PREVENTING A DIRTY BOMB

Nuclear Regulatory Commission Has Not Taken Steps to Address Certain Radiological Security Risks

Report to Congressional Requesters

September 2024
GAO-24-107014
United States Government Accountability Office

Accessible Version

GAO Highlights

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Highlights of GAO-24-107014, a report to congressional requesters
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Why GAO Did This Study

Terrorists' ability to obtain radioactive materials for use in a radiological dispersal device—also known as a dirty bomb—has been of particular concern for federal agencies since the attacks of September 11, 2001. Such a device could cause significant socioeconomic damage, including long-term economic lockout of the affected area. Among federal agencies, NRC, NNSA, CWMD, and CBP play key roles supporting U.S. domestic radiological security.

GAO was asked to review federal government efforts to protect the homeland against dirty bombs. This report examines (1) how key federal agencies' views of risk inform their security activities, and (2) the extent to which the agencies have taken actions GAO has recommended to protect against a dirty bomb. GAO reviewed NRC, NNSA, CWMD, and CBP documentation and interviewed agency officials about how these agencies' views of risk inform their efforts, and about progress made addressing GAO's recommendations to date.

What GAO Recommends

Congress should consider directing NRC to (1) incorporate socioeconomic consequences into relevant decision-making and regulations, and (2) require that all category 3 radioactive materials and licenses be centrally tracked and all category 3 licenses be subject to stronger verification measures. NRC neither agreed nor disagreed with GAO's report. GAO maintains that actions are needed.

What GAO Found

Agencies whose missions include radiological security share generally similar assessments of radiological threats and vulnerabilities. But these agencies differ in the extent to which they consider socioeconomic consequences (e.g., denial of access to property, economic loss, and cleanup costs) in their assessment of risk, affecting their security activities. Specifically, the National Nuclear Security Administration (NNSA) and the Department of Homeland Security's Countering Weapons of Mass Destruction Office (CWMD) pursue security activities based on a view of risk that includes primary consideration of the significant socioeconomic damage a dirty bomb can cause. The Nuclear Regulatory Commission (NRC) does not do so. Instead, it considers certain fatalities and health effects as the consequences of concern for the purposes of establishing its regulations. These differing focuses with regard to the consequences of a dirty bomb have resulted in NNSA and CWMD designing programs to secure radioactive materials that NRC regulations leave vulnerable.

The Three Elements of Radioactive Material Risk

Source: GAO analysis of Department of Homeland Security information. | GAO-24-107014

Accessible Data for The Three Elements of Radioactive Material Risk

Risk

- Threat: Threats are entities or actions with the potential to cause harm–including terrorist attacks.
- Vulnerability: Vulnerabilities are physical features or operational attributes that render an asset open to exploitation, including gates, perimeter fences, and computer networks.
- Consequence: Consequence is the effect of occurrences like terrorist attacks or natural disasters resulting in losses that impact areas such as public health and safety and the economy.

Source: GAO analysis of Department of Homeland Security information. I GAO-24-107014

NNSA, CWMD, and U.S. Customs and Border Protection (CBP) have implemented almost all of the actions GAO has recommended to reduce the risk of a dirty bomb. By contrast, NRC has not implemented the majority (11 of 18) of GAO's recommendations made between 2012 and 2024. Specifically, NRC has not taken actions to incorporate consideration of socioeconomic consequences into its regulations. It also has not strengthened the security of certain radioactive materials not subject to NRC's enhanced security requirements ("category 3" materials), such as by centrally tracking category 3 sources and licenses. In June 2024, NRC confirmed that nearly all action to implement these recommendations had ceased subsequent to a Commission vote not to proceed with a draft rule that would have addressed certain recommendations to better secure category 3 materials.

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Abbreviations

CBP	U.S. Customs and Border Protection
CBRN	Chemical, Biological, Radiological, and Nuclear
CIRP	Cesium Irradiator Replacement Project
CWMD	Countering Weapons of Mass Destruction Office
DHS	Department of Homeland Security
IAEA	International Atomic Energy Agency
LVS	License Verification System
NNSA	National Nuclear Security Administration
NRC	U.S. Nuclear Regulatory Commission
NSTS	National Source Tracking System
WBL	Web-based Licensing System

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September 30, 2024

The Honorable Bennie G. Thompson
Ranking Member
Committee on Homeland Security
House of Representatives

The Honorable Ritchie Torres
House of Representatives

Terrorists' ability to obtain radioactive materials for use in a radiological dispersal device—also known as a dirty bomb—has been of particular concern for federal agencies since the attacks of September 11, 2001. In March 2023, the President stated that one of the administration's most enduring national security priorities is protecting the nation from radiological weapons.[1] Radioactive materials are commonly used throughout the U.S. for medical and industrial purposes such as treating cancer, sterilizing medical instruments, and detecting flaws in metal welds. But in the hands of terrorists, even a small amount of these materials could be used to construct a dirty bomb. Beyond the harm caused by any explosives, a dirty bomb detonation or other dispersal of radioactive material would likely result in significant socioeconomic harm from public panic, decontamination costs, and exclusion of the public from the area for extended periods.

Recent security threats have raised concern that terrorists or other bad actors could target radioactive material for theft and use in a domestic attack. From 2013 through 2023, the U.S. Nuclear Regulatory Commission (NRC) reported 4,356 nuclear materials events, which include instances of lost or stolen radioactive materials. In addition, from 1993 to 2023, the International Atomic Energy Agency reported 4,243 illegal or unauthorized activities and events worldwide involving nuclear and radioactive material, including incidents of trafficking and malicious use. According to documentation provided by the Department of Homeland Security (DHS) Countering Weapons of Mass Destruction Office (CWMD), the Federal Bureau of Investigation (FBI) has conducted several investigations involving radioactive materials since 2013.

We have reviewed federal radiological security efforts for over 20 years. Our work has centered on the regulatory and licensing efforts of NRC, the security enhancement efforts of the National Nuclear Security Administration (NNSA), and DHS's detection and risk assessment efforts within CWMD (as well as one of its predecessor offices, the Domestic Nuclear Detection Office[2]) and U.S. Customs and Border Protection (CBP). We have also conducted multiple covert investigations for which we developed fake licenses and businesses through which we purchased (or secured commitments from a distributor to sell us) radioactive materials. Over

[1]The White House, "FACT SHEET: President Biden Signs National Security Memorandum to Counter Weapons of Mass Destruction Terrorism and Advance Nuclear and Radioactive Material Security" (Mar. 2, 2023).

[2]CWMD carries out functions that had previously been carried out by DHS's former Domestic Nuclear Detection Office, Office of Health Affairs, and other DHS elements.

roughly the last decade, we have made a total of 40 recommendations to these agencies to address shortcomings in radioactive material security that our reviews and investigations have exposed.[3]

This report serves as a capstone on the last decade of our work on radioactive material security. You asked us to review how the federal government is protecting the homeland against the use of dirty bombs. This report examines (1) how key federal agencies' views of risk inform their efforts to protect the homeland from a dirty bomb, and (2) the extent to which key federal agencies have taken actions we have recommended to protect against a dirty bomb.

For this report, we identified NRC, NNSA, and DHS's CWMD and CBP as key agencies because these agencies have roles in regulating or promoting the security of radioactive materials and have been the primary focus of our prior radiological security work. To report on how these agencies' views of risk inform their efforts to protect the homeland from a dirty bomb, we interviewed officials at NRC, NNSA, and CWMD about their efforts to provide or promote security of radioactive materials, including how these agencies' assessments of radiological risk—including threats, vulnerabilities, and consequences, including socioeconomic consequences[4]—inform such efforts.[5] To further understand how agencies assess risk, we reviewed agency documentation, including risk assessment documentation from late 2023, threat reports to Congress for fiscal years 2022 through 2024, and annual radiological incident reports from NRC from fiscal years 2014 through 2023. We also reviewed a 2021 study by the National Academies of Sciences, Engineering, and Medicine and a 2019 study by Sandia National Laboratories, which assessed the likely socioeconomic consequences of a dirty bomb.[6] We also reviewed NRC's estimated costs to centrally track certain radioactive sources and materials licenses and obtained information from NNSA, CWMD, and CBP about these agencies' expenditures related to radioactive material security.[7] We assessed the reliability of this expenditure data by interviewing officials regarding the agencies' data systems and measures agencies have taken to ensure the reliability of the data. Based on these steps, we determined that the expenditure information agencies provided was sufficiently reliable for our purposes.

To report on the extent to which the key federal agencies have taken actions we have recommended, we identified reports and associated recommendations that we have issued since 2012 and that pertained primarily to radioactive material security. We chose 2012 because this was the year we issued our first report

[3]Of the 40 recommendations we made to NRC, NNSA, and DHS (including CBP and CWMD), we consider 28 to be closed as implemented, two to be closed as unimplemented, and 10 to remain open. We provide details about these recommendations and agencies' actions to implement them later in this report and in appendix I.

[4]Socioeconomic consequences refer to the evacuation, cleanup, and possible social and economic lockout of contaminated areas following a radiological disaster (such as a dirty bomb). Individuals with homes and businesses in those areas may not be able to return for an extended period because of actual or feared contamination.

[5]While CBP is one of the key agencies discussed further in this report, CBP does not conduct risk assessments, according to CBP officials. According to CWMD officials, CWMD plays a leading role in conducting risk assessments to inform DHS radiological security efforts. Within NNSA, the office on which our domestic radiological security work has been focused is the Office of Radiological Security. We have also issued one recommendation to NNSA's Office of Nuclear Smuggling Detection and Deterrence, which works abroad with partner countries to provide radiation detection equipment and support in their radiation detection efforts. See GAO, *Combating Nuclear Smuggling: NNSA's Detection and Deterrence Program Is Addressing Challenges but Should Improve Its Program Plan*, GAO-16-460 (Washington, D.C.: June 17, 2016).

[6]National Academies of Sciences, Engineering, and Medicine. 2021. *Radioactive Sources: Applications and Alternative Technologies*. Washington, DC: The National Academies Press. https://doi.org/10.17226/26121. Sandia's 2019 study is not public.

