentation, licensees cannot be expected to know that the separate shipments have been aggregated to category 1 amounts by the motor carrier and would therefore not be responsible for ensuring that category 1 security requirements were implemented by the motor carrier. However, according to NRC documentation, because NRC does not regulate motor carriers, the motor carrier is also not responsible for ensuring that category 2 sources that are aggregated into category 1 quantities are protected in accordance with category 1 security requirements. NRC officials we interviewed stated that they believe this scenario is of a low probability and that the security risks to such shipments are low because of the transient nature of the aggregation by the motor carrier and the anonymity of the packages. NRC officials also explained that DOT transport index regulations help to limit the potential for aggregation by restricting the total amount of radioactivity in any one package and the total amount of radioactivity in any one vehicle. However, because NRC does not have information on shipments of category 2 sources, NRC officials acknowledged that they do not have the data to support their view that the likelihood of a single motor carrier collecting and aggregating multiple category 2 sources in quantities that exceed category 1 thresholds is of low probability.

We learned through our discussions with NRC officials that the NSTS database would be the best of NRC's databases for tracking shipment and mode of transportation information. However, NRC headquarters officials we interviewed stated that they did not see any regulatory or oversight benefit to collecting information on the total number of shipments or the modes by which these shipments are transported within the United States. These officials also stated that any change to the reporting requirements for information included in the NSTS database

would require going through the federal rule-making process, which is time-consuming, and that NRC has been hesitant to add additional information requirements without a strong justification. NRC officials also stated that the agency has other priorities for improving its databases, such as adding additional capabilities to NRC's Web Based Licensing System to support NRC's import and export licensing process.[71]

We understand NRC's concerns about the difficulty of adding information reporting requirements. However, without collecting and maintaining information on the total number of shipments of category 1 and category 2 sources and the mode by which they are transported, it is unclear how the agency can determine whether it is meeting its goal of providing reasonable assurance that it is preventing the theft or diversion of these dangerous materials. In addition, according to NRC officials, the NSTS database currently includes data fields related to transport that would allow licensees to document the shipment, which the agency could use to collect the number of shipments, but the use of these fields is optional. In addition, NSTS could be modified to include the shipment and routing information currently entered into the RAMQC database, and these modifications could provide NRC with more post shipment information that could allow NRC to address potential vulnerabilities and allocate resources if necessary. These officials also said, however, that these modifications to NSTS would be expensive and could raise security concerns because they could broaden the number of users that would need security credentials to access NSTS. By collecting information on the number of shipments and mode of transport for risk-significant sources, NRC could improve its awareness of the volume of shipments of this material and how it is transported, such as whether the majority of shipments are transported via ground, air transport, or some combination thereof. This information could allow NRC to better understand where potential vulnerabilities may exist while this material is being transported and whether and where additional resources may be needed to protect this material. This information could also give NRC greater confidence that it is achieving its goal of having reasonable assurance of preventing theft or diversion of these sources.

[71]Additional planned improvements to the Web-Based Licensing System include adding the Transportation Approval Package Information System, Reciprocity Tracking System, National Sealed Source and Device Registry System, and General License Tracking System.

Differences between NRC and DOT Thresholds Allow Many Shipments of Category 1 Sources to Be Transported without the Benefit of the Additional Protections That Result from an HRCQ Designation

NRC's threshold for determining which sources are category 1 risk-significant radioactive sources that require additional security protections is generally lower than DOT's HRCQ thresholds for determining which shipments of radioactive material require additional safety protections. As a result, many shipments of category 1 sources are transported without the benefit of the additional protections provided by an HRCQ designation. For example, NRC's category 1 threshold for cobalt-60 is 30 TBq, and DOT's HRCQ threshold for cobalt-60 is 1,000 TBq. As a result, a single package of cobalt-60 that exceeds NRC's category 1 threshold—such as a shipment with 900 TBq, or 30 times the amount deemed of concern from NRC's perspective—would not be designated as an HRCQ shipment and thus would not require additional HRCQ protections. As previously discussed, our analysis of RAMQC's database identified 351 shipments of domestic category 1 sources from 2013 through 2014. Of these, 130 were classified as HRCQ, and 221 fell below the HRCQ threshold. That is, more than half of category 1 sources transported from 2013 through 2014 did not meet or exceed the HRCQ threshold and thus were not required to be transported with the additional safety protections provided by the HRCQ designation.

As previously discussed, an HRCQ shipment requires additional safety protections, including requiring carriers to undergo a level VI safety inspection; select the most expedient preferred route; prepare a written route plan; and require drivers to carry proof of having received training on, among other things, handling and transporting hazardous material. For example, as previously discussed, the level VI safety inspection of an HRCQ shipment includes a review of the driver and the vehicle according to more stringent criteria, and if a critical violation of the operating criteria for the driver, vehicle, or cargo is identified, the inspector is to place the vehicle out of service until the violation is addressed. Any violations found regarding the driver or the vehicle could prevent a situation where a shipment is in transit with a driver and/or vehicle that may have a defect that could prevent the vehicle from meeting its planned schedule and create an opportunity for theft or diversion.

In addition to the differences between NRC and DOT thresholds, these agencies also differ in how they calculate the aggregation of radioactive material that can trigger NRC security thresholds and DOT safety thresholds. NRC security thresholds calculate the aggregation of material by the total radioactivity of radioactive material stored collectively in one location behind a single physical barrier or transported on a vehicle. In contrast, DOT package safety thresholds calculate the aggregation of material by the total radioactivity of the radioactive material accumulated

in a single package, according to DOT officials. For example, a shipment of one package holding 1,500 TBq of cobalt-60 sources is considered both a category 1 source by NRC and an HRCQ amount of material by DOT and would be subject to the additional HRCQ protections. However, a vehicle carrying two packages—each holding 750 TBq of cobalt-60—would be considered a category 1 amount by NRC but not an HRCQ amount of material by DOT. Therefore, the additional HRCQ protections would not apply in such a situation.

While motor carriers transporting category 1 amounts of material below DOT's HRCQ threshold are not required to comply with the additional HRCQ protections, we found instances where some states took actions to provide additional protections for such shipments. According to a guide provided by the Council of State Governments, in some cases, states use additional security and safety measures for some shipments of category 1 quantities of radioactive sources.[72] For example, some states may require that HRCQ shipments, and category 1 shipments below the HRCQ threshold, be accompanied by a security escort— ranging from a single unmarked car to a tactical team in an armored car with helicopter surveillance. In addition, a state may choose to conduct an en route inspection for any shipments transported on its roads, according to the guide. Whether states provide escorts or perform en route inspections of shipments below the HRCQ thresholds varies and—according to CVSA officials we interviewed—is up to the discretion of the individual states. States may choose to cover the costs of these escorts or pass the costs along to the carrier or licensee, according to state officials we interviewed.

Some NRC, DOT, and CVSA officials we interviewed stated that it was possible that additional HRCQ protections, such as level VI safety inspections, might make the driver and vehicle safer, but would not necessarily provide a security benefit. NRC and DOT officials said, however, that they had not studied the issue and did not provide additional details on the potential costs and security benefits from additional HRCQ protections. DOT and CVSA officials also stated that any increase in vehicle inspections would likely require DOT to provide significantly more funding to the states, since the states, according to DOT data, conduct all level VI safety inspections. One state official we interviewed said that one border state does not have any inspectors

[72] *Planning Guide for Shipments of Radioactive Material through the Midwestern States*, Council of State Governments Midwestern Office and the Midwestern Radioactive Materials Transportation Committee, (Lombard, IL: 2015).

certified to perform a level VI safety inspection, and must borrow an inspector from a neighboring state when needed. As previously discussed, our analysis of NRC's RAMQC database identified 130 category 1 shipments that were HRCQ shipments, and 221 category 1 shipments that were non-HRCQ shipments from 2013 through 2014. Given NRC's emphasis on securing risk-significant sources, an examination by NRC and DOT of the potential costs and security benefits associated with lowering the HRCQ threshold so that more or all category 1 shipments are designated as HRCQ shipments and thus receive additional HRCQ protections, could provide an opportunity to determine whether the benefits of increasing the security of such shipments would outweigh the costs. These additional protections—if applied to category 1 shipments that fall below the HRCQ threshold—could enhance the security of these shipments because the additional protections could help ensure that a shipment reaches its destination without delay, thereby lessening the potential for theft or diversion. NRC and DOT working together to examine the costs and benefits of this approach would be consistent with the stated goal in the 2015 MOU between NRC, DOT, and DHS of leveraging mutual interests.

Conclusions

Detonation of a dirty bomb by terrorists in the United States would have significant impacts on the nation's economy and could impact the health and sense of security of citizens. Protecting the risk-significant radioactive sources that could arm terrorists with the material to accomplish such disruption is a stated priority of NRC. Following the terrorist attacks on September 11, 2001, areas of potential vulnerability were identified surrounding the security of such sources. Over the last 15 years, NRC, DOT, and DHS have worked together to address such vulnerabilities and tighten the security of risk-significant radioactive sources, including during ground transport. Such efforts focused on enhancing security during ground transport are important because, according to IAEA documents, it is while in transit that these sources are most vulnerable to theft or sabotage by terrorists. Seizing opportunities to further enhance such security, however, may be warranted given the significant effects that even one dirty bomb incident in the United States could have on its citizens. For example, by collecting information from licensees on the number of shipments and mode of transport, by working together to identify an approach to verify that carriers are meeting NRC's Part 37 security requirements, and by considering an examination of the potential costs and security benefits associated with lowering the HRCQ threshold, NRC, DOT, and DHS may be in a better position to enhance the security of such sources, if it is determined to be warranted. This information could

provide the opportunity for these agencies to have greater assurance that risk-significant radioactive sources that travel around the United States on a daily basis are secure.

Recommendations for Executive Action

We are making the following three recommendations:

- To improve the awareness of how risk-significant radioactive sources are transported within the United States and to better determine whether Nuclear Regulatory Commission (NRC) is meeting its goal of providing reasonable assurance for preventing the theft or diversion of these dangerous materials, we recommend that the Chairman of NRC take actions to collect information from licensees on the number of shipments and mode of transport for such sources—for example, by identifying the extent to which an existing NRC database (e.g., NSTS) may be used to capture this information.
- To further enhance the security of radioactive sources during ground transport, we recommend that the Chairman of NRC, in consultation with the Secretary of Transportation and the Secretary of Homeland Security, identify an approach to verify that motor carriers are meeting NRC's Part 37 security requirements applicable to transportation, for example by having DOT inspectors verify compliance with NRC Part 37 security requirements during their on-site investigations.
- To further enhance the security of radioactive sources during ground transport, we recommend that the Secretary of Transportation, in consultation with the Chairman of NRC and the Secretary of Homeland Security, consider examining the potential costs and security benefits associated with lowering the HRCQ threshold so that more, or all, category 1 shipments are classified as HRCQ shipments.

Agency Comments and Our Evaluation

We provided a draft of this report to NRC, DOT, DHS, the Department of Energy, and the Department of Justice for review and comment. NRC provided written comments and an enclosure that included significant issues and technical comments. We incorporated the significant issues and technical comments as appropriate. DOT provided written comments and also provided technical comments, which we incorporated as appropriate. DHS and the Department of Energy provided technical comments, which we incorporated, as appropriate. The Department of Justice did not provide comments. NRC agreed with one recommendation, disagreed with another, and neither agreed nor disagreed with the third but stated that it would be willing to explore it with

DOT staff. DOT concurred with one recommendation concerning it and did not fully concur with the other, as discussed below.

In its written comments and the enclosure's significant issues, reproduced in appendix III, NRC stated that it disagreed with the draft report's recommendation that collecting additional information in NSTS on the number of shipments and mode of transport would improve the awareness of how risk-significant radioactive sources are transported within the United States and better determine whether NRC is meeting its goal of providing reasonable assurance for preventing theft or diversion of these dangerous materials.

NRC stated that it had taken steps following the terrorist attacks of September 11, 2001, to strengthen the security of risk-significant radioactive materials, including addressing the potential vulnerabilities associated with the use and transport of these materials. NRC explained that it had implemented a number of measures in coordination with federal and state agencies to ensure adequate protection of radioactive sources and that NSTS is only one of those measures. NRC also explained that the NSTS, along with the rest of the NRC and DOT regulatory framework, provide reasonable assurance of the safety and security of radioactive material in transit. Therefore, NRC stated that it does not believe that adopting this recommendation would result in safety or security improvements. In its enclosure noting significant issues, NRC provided a framework for transactions and shipments involving Category 1 and 2 sources as background for the NRC staff's disagreement. NRC's framework and our evaluation is as follows.