[7]Radioactive sources are radioactive materials sealed in a capsule or permanently bonded in solid form for use in various devices.

evaluating the increased security requirements that NRC implemented after September 11, 2001, and because we determined this time frame would reasonably capture issues that remain relevant to agencies' radiological security work today. Using this method, we identified 13 relevant reports and 40 associated recommendations (see app. 1). We obtained and summarized documentation on agencies' actions to implement the recommendations, and we interviewed agency officials to update information as needed.

We conducted this performance audit from August 2023 to September 2024 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

While other federal agencies also play a role in radioactive material security, NRC, NNSA, CWMD, and CBP have key roles providing the security architecture intended to prevent radioactive materials from falling out of regulatory control or being smuggled into the country.[8]

The Role of NRC

NRC is responsible for licensing the commercial possession and use of radioactive materials and regulating the security of such materials in the U.S. NRC has direct responsibility for licensing and regulation in 11 U.S. states, the District of Columbia, and three territories; the remaining 39 states have entered into agreements with NRC to assume this authority. NRC refers to these as agreement states.[9]

NRC requirements previously focused on safety and preventing inadvertent or accidental exposure of workers and the public to radioactive materials. These requirements included general provisions relating to the security of these materials. Following the attacks of September 11, 2001, NRC issued orders that directed certain radioactive materials licensees—such as medical and industrial entities—to implement increased security measures, such as for physical security and access control.[10] On March 19, 2013, NRC finalized a rule—Part 37 of Title 10 of the Code of Federal Regulations, or "Part 37"—that brought these orders together into one set of requirements.

[8]Other federal agencies include, for example, the FBI—which enforces statutes aimed at preventing criminal and terrorist activity involving nuclear and radioactive material, and supports collaborative exercises that test response capabilities to incidents involving radioactive materials—and the Environmental Protection Agency—which, in the event of an emergency involving radioactive material, works with federal, state, and local agencies to monitor radioactivity and clean up affected areas.

[9]The Atomic Energy Act of 1954 authorizes NRC to enter into agreements with states (called agreement states) so they assume, and NRC discontinues, regulatory authority over specified radioactive materials. NRC must find that a state's program is compatible with NRC's program for regulating such materials, as well as adequate to protect public health and safety, before entering into these agreements. NRC also retains authority for the protection of common defense and security. Agreement states do not operate power plants, regulate exports or imports of materials, or undertake certain disposal activities. 42 U.S.C. § 2021.

[10]NRC issued these orders under Section 161 of the Atomic Energy Act of 1954. Section 161 authorizes NRC to issue rules, regulations, and orders to promote the common defense and security or to protect health or to minimize danger to life or property.

NRC security requirements at Part 37 apply to 16 radionuclides of concern that, if gathered in sufficient quantities (called category 1 or 2 quantities), pose the highest risk of causing injury and thus warrant enhanced security and protection.[11] These requirements include, for example, that individuals with unescorted access to category 1 and 2 materials undergo a background investigation to establish their trustworthiness and reliability,[12] and that licensees possess the capability to continuously monitor and detect unauthorized entry into security zones where category 1 and 2 materials are stored.[13] Part 37's requirements do not apply to smaller quantities of materials, known as categories 3 through 5. Such quantities of materials are subject to health and safety requirements, including the requirement to secure such materials from unauthorized removal or access and to control and maintain constant surveillance of the material when it is not in storage.[14]

NRC requirements for tracking radioactive sources and verifying licenses when such sources are sold or transferred also differ depending on whether the sources contain less than a category 2 quantity of material. For example, NRC requires the use of the National Source Tracking System (NSTS) to track transfers of category 1 and 2 radioactive sources only. NSTS contains information on each major step the sources take in their lifecycle, including manufacture, shipment, arrival, disassembly, and disposal.[15] NRC does not require the use of NSTS to track transfers of category 3 through 5 sources. NRC and agreement states also retain all category 1 and 2 specific licenses in the Web-based Licensing System (WBL). According to NRC, 13 of the 39 agreement states retain licenses for category 3 through 5 quantities of materials in WBL as well. Finally, the License Verification System (LVS) is a system that draws upon NSTS and WBL to allow vendors and other would-be transferors to verify licenses. NRC requires the use of LVS or direct contact with NRC or agreement state regulators to verify category 1 and 2 licenses. NRC does not specifically require vendors to use LVS or directly contact regulatory authorities to verify category 3 through 5 licenses.[16]

[11]A category 1 quantity of a given radionuclide, the most dangerous, is defined as an amount 1,000 times or more than the amount necessary to cause permanent human injury. A category 2 quantity is defined as an amount at least 10 times but less than 1,000 times the amount necessary to cause permanent human injury.

[12]10 C.F.R. §§ 37.25(a), .21(b).

[13]10 C.F.R. § 37.49(a)(1).

[14]10 C.F.R. §§ 20.1801, .1802. A category 3 quantity of a given radionuclide is defined as at least the minimum amount, but less than 10 times the amount, sufficient to cause permanent injury. Category 4 and 5 quantities of radioactive materials are unlikely to cause permanent injury.

[15]Specifically, licensees must report to NSTS information on manufacture, transfer, receipt, disassembly, and disposal of sources. NSTS does not track these activities in real time; licensees must submit information to NSTS by the close of the next business day after the activity occurs. 10 C.F.R. §§ 20.1003 and 20.2207.

[16]Vendors and other would-be transferors must choose one of several methods to assure themselves that the purchaser has a license to acquire the sought category 3 or below radioactive materials. Obtaining a copy of the transferee's license and verifying the license directly with the appropriate regulatory body are two options. Other acceptable options include obtaining (1) a written certification that the transferee is authorized to receive the transfer, (2) oral certification that the transferee is authorized to receive the transfer for emergency shipments, or (3) information compiled by a reporting service from official records of the appropriate regulatory body. Only when none of these methods are available, or when a transferor desires to verify that information received by one such method is correct or up to date, is the transferor instructed to seek verification from the appropriate regulatory body itself. In December 2022, NRC staff submitted a draft rule to the Commission that would have mandated regulators and vendors specifically use LVS or contact regulatory authorities to verify category 3 licenses; however, the Commission did not reach consensus on the draft rule, and it therefore will not be promulgated. Additional details on the draft rule are provided later in this report.

The Role of NNSA

NNSA works domestically with local governments, law enforcement, and private businesses to provide security enhancements, replace certain radioisotopic devices with alternatives, and eliminate high-risk radioactive materials that could be used in a dirty bomb. NNSA's programs are voluntary. For example, its Domestic Material Protection program assesses users' existing security conditions and can provide financial assistance for security enhancements, such as motion sensors, alarms, and device hardening. The Cesium Irradiator Replacement Project helps subsidize costs for users—generally hospitals and universities—wishing to replace their cesium-based blood or research irradiators, and occasionally cobalt-based irradiators, with a non-radioisotopic alternative.[17]

The Roles of CWMD and CBP

CWMD manages efforts to enhance the United States' ability to detect, deter, and defend against chemical, biological, radiological, and nuclear threats. These efforts currently include, among others, (a) assessing radiological risk and threats to the homeland; (b) managing the Securing the Cities program, which DHS instituted in fiscal year 2007 to enhance the nuclear and radiological detection capabilities of state, local, tribal, and territorial agencies; and (c) developing, acquiring, and supporting radiation detection technologies for use by DHS components with radiological security missions, such as CBP and the U.S. Coast Guard. Such technologies include radiation portal monitors at land and sea ports of entry and mobile radiation detection equipment for first responders.[18]

CBP is responsible for securing the U.S. border against dangerous goods, among other things. To detect and interdict illicit nuclear and radiological materials, CBP uses radiation portal monitors to scan incoming cargo and vehicles to detect elevated radiation levels. CBP also verifies the legitimacy of NRC and agreement state licenses associated with international shipments of all categories of radioactive material.

[17]Blood irradiation refers to a widely used process whereby donor blood is exposed to radiation, which inactivates a type of white blood cell that may fatally complicate transfusion for some recipients. Cesium-137 is the most commonly used radioactive isotope for blood irradiation. The fiscal year 2019 National Defense Authorization Act established the goal for NNSA to eliminate the use of cesium-based blood irradiators in the U.S. by 2027 and authorized NNSA to subsidize the costs of removing such irradiators and replacing them with alternatives. John S. McCain National Defense Authorization Act for Fiscal Year 2019, Pub. L. No. 115–232, § 3141, 132 Stat. 1636, 2303 (2018). As we reported in 2021, while NNSA remains focused on cesium-based irradiations, the agency will on occasion remove cobalt-based irradiators when it facilitates risk elimination (see GAO, *Alternatives To Radioactive Materials: A National Strategy to Support Alternative Technologies May Reduce Risks of a Dirty Bomb*, GAO-22-104113 (Washington, D.C.: Oct. 21, 2024).

[18]A radiation portal monitor is a piece of equipment used to scan incoming cargo and vehicles for elevated radiation levels that may be indicative of smuggled nuclear or radiological materials.

Risk of a Dirty Bomb and Potential Fiscal Exposure

We reported in 2019 that the risk of a dirty bomb is determined by the function of three components: threat, vulnerability, and consequence (see fig. 1).[19] Threat is generally defined as entities or actions with the potential to cause harm—including terrorist attacks. Vulnerability includes physical features or operational attributes that render an asset open to exploitation, including gaps in security measures such as gates, locks, perimeter fences, and computer networks. The third component of risk, consequence, includes losses to public health and safety, as well as significant socioeconomic consequences that could result from public panic, decontamination costs, and the denial of access to affected infrastructure and property for extended periods of time. As we reported in 2019, the socioeconomic consequences of a dirty bomb could be catastrophic. We have also reported that such catastrophic losses represent an implicit fiscal exposure for the federal government, as the government might be expected to address the costs of such losses due to limited insurance coverage for such events.[20] Taken together, the three components make up the full scope of dirty bomb risk.

[19]GAO, *Combating Nuclear Terrorism: NRC Needs to Take Additional Actions to Ensure the Security of High-Risk Radioactive Material*, GAO-19-468 (Washington, D.C.: Apr. 4, 2019).