- In significant issues 2 and 5, that under NRC regulations, licensees are required to report some source shipment information in NSTS for Category 1 and 2 source transfers (e.g., shipping date and estimated date of arrival), and must report transactions no later than the close of business the day after a source transaction occurs. This was noted in the draft report.
- In significant issues 3 and 4, that due to the sensitivity of the information, the NSTS is neither the appropriate system to track the mode and shipment information for transfers of risk-significant sources nor designed to track such information. Using it for this purpose would require a new security categorization evaluation, which would likely result in a higher security categorization for the system. This would result in challenges in a number of areas, such as measures needed to provide licensees with access to the system. NRC also explained that imposing a requirement for licensees to

provide information in the NSTS on the mode of transport and shipment information would require a rulemaking. Such a rule is not likely to result in significant improvements in safety or security that would form a basis to justify a rulemaking and the additional reporting and recordkeeping burden. The draft report noted that NRC officials had expressed concern that changes to the NSTS might result in security issues. The draft report also noted that NRC officials stated that any change to the reporting requirements for information included in the NSTS would require a federal rule-making, and that NRC has been hesitant to add additional information requirements.

- In significant issue 6, that under NRC regulations licensees must provide advance notification of shipments of category 1 quantities of material to NRC and to the governor of any state through which the transport travels. The advance notification report must include, among other things, information related to material being transported, shipper and receiver, and a point of contact for obtaining current information on the shipment. This was noted in the draft report, and we have amended the report to include information about notifications to state governors.
- In significant issues 10 and 11, that under the regulations, licensees shipping category 1 sources must use movement control centers to maintain position information from a remote location, establish redundant communications that allow the transport to contact the escort vehicle, and other measures to protect the shipment. This was noted in the draft report.
- In significant issues 10 and 12, that under the regulations, licensees shipping category 2 sources must maintain constant control and/or surveillance during transit and have the capability for immediate communication to summon appropriate response or assistance or to use carriers with established package tracking systems. This was noted in the draft report.
- In significant issues 7 and 8, that NRC's RAMQC database is maintained by NRC to track advance notifications of category 1 shipments and that NRC provides reports from this database to other federal agencies as appropriate to assist in verifying transport of hazardous materials. This was noted in the draft report.
- In significant issues 9, that NRC has Memorandums of Understanding with DHS and DOT to ensure appropriate regulatory oversight of radioactive material shipments. This was noted in the draft report.

In NRC's written comments, NRC stated that the NSTS provides an accounting function for information on risk-significant sources following

their manufacture, transfer, receipt, disassembly, or disposal. We noted in the draft report that the NSTS was used to track transaction information, and have amended the report to clarify that the NSTS provides an accounting function for category 1 and 2 radioactive sources following their manufacture, transfer, receipt, disassembly, or disposal.

In its written comments and in the enclosure's significant issues 13 and 1, NRC also disagreed with the statement in the draft report that stated, "Not having information on all shipments of risk-significant sources or the mode by which they were transported could, in certain situations, complicate NRC's efforts to secure risk-significant sources and thereby inhibit the agency's ability to meet its objective of providing reasonable assurance of preventing their theft or diversion." NRC stated that it believes that the specific situation that we cited in support of this statement is not an issue that is solved by collecting post-shipment information but best addressed by appropriate coordination between NRC and DOT, as indicated by our second recommendation, with which it agrees. NRC suggested that we consider deleting or editing this statement. NRC further stated that accounting for the number of shipments and mode of transport for category 1 and 2 source transfers in NSTS would not provide any information that could be used to prevent the theft of diversion of category 1 and 2 materials.

We acknowledge in the report the measures that NRC has taken independently and in conjunction with federal agencies to improve the security of risk-significant sources, including while in transit. Our finding about the lack of information on the number of shipments and the mode by which these shipments are transported is premised on NRC's stated interest of improving its awareness of risk-significant sources that are transported within the United States. As our report notes, NRC has information on the number of transfers of risk-significant sources between licensees and has some information on shipments of category 1 sources, but it does not have information on the number of shipments or the mode of these shipments for category 2 shipments, which likely comprise the bulk of shipments of risk-significant sources based on available data on transfers. It is unclear to us how collecting information on the number and mode of shipments would not be in NRC's own stated interest of improving awareness of shipments. As it relates to our recommendation, we suggested using the NSTS as a mechanism for collecting this information based on input from NRC officials that the NSTS would be the NRC database most easily modified to gather this information as it already includes a data field for capturing shipment information. Furthermore, our recommendation did not suggest that the NSTS be

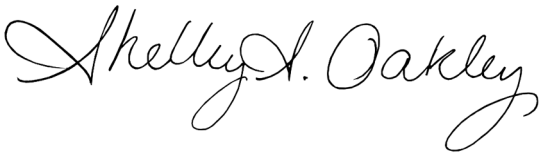
modified in a manner that would allow it to be used to track real-time shipments and address ongoing issues, but rather as a source of post-shipment information that could be used to determine how many shipments occur in the United States and how these shipments were transported, such as by truck, air, or some combination. Having this information, we believe, would provide NRC with an enhanced awareness of these shipments and allow for more informed decisions about where vulnerabilities may exist and where resources may need to be allocated to address any vulnerabilities. Given NRC's concern, we have revised our recommendation to clarify that modifying the NSTS could be one mechanism that NRC could use to collect the information, which allows NRC the flexibility to determine the most effective and efficient approach for gathering such information. We also revised the statement in the draft report that NRC disagreed with to clarify that we are not advocating for real-time tracking information on these shipments, but rather collecting post-shipment information that could allow NRC to address potential vulnerabilities and allocate resources if necessary.

In its written comments, reproduced in appendix IV, DOT stated that it did not fully concur with the recommendation that DOT identify an approach to verify that motor carriers are meeting NRC's Part 37 security requirements. DOT stated that, while it agreed conceptually with the intent of the recommendation, it has no authority to address NRC's Part 37 requirements. We acknowledged in our report that Part 37 requirements are the responsibility of NRC. Our report also discussed that while DOT is not responsible for assessing motor carrier compliance with Part 37, it is the federal entity with statutory oversight of motor carriers. As a result, any attempt by NRC to implement an approach for verifying motor carrier compliance with its regulations would require the cooperation of DOT and its inspectors. We have revised our recommendation and made modifications to the report to clarify that NRC, in consultation with DOT and DHS, identify an approach to directly verify that motor carriers are meeting NRC's Part 37 requirements. We believe this change makes it clear that the responsibility for ensuring compliance Part 37 is NRC's, but that addressing our recommendation would require action on the part of NRC as well as DOT, given the regulatory role of each agency.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies to the appropriate congressional committees, the Chairman of NRC, the Secretary of Transportation, the Secretary of Homeland Security, the Secretary of

Energy, the Attorney General, and other interested parties. In addition, the report will be available at no charge on the GAO website at http://www.gao.gov.

If you or your staff members have any questions about this report, please contact me at (202) 512-3841 or oakleys@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report are listed in appendix IX.



Shelby S. Oakley
Acting Director, Natural Resources and Environment

Appendix I: Objectives, Scope, and Methodology

This report addresses transportation security for risk-significant radioactive sources. Specifically, our objectives were to examine, (1) the steps that the Nuclear Regulatory Commission (NRC), Department of Transportation (DOT), and Department of Homeland Security (DHS) have taken since September 11, 2001, to strengthen the security of risk-significant radioactive sources during ground transport; and (2) the challenges, if any, that exist to further strengthening the security of these sources during ground transport and the potential opportunities to address them. For the purposes of this report, the term "risk-significant radioactive sources" refers to radioactive sources in specific quantities that meet category 1 and 2 thresholds, as defined by the International Atomic Energy Agency's (IAEA) *Code of Conduct on the Safety and Security of Radioactive Sources*. This report considered risk-significant radioactive sources that were shipped between NRC licensees within the United States and Canada. Except in the case of an NRC licensee based in Canada, imports, exports, and transshipments of risk-significant radioactive sources were not included in the scope of this report.

To identify what steps NRC, DOT, and DHS have taken since September 11, 2001, to strengthen the security of risk-significant radioactive sources during ground transport, we reviewed relevant laws, regulations, and agency guidance, and interviewed agency officials at NRC, DOT, DHS, the Department of Energy, the National Nuclear Security Administration, and the Federal Bureau of Investigation. To identify steps that NRC has taken, we reviewed the agency's orders and regulations, including 10 C.F.R. Part 37, for the physical protection of category 1 and 2 material, as well as packaging and transfer reporting regulations. We also reviewed IAEA documents, including the *Code of Conduct on the Safety and Security of Radioactive Sources*, the *Categorization of Radioactive Sources, and Regulations for the Safe Transport of Radioactive Material*, as well as information from the Incident and Trafficking Database. We interviewed NRC officials from the Office of Nuclear Material Safety and Safeguards, Office of Nuclear Security and Incident Response, and three NRC regional offices with oversight over NRC risk-significant radioactive source licensees to understand how NRC imposes and enforces Part 37 requirements. We also interviewed officials from the Organization of Agreement States to identify how agreement states are incorporating the NRC Part 37 requirements in state regulations. We also reviewed NRC's efforts in the 13 states in which Part 37 regulations were in effect during the time of our review.

To identify what steps DOT has taken, we reviewed Pipeline and Hazardous Materials Security Administration (PHMSA) and Federal Motor

Carrier Safety Administration (FMCSA) regulations and guidance, including those related to motor carrier transportation security plans and the Hazardous Materials Safety Permit program. We also interviewed officials from PHMSA's Office of Hazardous Materials Safety, FMCSA's Hazardous Materials Division, and FMCSA's Office of Enforcement and Compliance to determine how their regulatory programs have been implemented. We also used data from FMCSA's Motor Carrier Management Information System to determine how many on-site inspections of motor carriers federal and state officials conducted in 2015, the most recent full year of data at the time of our review. We assessed the reliability of the Motor Carrier Management Information System data by reviewing relevant documentation and Inspector General reports, and interviewing knowledgeable officials. We found the data to be sufficiently reliable to report on the number of annual motor carrier inspections and the number of violations cited. We also interviewed officials from the Commercial Vehicle Safety Alliance (CVSA) to determine how the motor carrier inspection program is implemented, and how level VI inspections are conducted.

To identify actions taken by DHS, we reviewed regulations and guidance issued by TSA, such as the Hazardous Materials Assessment Program, and interviewed officials from the Office of Security Policy and Industry Engagement. We also reviewed DHS regulations and documentation related to initiatives such as DHS's Critical Infrastructure Partnership Advisory Council and interviewed officials from the National Programs and Protection Directorate, Customs and Border Protection, and the Domestic Nuclear Detection Office to determine their role in securing radioactive sources.

In addition to these activities, we identified several mechanisms for interagency collaboration designed to improve the security of risk-significant radioactive sources—the Radiation Source Protection and Security, memorandums of understanding (MOU), and government and sector coordinating committees. Specifically, we evaluated federal agencies' progress toward enhancing the security of risk-significant sources as detailed in Radiation Source Protection and Security Task Force reports from 2006, 2010, and 2014, focusing on the agencies' progress in implementing recommendations and actions related to transportation security. Recommendations that we determined did not relate to transportation security were excluded from our analysis. We also reviewed the three MOUs among NRC, DOT, and DHS that are related to the security of risk-significant radioactive sources—specifically, the 1979 MOU between NRC and DOT, the 2004 MOU between DOT and DHS,

and the 2015 MOU among NRC, DOT, and DHS. We also analyzed the role that the Nuclear Government Coordinating Council and Nuclear Sector Coordinating Council played in facilitating dialogue and collaboration among the agencies and nuclear sector representatives by reviewing the councils' reports and documentation, and interviewing NRC, DOT, and DHS officials.