[20]GAO-22-104113. We have reported the extent of nuclear, biological, chemical, or radiological (NBCR) coverage as part of our ongoing reporting on Treasury's Terrorism Risk Insurance Program, under which the government and insurers share losses in the event of certain acts of terrorism. In 2008, we found that commercial property and casualty insurers and reinsurers generally seek to exclude coverage for NBCR risks or place significant restrictions on such coverage because of uncertainties about the risk and the potential for catastrophic losses. Treasury officials and stakeholders we interviewed for a follow-on report in 2020 agreed that primary and reinsurance coverage for NBCR events is limited, resulting in many businesses having limited or no coverage. See GAO, *Terrorism Insurance: Status of Coverage Availability for Attacks Involving Nuclear, Biological, Chemical, or Radiological Weapons*, GAO-09-39 (Washington, D.C.: Dec. 12, 2008); and *Terrorism Risk Insurance: Program Changes Have Reduced Federal Fiscal Exposure*, GAO-20-348 (Washington, D.C.: Apr. 20, 2020).

Figure 1: The Three Elements of Radioactive Material Risk

Source: GAO analysis of Department of Homeland Security information. | GAO-24-107014

Accessible Data for Figure 1: The Three Elements of Radioactive Material Risk

Risk

- Threat: Threats are entities or actions with the potential to cause harm – including terrorist attacks.
- Vulnerability : Vulnerabilities are physical features or operational attributes that render an asset open to exploitation, including gates, perimeter fences, and computer networks.
- Consequence: Consequence is the effect of occurrences like terrorist attacks or natural disasters resulting in losses that impact areas such as public health and safety and the economy.

Source: GAO analysis of Department of Homeland Security information. I GAO-24-107014

Key Agencies' Efforts to Protect against Dirty Bombs Are Informed by Different Assessments of Overall Risk

Key agencies assess the risks posed by radioactive materials on an ongoing basis.[21] NNSA and CWMD share generally similar assessments of the overall risk posed by dirty bombs—including threats, vulnerabilities, and consequences—and these assessments inform the agencies' radiological security efforts. We found NRC's view of the first two aspects of risk—threat and vulnerability—to be generally consistent with NNSA's and CWMD's assessments. However, whereas NNSA and CWMD incorporate consideration of socioeconomic consequences into their activities, NRC does not consider such consequences as a basis for assessing risk when developing security measures—such as regulations—to mitigate the risks of a dirty bomb.

NNSA and CWMD Pursue Security Activities Based on a View of Risk That Includes Socioeconomic Consequences

NNSA's and CWMD's Assessment of Risk

NNSA and CWMD assess overall radioactive material risk on an ongoing basis using various sources of information. The agencies also shared generally consistent views of the overall risk—including threat, vulnerability, and consequence—posed by dirty bombs, including their socioeconomic consequences.

Threat. NNSA officials stated that while they do not conduct formal threat assessments, they nonetheless receive ongoing threat information from several sources: NRC, the Department of Energy's (DOE) Office of Intelligence and Counterintelligence, daily situational awareness reports produced by Argonne National Laboratory that include incidents related to radioactive materials, and routine reporting from DHS and FBI threat briefings when NRC convenes the Radiation Source Protection Task Force (Task Force).[22] CWMD conducts ongoing radiological risk assessments that include assessments of threats. For these assessments, CWMD uses in-house intelligence capabilities, risk analytics provided by DHS's Science and Technology Directorate, reporting from the national laboratories, public data from open sources such as NRC's Nuclear Materials Events Database, and information from the intelligence community, according to CWMD officials.[23]

[21]While CBP is one of the key agencies discussed further in this report, we focus in this section on NNSA, CWMD, and NRC because these agencies have risk assessment processes that inform their security efforts, as discussed below. CBP does not conduct risk assessments, according to officials.

[22]The full name of the Task Force is the Interagency Task Force on Radiation Source Protection and Security. NRC chairs the Task Force, which includes 13 other federal agencies, including DOE and DHS. The Task Force was established by the Energy Policy Act of 2005 to, among other things, provide recommendations to Congress and the President on appropriate regulatory and legislative changes for the creation or modification of procedures for improving the security of use, transportation, and storage of radiation sources, and modifications to the national tracking system for radiation sources. The Task Force provides reports to Congress and the President every 4 years on the status of its recommendations and activities.

[23]NRC's Nuclear Material Events Database contains records of events involving nuclear and radiological material reported to the NRC by NRC licensees, agreement states, and non-licensees.

Based on interviews we conducted and agency documents we reviewed, NNSA and CWMD have generally consistent views of the threat posed by dirty bombs to the U.S. Specifically, the agencies assess the threat to be credible and enduring, with occasional dips and spikes in threat as specific domestic and foreign concerns arise. According to documentation CWMD provided, lone offenders or domestic violent extremists are the most likely domestic threat actors who may seek to obtain a dirty bomb. NNSA officials similarly stated that extremist ideologies and social media are important factors that inform the agency's understanding of the threat.

Vulnerability. NNSA and CWMD also assess radiological security vulnerabilities on an ongoing basis. NNSA officials stated that they stay abreast of potential facility vulnerabilities via routine coordination with licensees, with whom NNSA works to provide security enhancements; by retaining in-house expertise in radiological operations in various industries; and by obtaining the threat reporting discussed above. CWMD conducts vulnerability assessments of pathways radioactive materials may take into the U.S as part of ongoing risk assessments.[24]

Both agencies cited insiders—employees with access authority and professional knowledge of and familiarity with radioactive materials—as an enduring vulnerability of concern. Officials highlighted an incident in April 2019, when an employee of an Arizona company stole three radioactive sources with the intent to release the material in public.[25] According to documentation it provided, CWMD assesses that such employees with authority to access radioactive materials are a key vulnerability, as trusted insiders are the most likely actors to engage in potential dirty bomb attacks. NNSA officials shared similar concerns, stating that insider access was a key vulnerability that emerged in their study with Argonne on adversary motivations.

NNSA officials also stated that different contexts and methods of use present different vulnerabilities. For example, materials used in highly mobile contexts—such as well logging, in which americium-241 is often used in category 3 quantities and therefore not subject to Part 37—may be more vulnerable to theft and loss than materials used in stationary applications, such as blood irradiation.[26]

Consequence. NNSA and CWMD also consider the consequences of dirty bombs, including their socioeconomic consequences, as part of the agencies' overall effort to understand risk. For example, NNSA has partnered with Sandia National Laboratories since 2017 to model the effects—including socioeconomic effects—that a dirty bomb would have in different regions of the U.S. CWMD similarly includes estimates of socioeconomic damage in risk models that the agency uses to inform its radiological risk assessments.

NNSA and CWMD shared consistent views of the consequences of a dirty bomb, including socioeconomic consequences. For example, NNSA officials stated that recognition of radioactive materials' ability to cause

[24]According to documentation CWMD provided, CWMD assesses that the majority of dirty bomb risk to the homeland comes from material acquired in the United States that does not have to be transported across a border or through a point of entry. This is because of the difficulty in evading several layers of defensive architecture at U.S. ports of entry and secondary checkpoints to detect illegal entry of radiological materials into the U.S., including radiation portal monitors, gamma cameras, handheld detection devices, and visual range and infrared cameras.

[25]NRC officials stated that such incidents are a rare occurrence. Part 37 requires that licensees establish the trustworthiness and reliability of individuals granted unescorted access to category 1 and 2 quantities of radioactive materials. 10 C.F.R. § 37.21.

[26]Well logging involves the use of devices containing radioactive materials to measure the properties of underground geological formations and detect fossil fuel deposits. Well logging devices are lowered downhole and emit radiation that enables them to take readings on the characteristics of an underground formation. The radioactive sources used in well logging devices typically contain a mixture of americium-241 and beryllium-9, which together emit neutrons that can be used to measure such formations.

mass panic and severe economic loss is part of the basis for NNSA's work in general. This includes providing security enhancements and advocating for the use—when available—of alternative technologies that do not rely on radioactive materials. According to CWMD officials we interviewed and risk assessment documentation we received, dirty bombs using any quantity of materials—category 1, 2, or 3—would be unlikely to cause any direct radiation-related casualties but could result in severe socioeconomic damages. Further, according to the same officials and documentation, category 3 materials are more likely to be used in a dirty bomb than category 1 or 2 materials, due to category 3 materials' prevalence in the economy and lower security requirements compared to those for category 1 and 2 materials.

How Risk Informs NNSA's and CWMD's Radiological Security Activities

NNSA's and CWMD's views of the risk of dirty bombs—including their likely socioeconomic consequences—inform these agencies' radiological security efforts. For example, NNSA officials stated that they design and set priorities for NNSA's security enhancement programs based on ongoing threat and vulnerability information they receive through several interagency efforts, such as meetings with the NRC-led Task Force and intelligence agencies. NNSA program priorities are also informed by NNSA's view of the socioeconomic consequences of a dirty bomb. For example, NNSA uses information on socioeconomic consequences from the studies it commissions to help identify and advocate for the use of alternative, non-radioisotopic technologies among specific industries and categories of material users, according to officials. NNSA's Off-Site Source Recovery Program recovers and disposes of users' excess, unwanted, or disused radioactive sources, including sources containing category 3 quantities of radioactive materials, whose consequences—if released in a dirty bomb—would primarily be socioeconomic. NNSA also provides voluntary security upgrades such as tamper indication devices and GPS-tracking devices for users of category 3 quantities of radioactive materials in highly mobile contexts, including well logging, due to the concerns cited above regarding the heightened risk of theft and loss in such contexts.

CWMD also incorporates consideration of risk, including socioeconomic consequences, into its security efforts. According to officials, CWMD is currently coordinating with other DHS components, the State Department, NNSA, and other federal agencies to refine CWMD's risk model to better meet these agencies' information needs. CWMD may also use its risk assessment process to help other agencies like CBP identify radiological security capability gaps, develop and refine operational requirements, and inform CWMD budget requests for additional radiation detection equipment and training to state and local entities through its Securing the Cities program.[27] CWMD's risk assessments, which include estimates of the socioeconomic damage resulting from a radiological incident, are also an input to several, broader DHS risk communication and coordination products. These include a biennial Chemical, Biological, Radiological, and Nuclear (CBRN) Strategic Risk Assessment Summary, the annual CBRN Report to Congress, the annual Homeland Threat Assessment, and the recently revised Global Nuclear Detection Architecture Strategy for Fiscal Years 2023 through 2027.[28] As we recently

[27]DHS's Securing the Cities program works to reduce the risk of terrorist attacks in high-risk urban areas. The program helps state and local agencies in 13 regions detect radiological and nuclear materials that could be used in such attacks, such as by funding the purchase of wearable radiation detectors for police officers. CWMD is responsible for implementing Securing the Cities.

[28]The Global Nuclear Detection Architecture (GNDA) is a multilayered framework encompassing many different federal programs, projects, and activities to detect and deter nuclear smuggling in foreign countries, at U.S. borders, and inside the United States. CWMD contributes to annual GNDA reporting to Congress. CWMD has, to date, implemented three of four recommendations we made to improve these contributions (see GAO, *Countering Weapons of Mass Destruction: DHS Could Improve Its Acquisition of Key Technology and Coordination with Partners*, GAO-22-104498 (Washington, D.C.: Apr. 19, 2022)). See appendix I for details on our recommendations and CWMD's actions to implement them.

reported, CWMD also works with local law enforcement through its Securing the Cities program, conducting assessments of radiological threats, risks, and gaps to inform expansion of program partnerships to protect population centers.[29] Through the program, local law enforcement and other program partners may also obtain training and equipment for the detection of radiological materials, including category 3 materials.

NRC Bases Its Radiological Security Regulations on a View of Risk That Does Not Include Socioeconomic Consequences

NRC assesses the overall risk of a dirty bomb—including threat, vulnerability, and consequence—on an ongoing basis. According to NRC officials, intelligence analysts regularly review, assess, and brief the Commission on information related to the domestic threat environment obtained from classified intelligence networks shared among FBI, DHS, and the intelligence community, as well as from incident reports in NRC's Nuclear Material Events Database. Officials stated that staff also coordinate with counterparts within related National Joint Terrorism Task Forces and track trends in events that may be indicative of domestic threat, including overflights of licensee facilities and suspicious thefts and losses of radioactive material.

According to officials, NRC also keeps abreast of licensee facility vulnerabilities through routine NRC and agreement state inspections, as well as incident reporting involving radioactive material reported to NRC by licensees, agreement states, and non-licensees.[30] Officials stated that NRC requires licensees to take action to correct instances of noncompliance that may render their radioactive materials vulnerable to theft, sabotage, or diversion. Based on interviews we conducted and agency documents we reviewed, we found NRC's assessment of threat and vulnerability to be generally consistent with NNSA's and CWMD's.[31]

However, unlike NNSA and CWMD, NRC does not consider socioeconomic consequences—the most substantial effect of a dirty bomb—in its decision-making regarding its assessment of risk for the development of security requirements for radioactive materials. Instead, as we reported in April 2019, NRC assesses the risk of radioactive materials based on their ability to cause prompt fatalities and deterministic health effects from radiation.[32] NRC has on several occasions reassessed and repeatedly reaffirmed its use of prompt fatalities

[29]See GAO, *Nuclear Terrorism Prevention: DHS Has Strengthened the Securing the Cities Program, but Actions Are Needed to Address Key Remaining Challenges*, GAO-24-106922 (Washington, D.C.: Mar. 20, 2024). We issued five recommendations to CWMD in our report on Securing the Cities. However, due to their recency, we did not include them in our selection of recommendations for this report.

[30]NRC requires that corrective actions be taken to correct any noncompliance identified at a licensee's facility.

[31]NRC, NNSA, and CWMD generally agreed that the threat is credible and enduring, with occasional dips and spikes in threat as specific domestic and foreign concerns arise. We previously reported in October 2021 that NNSA officials told us that assessments of the threat environment at that time showed an increasing interest in using radioactive material for making a dirty bomb (see GAO, *Alternatives to Radioactive Materials: A National Strategy to Support Alternative Technologies May Reduce Risks of a Dirty Bomb*, GAO-22-104113 (Washington, D.C.: Oct. 21, 2019)). However, based on interviews we conducted and agency documents we reviewed for this report, we did not find meaningful discrepancies in agencies' current view of the threat.

[32]GAO-19-468. NRC defines prompt fatalities as deaths from the acute effects of radiation that may occur within a few months of the exposure. Prompt fatalities would usually result from acute exposures (large exposure received over a short period of time). According to NRC, deterministic health effects are defined as consistent with the principles of determinism, which hold that specific causes completely and certainly determine effects of all sorts. Furthermore, severe deterministic effects could be fatal or life-threatening or result in permanent injury that reduces quality of life.

and deterministic health effects as its primary criteria for measuring the consequences of a dirty bomb, as we reported in 2019 (our recommendation on this issue is discussed below).[33]

NRC's view of risk informs NRC's radiological security framework, including the establishment of security regulations. NRC officials stated that NRC's Part 37 security regulations—which apply to category 1 and 2 quantities of radioactive materials—are based on a baseline set of vulnerabilities that NRC and Sandia National Laboratories first identified in the period following the attacks of September 11, 2001, and that remain relevant today. Officials also stated that NRC uses its inspection program to monitor for ongoing vulnerabilities at licensee facilities and to determine compliance with security requirements. According to NRC, the agency may respond to changes in the security landscape by issuing emergency communications or security orders to licensees, or—if an issue is systemic and requires long-term mitigation that merits the potential costs imposed on licensees—by changing regulations. However, NRC officials stated that NRC has not made significant changes to its radiological security regulations since first promulgating Part 37 in 2013. They explained that NRC has determined that any changes in the overall risk of a dirty bomb since that time have not necessitated rulemaking.[34] NRC has also stated that incorporating consideration of socioeconomic damages into its security framework would be "a significant change in NRC's underpinning assumptions for safety and security."[35] As discussed further below, NRC officials we spoke with for this report confirmed that this remains NRC's position today.

NRC Has Not Taken Several Steps That Would Reduce the Risk of a Dirty Bomb

Since 2012, we have made numerous recommendations to key federal agencies that sought to enhance radiological security and reduce the risk of a dirty bomb. NNSA, CWMD, and CBP have implemented most of our recommendations. NRC, however, has not implemented the majority of our recommendations, including our recommendation that NRC consider socioeconomic consequences in its assessment of risk for the development of security requirements, and the majority of our recommendations for strengthening security for category 3 quantities of radioactive materials.

[33]Our 2019 report provides details on instances when NRC reassessed its position on socioeconomic consequences. These included when NRC developed its 2004 decision-making framework (Nuclear Regulatory Commission, *SECY-04-0222: Policy Issue: Notation Vote: Decision-Making Framework for Materials and Research and Test Reactor Vulnerability Assessments* (Washington, D.C.: Nov. 24, 2004); when it reviewed its regulatory framework after the Fukushima nuclear disaster in 2011; and in a 2012 staff analysis of the question of whether NRC should incorporate socioeconomic consequences into its protection and mitigation strategies. See GAO-19-468.

[34]NRC has, however, made enhancements to security guidance since 2013.

[35]Nuclear Regulatory Commission, Radiation Source Protection and Security Task Force, *The 2014 Radiation Source Protection and Security Task Force Report*, Report to the President and the U.S. Congress Under Public Law 109-58, The Energy Policy Act of 2005 (Washington, D.C.: Aug. 14, 2014).

NNSA, CWMD, and CBP Have Taken Nearly All Actions We Have Recommended to Enhance Radiological Security

NNSA, CWMD, and CBP have taken nearly all of the 22 selected actions we have recommended since 2012 to enhance radiological security and have taken partial action on the remaining recommendation.[36] In total, NNSA has implemented three out of three recommendations, CWMD has implemented 15 out of 16 and partially implemented the remaining recommendation, and CBP has implemented three out of three.[37]

For example,

- In response to our 2012 recommendation, NNSA officials stated that they had significantly increased their outreach efforts to promote awareness of and participation in NNSA's program to provide radioactive materials users with partially subsidized security enhancements.[38] NNSA's efforts included targeted outreach such as letters and phone calls to state regulators and licensees to solicit volunteers for the program.
- In response to our 2018 recommendation, CBP provided documentation that it had developed a system to better target high-risk shipments of radiological material and had revised its policies on verifying licenses for these shipments.[39]
- In response to our 2022 recommendation, CWMD reassessed its strategy for replacing its current fleet of radiation portal monitors.[40] As a result of its assessment, CWMD determined there was no longer a functional need or operational urgency to recapitalize the current fleet and decided to terminate the acquisition.

For further details about our recommendations and agencies' actions to implement them, see appendix I.

[36]We also issued a recommendation related to radiological security to DOE in 2023 (GAO, *High-Risk Radioactive Material: Opportunities Exist to Improve the Security of Sources No Longer in Use,* GAO-24-105998 (Washington, D.C. Nov. 30, 2023)). However, we did not include this recommendation in this report as our radiological security work over the last decade has generally focused on NNSA.

[37]Our count of recommendations to CWMD includes recommendations we made to the Domestic Nuclear Detection Office (DNDO), whose functions were incorporated into CWMD in 2017. It also includes five recommendations we issued to DHS. We included these recommendations in our count of recommendations to CWMD for the purposes of this report because four of these recommendations were issued in a report that focused on DNDO's acquisition of radiation portal monitors (GAO-13-256), and the remaining recommendation was implemented in part by DNDO (GAO-14-293).

[38]GAO, *Nuclear Nonproliferation: Additional Actions Needed to Improve Security of Radiological Sources at U.S. Medical Facilities*, GAO-12-295 (Washington, D.C.: Sept. 10, 2012).

[39]GAO, *Nuclear Security: CBP Needs to Take Action to Ensure Imported Radiological Material Is Properly Licensed*, GAO-18-214 (Washington, D.C.: Jan. 10, 2018).