To determine whether any challenges exist to further strengthening the security of risk-significant sources during ground transport and potential opportunities to address any such challenges, we evaluated the extent to which NRC and DOT have coordinated inspection and enforcement activities for verifying licensee and motor carrier compliance with relevant laws and regulations. We reviewed NRC Part 37 requirements for risk-significant radioactive sources for motor carriers, DOT transportation security and inspection regulations for motor carriers and CVSA inspection procedures, and interviewed NRC, DOT, and CVSA officials. Additionally, we reviewed a non generalizable sample of inspection records provided by NRC for 21 separate inspections of risk-significant source licensees to obtain examples of how NRC inspectors are inspecting for compliance with Part 37 requirements. NRC provided records for 21 inspections based on our request for examples of 3 to 4 inspection records for each NRC region. To determine how NRC Part 37 transportation security requirements have been implemented, we also interviewed representatives from four motor carrier companies that transport risk-significant radioactive sources which we identified through interviews and research and which responded to our request for an interview. We interviewed two source manufacturing licensees that were identified as the largest manufacturers by NRC officials for their perspectives on how relevant regulations are implemented. We visited one of these manufacturers to observe how radioactive sources are manufactured and packaged and observed a level VI safety inspection for a highway route controlled quantity (HRCQ) of material. During this visit, we also met with federal and state law enforcement officials, as well as state officials responsible for securing risk-significant sources, to understand how NRC and DOT regulations are implemented at the state level.[1] We also interviewed an industry stakeholder with expertise in the measures taken by motor carriers to comply with federal regulations involving radioactive materials to understand how motor carriers in general implement radioactive material transportation requirements.

[1]We selected officials from the state in which the manufacturer was located.

While the views of these individuals provided relevant insights, they are not representative of the universe of licensee, motor carrier, or law enforcement representatives with responsibility for the security of radioactive sources during transport and therefore do not represent all views on this topic.

In addition, we analyzed information from NRC's National Source Tracking System (NSTS) and interviewed responsible agency officials to determine what information NRC collected from licensees regarding the transfer of risk-significant radioactive sources. Further, we analyzed NSTS data to determine the extent to which the federal government had information on the number of risk-significant sources transported annually and the modes by which they were transported. To assess the reliability of data from the NSTS database, we reviewed relevant documentation, including NRC Inspector General audits, and interviewed NRC officials regarding the database's development, its primary users, data entry, security, and accuracy and completeness of the data. We found the data from the NSTS to be sufficiently reliable to report on the number of risk-significant source transfers from 2013 through 2014, the 2 most recent years for which complete data were available at the time of our review.

We also obtained and analyzed data from NRC's radioactive material in quantities of concern (RAMQC) database for 2013 through 2014, the 2 most recent years for which complete data were available at the time of our review, to determine the extent to which NRC has information about the number of domestic category 1 shipments and shipments involving a licensee based in Canada, as well as shipments that are also documented as HRCQ shipments. To assess the reliability of data from the RAMQC database, we reviewed relevant documentation, interviewed NRC officials, and reviewed the data for errors. NRC officials with responsibility for the RAMQC database explained that errors in radioactivity totals, among other fields, may be introduced during manual data entry. According to these officials, while they conduct a weekly audit of information in the system, the agency is not required to maintain data in RAMQC as a historical record. As a result, we limited our analyses to only those records that NRC had clearly documented as category 1 domestic shipments and category 1 imports and exports from a licensee based in Canada. We included the Canadian NRC licensee in our analysis because it is the sole NRC licensee outside the United States and transfers to and from it to other domestic licensees are regarded as domestic transfers in NSTS. Representatives from the licensee stated that it had been an NRC licensee for several decades. We determined that data from the RAMQC database were sufficiently reliable to report on

the number of records it contained for domestic category 1 shipments and shipments involving a licensee based in Canada from 2013 through 2014. We also reviewed federal regulations and interviewed NRC and DOT officials; state law enforcement officials responsible for radioactive sources; and officials with CVSA to determine the extent to which DOT and NRC had assessed whether additional level VI safety inspections could enhance the security of shipments of risk-significant radioactive sources that would not otherwise undergo such inspections. We further reviewed a guide from the Council of State Governments to determine what additional security and safety measures states may choose to take for shipments of radioactive material.

We conducted this performance audit from April 2015 to February 2017 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: List of Additional Transportation-related Radiation Source Protection and Security Task Force Recommendations

Table 2: Transportation-related Radiation Source Protection and Security Task Force Recommendations to the Department of Transportation (DOT), Nuclear Regulatory Commission (NRC), and Other Government Entities, 2006-2014

Government Entity	Recommendation[a]	Description	Actions Taken in Response and Year Reported
DOT	2006 Action 3-2	DOT should consider using risk-significant thresholds[b] in domestic transportation regulations.	Complete (2010). DOT now requires motor carriers transporting radioactive material that meets risk-significant thresholds to have a security plan.
DOT	2006 Action 5-2	DOT should consider incorporating additional best practices into its security plan requirements high-risk radioactive material, and DOT should evaluate whether transportation of lower risk radioactive material should be subject to or exempt from some of these security plan requirements.	Complete (2010). DOT and Transportation Security Administration (TSA) assessed vulnerabilities of transporting hazardous materials through high-threat urban areas, resulting in voluntary improvements to rail systems.
NRC	2006 Action 3-1	NRC should evaluate the need to reissue the orders to the manufacturing and distribution licensees to make sure no security issues have been introduced from the use of different units of radioactivity.	Complete (2010). NRC issued an order in 2006 that amended some of the security measures imposed by a previous order to reflect that the primary values used for compliance with security requirements are in terabecquerels.
NRC	2006 Action 4-1	NRC should consider additional measures to verify the validity of NRC licenses authorized to possess risk-significant radioactive material.	Complete (2014). NRC's Part 37 regulations require licensees transferring risk-significant radioactive sources verify the validity of a license either through the NRC's License Verification System or through the license-issuing authority.
NRC	2006 Action 6-1	NRC should implement fingerprint checks for applicants for and licensees with access to risk-significant radioactive sources.	Complete (2014). NRC's Part 37 regulations provide the fingerprinting requirements for licensees with risk-significant radioactive sources.
NRC	2006 Action 6-2	NRC should evaluate the feasibility of establishing a database for materials licensees that includes pending applications and information on individuals cleared for unescorted access.	Complete (2014). NRC established the Web Based Licensing system to manage licensing process and application information. NRC determined that establishing a database to contain information on individuals cleared for unescorted access was not feasible.