[40]GAO, *Countering Weapons of Mass Destruction: DHS Could Improve Its Acquisition of Key Technology and Coordination with Partners*, GAO-22-104498 (Washington, D.C.: Apr. 19, 2022).

NRC Has Not Taken the Majority of Steps We Recommended That Would Reduce the Risk of a Dirty Bomb

NRC has not implemented the majority of the actions we have recommended that would reduce the risk of a radiological disaster resulting from a dirty bomb. Specifically, NRC has not implemented 11 out of 18 actions we have recommended since 2012. These unimplemented recommendations generally fall into two categories. First, NRC has not taken action to consider socioeconomic consequences in its decision-making criteria for determining security requirements for radioactive materials. Second, NRC has not taken the majority of the actions we have recommended to strengthen the security of category 3 quantities of radioactive materials.

Consideration of Socioeconomic Consequences

As stated previously, NRC has not incorporated consideration of the socioeconomic consequences of a dirty bomb into its decision-making when assessing risk for the development of security measures. So that NRC could be better assured its requirements reflect these significant and more likely consequences, in 2019 we recommended that NRC account for socioeconomic consequences in its decision-making regarding security measures for materials that could be used in a dirty bomb.[41] NRC disagreed and, in its comments on our 2019 report, stated that the likelihood of a dirty bomb was low and its regulations were sufficient to provide for the safe and secure use of radioactive materials. Officials we interviewed for this report stated that this remains NRC's position today and confirmed that NRC does not plan to implement this recommendation.

As discussed above, NNSA and CWMD officials we interviewed stated that those agencies consider socioeconomic consequences highly relevant to their security activities. However, NRC does not do so. Instead, NRC has cited prompt fatalities and deterministic health effects from radiation as the primary consequences of concern for the purposes of assessing risk. As we reported in 2019, experts generally agreed that prompt fatalities and deterministic health effects have limited value as criteria for assessing the risk of a dirty bomb. This is because, according to these experts, such consequences are unlikely to occur, even if a dirty bomb contained a large quantity of radioactive material—such as a category 1 or 2 quantity.[42]

By not incorporating consideration of such socioeconomic consequences into its decision-making and, ultimately, its regulations, NRC cannot have assurance that its security requirements capture the full scope of risk for dangerous quantities of radioactive materials. Several studies (including a 2021 study by the National Academies of Sciences, Engineering, and Medicine),[43] radiological experts we previously convened, officials we interviewed for this report, and the NRC-led Task Force all agree—and recent events corroborate—that the

[41]GAO-19-468.

[42]GAO-19-468.

[43]In its report, the National Academies found that small radiation releases and small radiation exposures of populations below the levels that can cause deterministic effects may have serious and long-term socioeconomic consequences. Various real-life radiological events are supportive of this conclusion. A safety system that is based solely on deterministic effects of radioactive sources may provide an inadequate level of protection to society. See National Academies of Sciences, Engineering, and Medicine. *Radioactive Sources: Applications and Alternative Technologies* (Washington, D.C.: The National Academies Press, 2021). https://doi.org/10.17226/26121.

socioeconomic consequences from a dirty bomb would be severe.[44] For example, in 2017 and 2018, Sandia National Laboratories estimated that a dirty bomb using category 1 or 3 quantities of materials could cause an estimated $24 to $30 billion in damages and economic losses, most of which would be socioeconomic.[45] Sandia conducted another study in 2019 on the effects of a dirty bomb in a different economic context and reaffirmed that the socioeconomic consequences would be dramatic.[46]

[44]In 2010, all Task Force agencies—including NRC—endorsed a definition of a "significant" dirty bomb that includes socioeconomic damages. However, NRC later stated in a 2014 Task Force report that considering such damages would be "a significant change in NRC's underpinning assumptions for safety and security," and that NRC does not use the Task Force's definition of a "significant" dirty bomb in its regulatory framework. As stated above, NRC officials we spoke with for this report confirmed that this remains NRC's position today.

[45]2017 study: Lawrence C. Trost, Vanessa Vargas, Drake Warren, Robert Knowlton, William Fogleman, and Emma Grazier. "(U) Economic Impacts of an RDD Incident", Sandia National Laboratories, March 2018. 2018 study: Sandia National Laboratories, *A Comparison Study of RDD Economic Impacts*, SAND2018-7945, (Albuquerque, NM: July 2018).

[46]Sandia's 2019 study modeled the consequences of a dirty bomb using a category 2 quantity of radioactive material. NNSA officials stated they expect the damages from a category 3 quantity of material would remain significant.

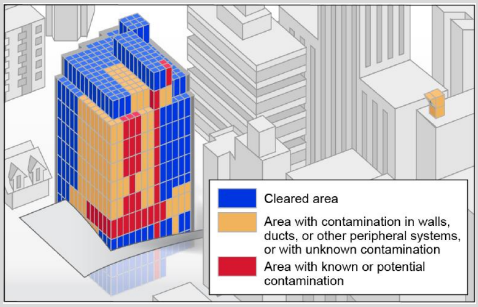
Cesium Release at the University of Washington, Seattle (May 2019)

In May 2019, a subcontractor for the National Nuclear Security Administration (NNSA) inadvertently breached a sealed cesium-137 source in an irradiator at the University of Washington (UW) Harborview Medical Center near downtown Seattle. Assessments found that radiation was released into the building's loading dock, made its way throughout the building via the ventilation systems and elevator shaft, and reached an adjacent building's roof. UW closed off the entire building until April 2021.

Had it been licensed on its own, the amount of material released in this accident—about 1.25 curies, which is a measure of radioactivity—would not have been enough to subject it to NRC regulation under Part 37 or require tracking in NRC's licensing databases. Despite the small amount of material, representatives from UW we interviewed for a 2021 report said that the socioeconomic consequences have been severe. Over 80 research programs valued in the tens of millions of dollars were affected, and over 200 researchers and laboratory staff had to be relocated. Several researchers could not find replacement laboratories to host their research and were compelled to seek employment elsewhere.

NNSA estimated the total cost of the incident—including cleanup, remediation, reconstruction, and other costs—to be $156 million. For more details, see our report, *Alternatives to Radioactive Materials: A National Strategy to Support Alternative Technologies May Reduce Risks of a Dirty Bomb*, GAO-22-104113.

Known or Suspected Radioactive Contamination at the University of Washington in September 2019



Source: GAO. | GAO-24-107014

These studies are also corroborated by recent events, such as the 2019 radioactive material leak at the University of Washington's Harborview Medical Center, where the accidental leak of about 1.25 curies of cesium-137—a category 4 quantity—led to $156 million in damages (see sidebar).[47]

Security of Category 3 Materials

NRC has implemented few recommendations we have made for strengthening the security of category 3 materials. As discussed below, NRC considered a rulemaking that would have addressed some of our recommendations, but it was not carried forward. Our work has consistently revealed vulnerabilities in NRC's security requirements for category 3 materials, whose consequences, if used in a dirty bomb, would be nearly as catastrophic as one using category 1 or 2 materials. Our resulting recommendations have aimed, in general, to help ensure NRC's requirements provide for sufficient controls to prevent a bad actor from obtaining these materials, and to provide a level of security commensurate with the socioeconomic damages these materials could cause if used in a dirty bomb. The actions we recommended generally fall into two categories: strengthening category 3 source and license oversight, and increasing security for category 3 materials.

[47]Curies are a measure of radioactivity. For details about the incident at the University of Washington, see our 2022 report, *Alternatives To Radioactive Materials: A National Strategy to Support Alternative Technologies May Reduce Risks of a Dirty Bomb*, GAO-22-104113 (Washington, D.C.: Oct. 21, 2022). We cite the leak at the University of Washington as an example of the potential socioeconomic damages even a small amount (in this case, a category 4 amount) of radioactive material can cause. We have not conducted reviews that specifically focus on the security of category 4 and 5 amounts of materials.

GAO Purchased Radioactive Material Using Fake Licenses

In 2022, using shell companies with fake licenses, GAO successfully purchased a category 3 quantity of radioactive material from two different vendors in the U.S. Specifically, GAO forged a license, provided copies of the forged license to two vendors, subsequently obtained invoices, and paid the vendors. As GAO has previously reported, a category 3 quantity of radioactive material can, on its own, result in billions of dollars of socioeconomic costs if dispersed using a dirty bomb. By purchasing more than one shipment of a category 3 quantity of radioactive material, GAO also demonstrated that a bad actor might be able to obtain a category 2 quantity by purchasing and aggregating more than one category 3 quantity from multiple vendors. Nuclear Regulatory Commission (NRC) officials told GAO that NRC planned to pursue rulemaking that would implement new verification requirements. However, in March 2024, the Commission announced that it was unable to reach a decision on the draft rule, and as a result, no rule will be proposed. According to NRC officials, it has no current plans to pursue these measures further.

Radioactive Materials Purchased Using Fake Licenses

Source: GAO. | GAO-24-107014

- **Strengthening source and license oversight.** We have made several recommendations to strengthen NRC requirements related to the oversight and verification of category 3 sources and licenses. Specifically, in a 2016 investigation, we demonstrated the ability to obtain a real license for a fictitious company and then alter that license to secure commitments to purchase enough category 3 quantities of radioactive material to, in aggregate, obtain a category 2 quantity of material. In our resulting report, we recommended that NRC (1) take steps needed to add all category 3 licenses to the Web-based Licensing System (WBL) and all category 3 sources to the National Source Tracking System (NSTS); (2) in the interim, require that all vendors verify the legitimacy of would-be purchasers' category 3 licenses with NRC or a state regulatory authority; and (3) require on-site security reviews for all unknown applicants for category 3 licenses to verify the applicant is prepared to implement the required security measures.[48] We made related recommendations in 2022, following another GAO investigation involving category 3 materials and the use of fake licenses (see sidebar).[49] We made another related recommendation in 2023, when we found that centralized tracking of category 3 sources in NSTS could help mitigate the risk that such materials with limited disposal pathways are abandoned, lost, misplaced, or stolen, especially in boom-and-bust industries like well logging.[50]

  Despite taking actions to consider our recommendations to strengthen source and license oversight, NRC ultimately has implemented only one of them. Specifically, in a 2017 analysis, staff recommended that NRC take steps to address our recommendation that NRC require on-site security reviews for all unknown

[48]GAO, *Nuclear Security: NRC Has Enhanced the Controls of Dangerous Radioactive Materials, but Vulnerabilities Remain*, GAO-16-330 (Washington, D.C.: July 1, 2016).