Government Entity	Recommendation[a]	Description	Actions Taken in Response and Year Reported
NRC	2006 Action 11-3	The Task Force suggests that a comprehensive analysis be conducted on the inclusion of category 3 sources in the National Source Tracking System (NSTS).	Complete (2010). In 2008, NRC issued a proposed rule to include category 3 sources in NSTS. Following public comments, NRC decided to not publish a final rule.
NRC	2014 Recommendation 2	NRC should evaluate the need for sealed source licensees to address the eventual disposition/disposal costs of risk-significant radioactive sources through source disposition/disposal financial planning or other mechanisms. Disposition costs should include the cost of packaging, transport, and disposal (when available) of these sources.	N/A.
Multiple Agencies and States	2006 Recommendation 4-2	Agencies and States improve coordination and communication of ongoing activities related to radiation protection and security for risk-significant sources.	Complete (2014). The Task Force found significant improvement was made in Federal, State, Tribal, and stakeholder communication and cooperation. Groups and forums continue to meet to address policy and programmatic issues.
Multiple Agencies	2006 Recommendation 5-1	Agencies develop a memorandum of understanding (MOU) to serve as a foundation for a transport security program for risk-significant sources.	Ongoing (2014).[c]
Multiple Agencies	2006 Action 5-1	Agencies determine if “high hazard” hazardous materials transport security measures should be applied to transport of risk-significant radioactive sources.	Complete (2014). NRC’s Part 37 regulations provide security requirements for licensees who transport risk-significant radioactive sources.
Multiple Agencies	2006 Action 6-3	The NRC and the Department of Homeland Security (DHS) should enter into a MOU to cover access to the Systematic Alien Verification for Entitlements (SAVE) database for materials licensees.	Complete (2010). DHS and NRC signed a MOU in 2003 and amended it in 2008 to allow NRC materials licensees with a vehicle to access the SAVE database.
Multiple Agencies	2006 Action 11-1	The Task Force encourages the National Source Tracking System (NSTS) Interagency Coordinating Committee to develop a procedure/policy with guidelines on how to handle both government and non-government requests for information in the NSTS.	Complete (2010). A procedure for handling government and non-government requests was developed.

Government Entity	Recommendation[a]	Description	Actions Taken in Response and Year Reported
Multiple Agencies	2010 Recommendation 1	U.S. Government agencies should use radionuclides and associated category 2 threshold quantities as the framework for considering which sources warrant enhanced security and adopt the definitions for significant Radiological Exposure Device (RED) and Radiological Dispersal Device (RDD) for prioritizing and allocating resources to eliminate, control, or mitigate risks of malevolent radiological incidents.	Complete (2014). While NRC does not use definitions of a significant RED or RDD in its regulatory policies, NRC policy uses the category 1 and 2 radionuclides and threshold quantities in security orders and in NRC's Part 37 regulations, among others. Among other agencies' actions, the Department of State reported that they will urge other countries to establish and maintain controls for risk significant radionuclides in bilateral and multilateral meetings.
Multiple Agencies	2010 Recommendation 2	U.S. Government agencies should reevaluate protection and mitigation strategies to protect against significant RED and RDD attacks considering consequences to public health, safety and the environment. Agencies should use the Task Force-endorsed definitions, radionuclides, and thresholds for a significant RED and RDD and other associated information in the assessment of risk and management of homeland security activities.	Ongoing (2014).
U.S. Government	2006 Recommendation 3-1	The U.S. Government should periodically reevaluate list of radioactive sources that warrant enhanced security and protection.	Complete (2014). List was reevaluated by the Task Force in 2009 and 2012. Future reevaluations are to be performed as directed by the Task Force.
U.S. Government	2006 Recommendation 5-2	U.S. Government should evaluate the feasibility of using new and existing technologies, such as tracking technologies, to detect and discourage theft of risk-significant radioactive materials during transport.	Complete (2014). Multiple agencies completed evaluations, and the National Nuclear Security Administration (NNSA) is continuing to work with device manufacturers.
U.S. Government	2006 Recommendation 5-3	The U.S. Government should develop a strategy and take actions to address the security of international shipments of risk-significant radioactive sources that transit or are transshipped through the land territory of the United States.	Complete (2014). Customs and Border Protection (CBP) and TSA addressed transshipment issues in several meetings in 2013. But the Task Force proposed that the DOT and CBP address security requirements of transshipments, such as adopting requirements similar to the NRC's Part 37 regulations.
U.S. Government	2010 Recommendation 8	The U.S. Government should enhance support for research and development of certain types of shipping containers for source recovery efforts.	Ongoing (2014).

Source: GAO analysis of Radiation Source Protection and Security Task Force information. | GAO-17-58

[a]The 2006 report included both recommendations and action items. However, starting with the 2010 report, the task force began referring to all actions to be taken as recommendations. As such, we refer to the 2006 action items as recommendations.

[b]The term risk-significant radioactive sources refers to radioactive sources individually or in aggregated quantities that meet or exceed category 1 and 2 thresholds, as defined by the International Atomic Energy Agency's (IAEA) *Code of Conduct on the Safety and Security of Radioactive Sources*.

[c]The participating agencies had all signed the MOU as of January 2015.

Appendix III: Comments from NRC

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

January 13, 2017

Shelby S. Oakley, Acting Director
Natural Resources and Environment
U.S. Government Accountability Office
Room 2T23
441 G Street, N.W.
Washington, DC 20548

Dear Mr. Oakley:

Thank you for the opportunity to review and comment on the draft of the U.S. Government Accountability Office (GAO) Report - Radioactive Sources: Opportunities Exist for Federal Agencies to Strengthen Transportation Security (GAO-17-58). The U.S. Nuclear Regulatory Commission (NRC) staff is in general agreement with the overall content of the draft audit report. However, the NRC staff disagrees with the first recommendation as well as the wording of a related passage in the body of the draft report. Otherwise, the NRC staff agrees with the second recommendation and is not opposed to the third recommendation. NRC's specific concerns are summarized below and detailed in the enclosed comments.