[49]GAO, *Preventing a Dirty Bomb: Vulnerabilities Persist in NRC's Controls for Purchases of High-Risk Radioactive Materials*, GAO-22-103441 (Washington, D.C.: July 14, 2022).

[50]GAO-24-105998. According to NRC, while category 3 materials are not tracked in NSTS, licensees are nonetheless required to inventory radioactive materials in their possession—including category 3 materials—and are subject to inspection oversight to verify they are implementing requirements to adequately account for and secure these materials.

applicants for category 3 licenses, stating that such steps would not impose additional costs on licensees beyond those already needed to conduct licensed activities. In 2019, NRC updated guidance—including inspection checklists—that regulators are required to use for conducting pre-licensing site visits. The updated guidance clarifies what constitutes a known and unknown applicant and includes questions regarding applicants' ability to provide for adequate security.[51]

However, NRC has not implemented the other recommendations we have made to strengthen source and license oversight. With regard to our 2016 recommendation to include category 3 sources in NSTS and licenses in WBL, NRC staff determined in its 2017 analysis that the risk of a radiological incident involving category 3 sources did not justify the estimated cost to implement these measures. The estimated cost was about $11 million for the initial implementation with a recurring annual cost of about $1.7 million.[52] We recommended again in 2023 that NRC take this and additional steps to track and secure category 3 and other sources.[53] While NRC did not specifically agree or disagree with this recommendation at the time, NRC staff we spoke with in June 2024 stated NRC has no further plans to consider requiring that category 3 sources be added to NSTS.

In its 2017 analysis, NRC staff also considered our recommendation that NRC specifically require verification of category 3 licenses. In the analysis, NRC staff similarly determined that the risk of a radiological incident did not justify the costs of implementing such a requirement. However, in our 2022 investigation, we further demonstrated how category 3 quantities of material could be acquired using a fake license, and recommended NRC immediately require that vendors verify category 3 licenses with NRC or state regulatory authorities.[54] NRC agreed that the vulnerability we revealed in 2022 warranted timely action, and stated that it took steps to expedite a draft rule that would have addressed our recommendation. In March 2024, however, NRC officials informed us that the NRC commissioners had voted 2–2 on proposing the draft rule.[55] Without a majority of commissioners in favor of proposing the draft rule, the Commission was unable to reach a decision and therefore no rule will be proposed. In June 2024, NRC staff we spoke with stated that NRC has no further plans to consider requiring would-be purchasers to verify category 3 licenses with NRC or a state regulatory authority.

[51]We originally considered this recommendation open while NRC developed a draft rule that would have required safety and security equipment to be in place before granting a license for an unknown entity. In March 2024, NRC officials informed us that the Commission had voted 2–2 on proposing the draft rule, meaning no rule will be proposed. However, after discussions with NRC staff, we determined that NRC's 2019 actions to update its required pre-licensing guidance also address our recommendation.

[52]NRC estimated the costs to NRC, agreement states, and industry associated with various options for tracking category 3 materials in NSTS and licenses in WBL. The costs for these options—and for each party in each option—varied. The costs we are reporting here are the sum of NRC's estimated costs to NRC, agreement states, and industry to implement the option that was the most costly and involved the greatest number of steps beyond current NRC requirements (NRC completed its analysis in 2017; for the purposes of this report we have inflated the costs NRC estimated to fiscal year 2023 dollars). Nuclear Regulatory Commission, *SECY-17-0083, Re-Evaluation of Category 3 Source Security and Accountability in Response to SRM-COMJMB-16-0001* (Aug. 18, 2017).

[53]GAO-24-105998. Our full recommendation was that the Chairman of the NRC comprehensively assess leading practices that, if implemented, would minimize the time that disused radiological sources are in a licensee's possession. These practices include financial assurances for all category 1, 2, and 3 sources; tracking of category 3 sources (e.g. in NSTS); possession time limits or fees for disused sources; and orphan source funds. See our report GAO-24-105998 for more details on how these practices can support security for radioactive materials.

[54]GAO-22-103441.

[55]NRC is headed by five Commissioners appointed by the President and confirmed by the U.S. Senate for 5-year terms. According to NRC, one of the commissioner's terms had expired prior to the vote on the draft rule, and at the time of the vote the position had not yet been filled.

We continue to believe that NRC cannot be assured of adequate security and oversight for category 3 materials without taking all of the actions we recommended. The vulnerabilities exposed by our fake businesses and fake licenses demonstrate that a bad actor could use similar methods to obtain dangerous quantities of these materials.

See table 1 for a timeline of NRC's response to our recommendations related to category 3 source and license oversight.

Table 1: Timeline of Nuclear Regulatory Commission (NRC) Response to GAO Recommendations to Strengthen Category 3 Source and License Oversight

Date	Action
July 2016	GAO issues recommendations to strengthen category 3 source and license oversight. GAO issues GAO-16-330, in which it demonstrates the ability to obtain a real license for a fake company, and then alter the license to secure commitments to purchase enough category 3 quantities of radioactive material to, in aggregate, obtain a category 2 quantity of material. GAO recommends that NRC (1) require all category 3 licenses be added to the Web-based Licensing System (WBL) and all category 3 materials be added to the National Source Tracking System (NSTS); (2) in the interim, require all vendors to verify the legitimacy of would-be purchasers' category 3 licenses with the appropriate regulatory authority; and (3) require on-site security reviews for all unknown applicants for category 3 licenses.
August 2017	NRC staff evaluates the costs and benefits of potential changes to its category 3 requirements. Staff recommends against (1) adding category 3 licenses to WBL and category 3 sources to NSTS and (2) mandating vendors verify the licenses of would-be purchasers' category 3 licenses (the first and second recommendations from GAO's 2016 report), citing insufficient risk of a radiological incident to justify the cost. To address our third recommendation, the staff recommends the Commission pursue rulemaking to require safety and security equipment to be in place before granting a license for an unknown entity and update pre-licensing guidance for regulators regarding on-site security reviews.
January 2019	NRC updates pre-licensing guidance for regulators regarding on-site security reviews.
December 2021	The Commission directs the staff to pursue the rulemaking regarding on-site security reviews, per the staff's 2017 recommendation. The Commission also directs the staff to pursue rulemaking mandating vendors verify the licenses of would-be purchasers' of category 3 sources, despite the staff's 2017 recommendation against it. The Commission does not direct staff to pursue rulemaking to add category 3 licenses to WBL or category 3 sources to NSTS.
July 2022	GAO issues GAO-22-103441, in which it further demonstrates how category 3 quantities of material could be acquired using a fake license. GAO recommends NRC immediately require vendors to verify category 3 licenses with the appropriate NRC or agreement state regulatory authority and add security features to its licensing process to make it less susceptible to forgery. NRC states that it will consider GAO's recommendations as part of its ongoing rulemaking.
December 2022	NRC staff submits a draft rule to the Commission regarding on-site security reviews and license verification.
November 2023	GAO issues GAO-24-105998, again recommending NRC require category 3 sources be tracked in NSTS, among other measures. NRC reiterates its prior determination that the risk does not justify the cost.
March 2024	The Commission reaches a 2–2 tie vote on its draft rule and is thus unable to reach a decision. The rule is not proposed. NRC thus ends consideration of nearly all GAO recommendations to strengthen category 3 source and license oversight

Source: GAO reports and NRC documentation. | GAO-24-107014

- **Increasing security for category 3 materials.** We also made recommendations that aimed to enhance NRC's security requirements for category 3 materials, including when these materials are aggregated such that their total quantity becomes a category 1 or 2 quantity. For example, in 2014 we reported that some well logging facilities in the oil and gas industry housed multiple category 3 quantities of americium-241 that, in aggregate, represented a category 1 or 2 quantity. However, because these

materials were stored in multiple separately locked containers, NRC did not consider them "aggregated."[56] The materials were therefore not subject to security requirements, such as trustworthiness and reliability determinations for individuals with unescorted access. We recommended that NRC consider revising its definition of "aggregated" for well logging facilities that keep multiple category 3 radioactive materials in a single storage area. NRC considered revising its definition as part of a review of its Part 37 regulations in 2016 and determined that its definition was adequate to ensure the security of sources at well logging facilities.[57]

In 2019, we reported that experts we convened at the time generally agreed that certain category 3 radioactive materials should be subject to additional security measures due to attributes that would make these materials more hazardous than other radioactive materials if used in a dirty bomb. Experts also generally agreed that there could be long-term socioeconomic consequences from a dirty bomb that used a category 3 quantity of radioactive material. We therefore recommended that NRC require additional security measures for certain category 3 materials and assess whether additional security measures were required for all category 3 materials in general.

The experts we convened in 2019 also agreed that weaknesses continued to exist in how NRC was regulating the aggregation of multiple category 3 quantities of americium-241 at a single facility—as described in our 2014 report, discussed above. Specifically, NRC permits aggregation of multiple category 3 quantities of material that in total reach a category 1 or 2 quantity of material without applying Part 37 security requirements. Experts told us that well logging facilities were storing multiple category 3 quantities of americium-241 without triggering NRC's Part 37 security requirements. We therefore recommended that NRC require additional security measures for multiple quantities of americium-241 in a single facility such that, in aggregate, the materials represent a category 1 or 2 quantity.[58]

NRC neither agreed nor disagreed with the first of our 2019 recommendations, stating that a significant gap related to the security of category 3 sources had not been identified.[59] NRC disagreed with the second recommendation, stating that its requirements and guidance were sufficient. We disagree in both cases. We continue to believe that by not taking the actions we recommended, NRC does not have assurance that its requirements and guidance adequately protect radioactive materials from theft, aggregation into quantities beyond what a user is licensed to possess, or their use in a dirty bomb.

As discussed above, NRC stated in its 2017 analysis that the risk of a radiological incident did not justify the estimated cost of implementing some of our recommendations. However, we found that NRC's analysis estimated only the costs to add category 3 sources to NSTS and licenses to WBL. It did not, however, quantify any benefits, such as a reduction in the risk of significant socioeconomic damages, the costs of which the government might be expected to address. Such damages may range from $24 to $30 billion for a single

[56]GAO-14-293. Aggregated means "accessible by the breach of a single physical barrier that would allow access to radioactive material in any form, including any devices that contain the radioactive material, when the total activity equals or exceeds a category 2 quantity of radioactive material." 10 C.F.R. § 37.5. We use the term "aggregated" in this report as this is the term used in NRC's regulations. However, in our 2014 report, we used the term "collocated," because this is the term that was used in the orders that preceded Part 37. The terms have the same meaning.

[57]While NRC ultimately chose not to revise its definition of aggregation, we considered this recommendation closed as implemented, as we had recommended NRC reconsider its definition.

[58]GAO-19-468.

[59]NRC subsequently cited the draft rule discussed above as responsive to this recommendation. However, as discussed, the rulemaking did not move forward.

incident, according to studies conducted by Sandia. Given the possibility for such substantial damages, the costs NRC estimated—approximately $27 million over a ten-year period, based on our analysis of the costs NRC estimated in its 2017 analysis—are low.[60] This is particularly the case when compared to investments the U.S. has made in other radiological security efforts over approximately the last ten years, as shown below. While the efforts presented below do not pertain exclusively to category 3 materials, we present them as examples of the scale of investment the U.S. has made in radiological security broadly. Such efforts include:[61]

- NNSA's program to remove disused radioactive sources, which has cost approximately $394 million since fiscal year 2014.
- NNSA's Cesium Irradiator Replacement Project, which has cost an estimated $213 million since fiscal year 2016.
- CBP's operation and maintenance of radiation portal monitors, which has cost approximately $228 million since fiscal year 2014.
- CWMD's acquisition of radiation portal monitors, which has cost approximately $393 million since fiscal year 2014.
- CWMD's Securing the Cities program, which has cost approximately $214 million since fiscal year 2014.

A recent event demonstrates the benefits that investment in radiological security can yield. In Houston, on October 16, 2023, police who were trained and equipped with radiation detection equipment provided through the STC program used this equipment to detect and secure four radioactive sources that had been improperly discarded in a scrapyard. Had these sources been breached and the radioactive materials dispersed within the local community, the socioeconomic consequences could have been devastating.

Conclusions

Recent security threats have raised concern that terrorists or other bad actors could target radioactive material for theft and use in a domestic attack. Studies we reviewed and experts we previously convened agree that the socioeconomic consequences of a radiological attack, such as a dirty bomb, would be devastating. However, NRC has not implemented our recommendation to consider socioeconomic consequences in its decision-making regarding its assessment of risk for the development of security requirements. By not incorporating consideration of such consequences into its decision-making and, ultimately, its regulations, NRC cannot have assurance that its security requirements capture the full scope of risk for dangerous quantities of radioactive materials.

NRC has also implemented few of our recommendations to address gaps we have identified in its security requirements for category 3 radioactive materials. While NRC took steps to consider some of these

[60]NRC completed its analysis in fiscal year 2017. For the purposes of this report, we have inflated the costs NRC estimated to fiscal year 2023 dollars.

[61]The costs we are reporting here represent radiological security expenditures reported to us by NNSA, CBP, and CWMD since fiscal year 2014, with the exception of NNSA's Cesium Irradiator Replacement Project (CIRP), for which NNSA could only provide expenditures since fiscal year 2016. NNSA officials provided us with CIRP's estimated expenditures for fiscal years 2024 and 2025 to provide us with an overall, 10-year estimate of the program's expenditures. We have adjusted all expenditures to fiscal year 2023 dollars.

recommendations, including drafting a rule, the rule was not promulgated. These recommendations remain unimplemented, and officials we interviewed for this report stated that NRC has no plans to implement most of them. By not taking our recommended actions to close the gaps we have identified, NRC cannot be assured that its security requirements address the full scope of risk facing the homeland from dangerous quantities of radioactive materials. This results in increased fiscal exposure to the federal government—and undue risk to the American people—associated with the potential socioeconomic consequences of a radiological disaster, such as a dirty bomb.

Given NRC's continued resistance to implementing our recommendations to incorporate socioeconomic consequences into its decision-making and to address gaps in security for category 3 materials, legislative action may be needed.

Matters for Congressional Consideration

We are making the following two matters for congressional consideration:

Congress should consider directing NRC to incorporate socioeconomic consequences into NRC's decision-making for setting security measures for radioactive materials, and direct NRC to update its regulations accordingly. (Matter for Consideration 1)

Congress should consider directing NRC to immediately require that all category 3 licenses be added to the Web-based Licensing System, all category 3 sources be included and tracked in the National Source Tracking System, and that all vendors verify the legitimacy of would-be purchasers' category 3 licenses with the regulator. (Matter for Consideration 2)

Agency Comments

We provided a draft of this report to the Chairman of NRC, the Administrator of NNSA, and the Secretary of Homeland Security. NRC provided written comments on the draft report, which are presented in appendix II. In addition, NRC provided technical comments, which we incorporated as appropriate. NNSA and DHS did not provide written comments. NNSA and DHS provided technical comments, which we incorporated as appropriate.

In its comments, NRC neither agreed nor disagreed with the findings of the report. NRC generally stated that its current regulatory requirements provide for the safe and secure use of radioactive materials, regardless of their category. NRC also asked that we consider the conclusion of the Radiation Source Protection and Security Task Force (Task Force), which stated in its 2022 report that, "there are no significant gaps in the area of radioactive source protection and security that are not already being addressed through interagency cooperation and actions."[62]

[62]Nuclear Regulatory Commission, Radiation Source Protection and Security Task Force, *The 2022 Radiation Source Protection and Security Task Force Report*, Report to the President and the U.S. Congress Under Public Law 109-58, The Energy Policy Act of 2005 (Washington, D.C.: Aug. 5, 2022).

NRC seems to be using the statement of the Task Force, which it chairs, as a basis for not taking action to address the gaps and vulnerabilities we have detailed in this report and throughout the years. However, over the years, NRC has taken action to consider our recommendations to address these gaps and vulnerabilities, despite the Task Force's repeated statement that "there are no significant gaps...not already being addressed," which has been repeated in every Task Force report since 2006. For example, NRC stated our 2022 findings on vulnerabilities in license verification required timely action and stated that it took steps to expedite a draft rule that would have helped address our recommendations. As we discussed above, however, no action was ultimately taken. Similarly, when NRC has considered addressing other known gaps and vulnerabilities, it has generally resulted in the agency taking no substantive action.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 3 days from the report date. At that time, we will send copies to the appropriate congressional committees, the Chairman of the NRC, the Administrator of NNSA, the Secretary of Homeland Security, and other interested parties. In addition, the report is available at no charge on the GAO website at http://www.gao.gov.

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

Allison Bawden
Director, Natural Resources and Environment

Appendix I: Status of Selected GAO Radiological Security Recommendations to Key Federal Agencies

We have made numerous recommendations to federal agencies that aimed to enhance radiological security in areas such as regulation and licensing, physical security measures, license verification measures, and risk assessment. Our work has primarily focused on the radiological security efforts of the Nuclear Regulatory Commission (NRC), the National Nuclear Security Administration (NNSA), and the Department of Homeland Security's (DHS) Countering Weapons of Mass Destruction Office (CWMD) and U.S. Customs and Border Protection (CBP). For this report, we identified 13 relevant reports and 40 associated recommendations that we issued to the above agencies since 2012 and that relate primarily to radiological security.[1] As of July 2024,

- NRC has implemented seven and not yet implemented nine of our recommendations; we have closed two recommendations to NRC as unimplemented (out of 18 total recommendations);
- NNSA has implemented three recommendations (out of three total recommendations);
- CWMD has implemented 15 recommendations and has partially implemented one recommendation (out of 16 total recommendations);[2] and
- CBP has implemented three recommendations (out of three total recommendations).

Tables 2 through 5 provide, by agency, descriptions of the reports and recommendations we selected, together with the status of the recommendations' implementation. For the most up-to-date status of these recommendations, see our website: http://www.gao.gov.

[1]We chose 2012 because this was the year we issued our first report evaluating the increased security requirements that NRC implemented after September 11, 2001 and because we determined this time frame would reasonably capture issues that remain relevant to agencies' radiological security work today.

[2]Our count of recommendations to CWMD includes recommendations we made to the Domestic Nuclear Detection Office (DNDO), whose functions were incorporated into CWMD in 2017. It also includes five recommendations we issued to DHS. We included these recommendations in our count of recommendations to CWMD for the purposes of this report because four of these recommendations were issued in a report that focused on DNDO's acquisition of radiation portal monitors (GAO-13-256), and the remaining recommendation was implemented in part by DNDO (GAO-14-293).