The NRC staff disagrees with the draft report's first recommendation that collecting additional information in the NRC's National Source Tracking System (NSTS) on the number of shipments and mode of transport would improve the awareness of how risk-significant radioactive sources are transported within the United States and better determine whether the NRC is meeting its goal of providing reasonable assurance for preventing the theft or diversion of these dangerous materials. Following the terrorist attacks of September 11, 2001, the NRC took steps to strengthen the security of risk-significant radioactive materials, including addressing the potential vulnerabilities associated with the use and transport of these materials. The NRC implemented a number of measures in coordination with Federal and State agencies to ensure adequate protection of radioactive sources. The NSTS is only one of those measures. NSTS provides an accounting function for Category 1 and 2 sources following their manufacture, transfer, receipt, disassembly, or disposal. The NSTS, along with the rest of the NRC and the U.S. Department of Transportation (DOT) regulatory framework, provide reasonable assurance of the safety and security of radioactive material in transit. Therefore, the NRC staff does not believe that adopting this recommendation would result in improvements in safety or security. The enclosed NRC comments provide additional details.

On a related note, the NRC staff disagrees with the following statement in the draft report on pages 34 and 35:

> Not having information on all shipments of risk-significant sources or the mode by which they were transported could, in certain situations, complicate NRC's efforts to secure risk-significant sources and thereby inhibit the agency's ability to meet its objective of providing reasonable assurance of preventing their theft or diversion.

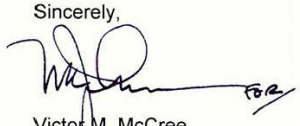
NRC licensees possessing an aggregated Category 1 or Category 2 quantity of radioactive material are required to comply with NRC's Title 10 of the *Code of Federal Regulations* (10 CFR) Part 37. The NRC verifies licensee compliance with requirements through its oversight program. This enables the NRC to meet its objective of providing reasonable assurance of safety and security of radioactive materials consistent with its mission. The NRC believes that the specific situation cited by GAO in support of this statement is not an issue that is solved by collecting post-shipment information, but is instead best addressed by appropriate coordination between the NRC and DOT, as indicated by GAO's second recommendation, with which we agree. Therefore, the NRC suggests that GAO consider deleting or editing this statement. Additional details are provided in the enclosure.

As mentioned above, the NRC agrees with the report's second recommendation that the NRC should, working in consultation with the U.S. Department of Homeland Security and with the DOT, identify an approach to verify that motor carriers are meeting Part 37 security requirements applicable to transportation.

Recognizing that highway route controlled quantities (HRCQ) thresholds are within DOT's jurisdiction, NRC is willing to explore with DOT staff the draft report's third recommendation that the NRC should consider examining the potential costs and security benefits associated with lowering the HRCQ threshold such that more or all Category 1 shipments are classified as HRCQ shipments.

If you have any questions regarding the NRC's response, please contact John R. Jolicoeur by phone at 301-415-1642 or by email at John.Jolicoeur@nrc.gov.

Sincerely,



Victor M. McCree
Executive Director
for Operations

Enclosure:
As stated

U.S. Nuclear Regulatory Commission Comments on (GAO-17-58), "Radioactive Sources: Opportunities Exist for Federal Agencies to Strengthen Transportation Security"

The U.S. Nuclear Regulatory Commission (NRC) staff's comments on the draft report, for the Government Accountability Office's (GAO's) consideration, are as follows:

A. Significant issues:

The draft report included three recommendations. The NRC staff disagrees with the first recommendation, agrees with the second recommendation, and is not opposed to the third recommendation. Because the NRC staff has no significant issues with the second or third recommendation, they are not discussed in this section.

This section provides comments on the first recommendation, which stated:

> *1. To improve the awareness of how risk-significant active sources are transported within the United States and to better determine whether it is meeting its goal of providing reasonable assurance for preventing the theft or diversion of these dangerous materials, we recommend that the Chairman of the Nuclear Regulatory Commission take actions to collect information from licensees on the number of shipments and mode of transport for such sources for inclusion in NRC's [National Source Tracking System] NSTS.*

Based on their assessment last year of the effectiveness of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 37, the NRC staff is confident that the security requirements in this regulation provide reasonable assurance of adequate protection of this material. Therefore, we disagree with this recommendation. Following the terrorist attacks of September 11, 2001, the NRC took steps to strengthen the security of risk-significant radioactive materials, including addressing the potential vulnerabilities associated with the use and transport of these materials. The NRC implemented a number of measures in coordination with Federal and State agencies to ensure adequate protection of radioactive sources. The NSTS is just one of those measures. NSTS provides an accounting function for Category 1 and 2 sources with respect to their manufacture, transfer, receipt, disassembly, or disposal. To provide background for the basis of the NRC staff's disagreement, the following framework for transactions and shipments involving Category 1 and 2 sources is provided:

1

- Accounting for the number of shipments and mode of transport (road, rail, etc.) for Category 1 and 2 source transfers in NSTS would not provide any information that could be used to prevent the theft or diversion of Category 1 and 2 materials.

2

- Licensees are required to report some source shipment information in NSTS for Category 1 and 2 source transfers, including the shipping date and estimated date of arrival. For waste shipments, the waste manifest number and the container identification must be recorded in NSTS. The reporting of this information is all done post-shipment.

Enclosure

3

- Due to the sensitivity of the information, NSTS is not the appropriate system to track the mode of transport and shipment information for transfers of Category 1 and 2 sources, nor was it designed to track such information. If this information were to be tracked in NSTS, a new security categorization evaluation would need to be performed, and it is likely that the results would necessitate designation of a higher security categorization for the system. This would result in challenges in a number of areas, such as measures needed to provide licensees with access to the system.

4

- The NRC established the requirements for the NSTS through a notice and comment rulemaking and in close coordination with other Federal and State agencies involved with the safety and security of radiation sources and transportation of hazardous materials. The rulemaking process considered a broad range of comments and suggestions (71 FR 65686; November 8, 2006). Imposing a requirement for licensees to provide information in the NSTS on the mode of transport and shipment information for each source would require rulemaking. Such a rule is not likely to result in significant improvements in safety or security that would form a basis to justify a rulemaking and the additional reporting and recordkeeping burden.

5

- As required by 10 CFR20.2207, licensees must report transactions involving Category 1 and 2 sources no later than the close of business the day after a source transaction occurs. Transactions include the manufacture, transfer, receipt, disassembly, or disposal of sources.

6

- In accordance with 10 CFR 37.77, licensees must provide advance notification of shipments containing a Category 1 quantity of material to the NRC (and the governor of any State through which the transport travels). This report must include information related to the material being transported, shipper and receiver, and anticipated departure and arrival times. The report must also provide a point of contact for obtaining current information on the shipment.

7

8

- The "RAMQC" database is maintained by NRC to track advance notifications of Category 1 shipments.
- The RAMQC database is not accessible by licensees or other outside entities. NRC provides reports from the RAMQC database to other Federal agencies, as appropriate (e.g., Customs and Border Protection) to assist them in verifying the secure, legitimate transport of hazardous materials in the United States.

9

- NRC has Memorandums of Understanding (MOUs) with the Department of Homeland Security and the Department of Transportation to ensure appropriate regulatory oversight of radioactive material shipments.

10

- The NRC currently requires licensees to comply with specific security measures under 10 CFR 37.79 for shipments by road or rail. For example:

11

- For Category 1 shipments by road: Licensees or carriers must use movement control centers to maintain position information from a remote location, establish redundant communications that allow the transport to contact the escort vehicle

(when used), and movement control center at all times; use telemetric positioning systems to continuously monitor shipments; provide a second individual to accompany the driver for "long drive time" shipments; and have procedures for normal and contingency situations (including responding to actual or attempted theft or diversion of a shipment).

12

- For Category 2 shipments by road: Licensees must maintain constant control and/or surveillance during transit and have the capability for immediate communication to summon appropriate response or assistance. Alternately, licensees may use carriers with established package tracking systems that maintain constant control/surveillance during transit and have the capability to summon local law enforcement agencies.

The NRC staff also suggests that using the term "radioactive sources" instead of "active sources" in the first sentence of this recommendation may make the intent of the statement more clear

13

In addition, NRC staff disagrees with the following statement included in the draft report on pages 34 and 35:

> *Not having information on all shipments of risk-significant sources or the mode by which they were transported could, in certain situations, complicate NRC's efforts to secure risk-significant sources and thereby inhibit the agency's ability to meet its objective of providing reasonable assurance of preventing their theft or diversion.*

NRC licensees possessing an aggregated Category 1 or Category 2 quantity of radioactive material are required to comply with Part 37. The NRC verifies licensee compliance with requirements through its oversight program. This enables the NRC to meet its objective of providing reasonable assurance of safety and security of radioactive materials consistent with its mission. The NRC staff believes that the specific situation cited by GAO in support of this statement is not an issue that is solved by collecting post-shipment information, but is instead best addressed by ensuring compliance with existing regulations through appropriate coordination between the NRC and DOT. Therefore, the NRC suggests that GAO consider deleting or editing this statement

The NRC staff is confident that the security requirements in 10 CFR Part 37 are adequate to protect against theft, sabotage, or diversion. We do not believe that adopting this recommendation would result in significant improvements in safety and security. This conclusion is supported by the NRC staff's recent assessment, which concluded that the regulation is effective in achieving its objective of "providing reasonable assurance of the security of Category 1 or 2 quantities of radioactive material by protecting these materials from theft or diversion."

Appendix IV: Comments from DOT

U.S. Department of Transportation
Office of the Secretary of Transportation

Assistant Secretary for Administration

1200 New Jersey Avenue, SE
Washington, DC 20590

JAN 13 2017

Shelby S. Oakley
Acting Director, Natural Resources and Energy Issues
U.S. Government Accountability Office
441 G Street NW
Washington, DC 20548

The Department of Transportation (DOT) is charged with the responsibility to protect America against the risks to life, property, and the environment that are inherent in the transportation of hazardous materials, and we are committed to ensuring the safe and secure transportation of radioactive sources by highway. Both the Federal Motor Carrier Safety Administration (FMCSA) and the Pipeline and Hazardous Materials Safety Administration (PHMSA) have implemented regulations to mitigate the security risks associated with the transportation of these materials.

Most recently, DOT, working with the Nuclear Regulatory Commission (NRC) in a joint effort to improve the security of radioactive sources in transportation, implemented an interagency Memorandum of Understanding (MOU) addressing Cooperation on Radioactive Materials Security. The MOU establishes a framework for allowing DOT and NRC to coordinate, to the extent practicable, their respective responsibilities and activities relating to the secure transportation of radioactive materials. Through this coordination, DOT and NRC strive to achieve goals, including: enhancing collaborative exchanges; leveraging mutual interests; reducing the duplication of efforts in areas of shared interests; and promoting the standardization of approach and policy on the transportation security of radioactive materials.

Upon review of the draft report, we note the two recommendations affecting DOT generally align with the goals of our ongoing coordination with the NRC. We concur with the recommendation to consider examining the potential costs and security benefits associated with lowering the Highway Route Controlled Quantity (HRCQ) threshold such that more or all category 1 shipments are classified as HRCQ shipments. However, we do not fully concur with the recommendation that DOT identify an approach to verify that motor carriers are meeting NRC Part 37 security requirements. While we agree conceptually with the intent of the recommendation, DOT notes that it has no authority to address part 37 requirements. Nevertheless, DOT and NRC, in consultation with the Department of Homeland Security, are exploring ways to achieve the stated goal by working together to "consider an approach to verify that motor carriers are meeting NRC's Part 37 security inspection requirements applicable to transportation." We encourage GAO to revise the second recommendation to accurately reflect DOT's lack of authority with respect to Part 37 security requirements.

The Department will provide a detailed response to the recommendations within 60 days of the final report's issuance. We appreciate the opportunity to respond to the GAO draft report. Please contact Madeline M. Chulumovich, Director, Office of Audit Relations and Program Improvement at (202) 366-6512 with any questions or if you would like to obtain additional details.

Sincerely,

Jeff Marootian
Assistant Secretary for Administration

Appendix V: GAO Contact and Staff Acknowledgments

GAO Contact

Shelby S. Oakley, (202) 512-3841 or oakleys@gao.gov.

Staff Acknowledgments

In addition to the individual named above, Daniel Feehan (Assistant Director), Richard Burkard, Kendall Childers, Wesley Collins, Julia Coulter, John Delicath, Chris Ferencik, Cindy Gilbert, Brandon Haller, Mitch Karpman, Dan Royer, Zachary Sivo, Amy Suntoke, Kiki Theodoropoulos, and Sarah Veale made significant contributions to this report.