Table 2: Selected GAO Radiological Security Recommendations to the Nuclear Regulatory Commission (NRC)

Report	Agency recommendation	Status
Nuclear Nonproliferation: Additional Actions Needed to Improve Security of Radiological Sources at U.S. Medical Facilities, GAO-12-925	The Chairman of NRC should strengthen NRC security requirements by providing hospitals and medical facilities with specific measures they must take to develop and sustain a more effective security program, including specific direction on the use of cameras, alarms, and other relevant physical security measures.	Closed – Not Implemented In its comments on our report, NRC stated that it believes the agency's performance-based security requirements provide for adequate security. However, NRC did not provide hospitals and medical facilities with specific measures they must take to develop and sustain a more effective security program, including specific direction on the use of cameras, alarms, and other relevant physical security measures. Therefore, this recommendation is closed, but not implemented.
GAO-12-925	The Chairman of NRC should ensure that NRC and agreement state inspectors receive more comprehensive training to improve their security awareness and ability to conduct related security inspections.	Closed – Implemented In February 2014, NRC offered an updated training course to inspectors entitled "NRC Materials Control and Security Systems and Principles." It includes information on 10 C.F.R. Part 37 and emphasized best security practices including effective application of cameras, alarms, and other physical security measures.
Nuclear Nonproliferation: Additional Actions Needed to Increase the Security of U.S. Industrial Radiological Sources, GAO-14-293	The Chairman of NRC should obtain the views of key stakeholders, such as licensees, during the development of the Best Practices Guide to ensure that the guide contains the most relevant and useful information on securing the highest-risk radiological sources.	Closed – Implemented NRC agreed and, in March 2015, stated that it planned to assess the effectiveness of the guidance document "Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material." In February 2024, officials confirmed that their review included substantial public comment and outreach to agency stakeholders and licensees.
GAO-14-293	The Chairman of NRC should reconsider whether the definition of collocation should be revised for well logging facilities that routinely keep radiological sources in a single storage area but secured in separate storage containers.	Closed – Implemented In December 2016, NRC provided Congress a report detailing its review of Part 37. The review considered whether additional security measures or rulemaking changes were appropriate and concluded that the definition of aggregation is adequate to ensure that the security of sources at well logging facilities is reasonably assured. In this report, NRC also stated that its assessment of the potential need to revise the definition of "aggregation" resulted in recommendations to revise the pre-licensing activities performed by NRC for well logging licensees that are capable of aggregating above a category 2 quantity of radioactive material to ensure a thorough evaluation of their strategies for controlling those materials.[a]

Report	Agency recommendation	Status
GAO-14-293	The Chairman of NRC should conduct an assessment of the trustworthiness and reliability process—by which licensees approve employees for unescorted access—to determine if it provides reasonable assurance against insider threats.	Closed – Implemented In November 2016, NRC staff completed an evaluation of NRC's trustworthiness and reliability process and stated that they were in the process of updating NRC's implementation guidance for Part 37 to include specific examples of information that could be collected in relation to employment, military service, education, and references regarding personal history disclosure during background investigations. In 2022, NRC published an updated version of its implementation guidance that included this information.
GAO-14-293	The Administrator of the National Nuclear Security Administration (NNSA), the Chairman of NRC, and the Secretary of the Department of Homeland Security (DHS) should review their existing collaboration mechanism for opportunities to enhance collaboration, especially in the development and implementation of new technologies.	Closed – Implemented In March 2015, DHS, NRC, and NNSA issued a joint statement affirming that they reviewed their existing collaboration mechanisms in response to our recommendation. These efforts included collaboration on efforts regarding radiological materials, nuclear security, and the Global Nuclear Detection Architecture (an interagency radiological security framework); updating the Nuclear Defense Research and Development Roadmap; and DHS use of details from both NNSA and NRC when working on-site to enhance collaboration between offices.
Nuclear Security: NRC Has Enhanced the Controls of Dangerous Radioactive Materials, but Vulnerabilities Remain, GAO-16-330	NRC should take the steps needed to include category 3 sources in the National Source Tracking System (NSTS) and add agreement state category 3 licenses to its online license database, the Web-based Licensing System (WBL) as quickly as reasonably possible.	Open In October 2016, the Commission directed staff to evaluate whether it is necessary to revise NRC security regulations or processes governing category 3 sources. In August 2017, NRC staff completed its analysis and recommended against NRC including category 3 sources in NSTS and adding agreement state category 3 licenses to WBL. Staff confirmed that NRC has no plans to implement these measures.
GAO-16-330	NRC should, at least until such time that category 3 licenses can be verified using its License Verification System (LVS), require that transferors of category 3 quantities of radioactive materials confirm the validity of a would-be purchaser's radioactive materials license with the appropriate regulatory authority before transferring any category 3 quantities of licensed materials.	Open NRC staff submitted a draft rule to the Commission in December 2022 that would have required licensees transferring category 3 quantities of radioactive material to verify purchaser licenses through LVS or the appropriate regulatory authority. In March 2024, the draft rule reached a 2–2 vote among the Commission, meaning the rule will not be proposed. NRC staff we spoke with stated NRC has no current plans to address this issue further.
GAO-16-330	NRC should, as part of the ongoing efforts of NRC working groups meeting to develop enhancements to the prelicensing requirements for category 3 licenses, consider requiring that an on-site security review be conducted for all unknown applicants of category 3 licenses to verify that each applicant is prepared to implement the required security measures before taking possession of licensed radioactive materials.	Closed – Implemented In 2019, NRC staff updated guidance that regulators are required to use for conducting pre-licensing site visits, including inspection checklists. The updated guidance clarifies what constitutes a known and unknown applicant and includes questions regarding applicants' ability to provide for adequate security.

Report	Agency recommendation	Status
Radioactive Sources: Opportunities Exist for Federal Agencies to Strengthen Transportation Security, GAO-17-58	The Chairman of NRC should take actions to collect information from licensees on the number of shipments and mode of transport for risk-significant radioactive sources—for example, by identifying the extent to which an existing NRC database (e.g., NSTS) may be used to capture this information.	Closed – Not implemented In comments on our report, NRC stated it disagrees with this recommendation. NRC stated that it currently collects the number of shipments and mode of transport for domestic transfers, and the import and export of category 1 and 2 quantities of radioactive material, and that this information provides NRC with an understanding of the potential modes of transport for category 1 and 2 quantities of radioactive material and existing regulatory requirements provide robust protection for all such modes. In a February 2018 report to Congress on actions NRC has taken in response to GAO recommendations, NRC stated that it does not consider the proposed additional information collection activity to be of sufficient safety or security benefit to justify the associated regulatory actions. We disagree, as discussed in our report, and consider this recommendation not implemented.
GAO-17-58	The Chairman of NRC, in consultation with the Secretary of Transportation and the Secretary of Homeland Security, should identify an approach to verify that motor carriers are meeting NRC's Part 37 security requirements applicable to transportation, for example by having Department of Transportation (DOT) inspectors verify compliance with NRC Part 37 security requirements during their on-site investigations.	Closed – Implemented In July 2018, NRC officials reported that they had implemented this recommendation by meeting internally and with federal partners to explore approaches to verify that motor carriers are meeting 10 C.F.R. Part 37 transportation security requirements. NRC officials reported that in the internal NRC meetings and in meetings NRC held with DOT, staff determined that the existing methods being employed to verify that motor carriers are implementing security requirements provide reasonable assurance that the requirements are being met.
Combating Nuclear Terrorism: NRC Needs to Take Additional Actions to Ensure the Security of High-Risk Radioactive Material, GAO-19-468	The Chairman of NRC should direct NRC staff to consider socioeconomic consequences and fatalities from evacuations in the criteria for determining what security measures should be required for radioactive materials that could be used in a radiological dispersal device.	Open In its 2019 comments in response to this report, NRC disagreed with this recommendation, stating that its regulatory requirements provide for the safe and secure use of radioactive materials. Moreover, the agency argued that postulated fatalities from evacuation should not be considered, as the recommended protective action in response to a dirty bomb would be to shelter in place. In a written update on the status of our recommendations that NRC sent to GAO in February 2024, NRC stated it does not plan to implement this recommendation.
GAO-19-468	The Chairman of NRC should require additional security measures for high-risk quantities of certain category 3 radioactive material, and assess whether other category 3 materials should also be safeguarded with additional security measures.	Open As of February 2024, NRC disagrees that additional security measures beyond what is currently in place are necessary.

Report	Agency recommendation	Status
GAO-19-468	The Chairman of NRC should require all licensees to implement additional security measures when they have multiple quantities of category 3 americium-241 at a single facility that in total reach a category 1 or 2 quantity of material.	Open NRC disagrees with this recommendation and maintains that its current security controls are sufficient, including additional licensing guidance that NRC issued in response to GAO-14-293. However, NRC also did not change any of its requirements in response to the recommendation. We therefore consider this recommendation open.
Preventing a Dirty Bomb: Vulnerabilities Persist in NRC's Controls for Purchases of High-Risk Radioactive Materials, GAO-22-103441	The Chairman of NRC should immediately require that vendors verify category 3 licenses with the appropriate regulatory authority.	Open NRC staff submitted a draft rule to the Commission in December 2022 that would have required licensees transferring category 3 quantities of radioactive material to verify purchaser licenses through LVS or the appropriate regulatory authority. In March 2024, the draft rule reached a 2–2 vote among the Commission, meaning the rule will not be proposed. NRC staff we spoke with stated NRC has no current plans to address this issue further.
GAO-22-103441	The Chairman of NRC should add security features to its licensing process to improve its integrity and make it less vulnerable to altering or forging licenses. These security features could include multifactor authentication or moving away from paper licenses to electronic-based licensing.	Open In its agency comments, NRC stated it agreed with this recommendation. NRC staff submitted a draft rule to the Commission in December 2022 that would provide additional guidance to regulators and licensees that would reduce the potential for altered or forged documents to be used in acquiring category 3 sources. In March 2024, the draft rule reached a 2–2 vote among the Commission, meaning the rule will not be proposed. NRC staff we spoke with stated that, separate from measures proposed in the draft rule, NRC staff are conducting a cost-benefit analysis on adding certain security features to the licensing system.
High-Risk Radioactive Material: Opportunities Exist to Improve the Security of Sources No Longer in Use, GAO-24-105998	The Chairman of the NRC, in coordination with the Department of Energy and in consultation with other relevant stakeholders, should conduct an analysis to evaluate options and take action to facilitate long-term storage, within agency authorities, to better secure foreign-origin americium-241 until a permanent disposal or viable recycling option is available.	Open In July 2024, NRC officials stated that current regulations and oversight programs facilitate licensees' safe, long-term storage of sources awaiting a disposal pathway. They stated that NRC will continue to participate in relevant interagency activities, but that NNSA is the appropriate agency to lead and conduct any analysis required to develop a disposition solution. If required, NRC is prepared to license a facility that NNSA determines is a viable option to store foreign-origin americium-241.

Report	Agency recommendation	Status
GAO-24-105998	The Chairman of the NRC should comprehensively assess leading practices that, if implemented, would minimize the time that disused sources are in a licensee's possession. These practices include financial assurances for all category 1, 2, and 3 sources; tracking of category 3 sources; possession time limits or fees for disused sources; and orphan source funds.	Open In July 2024, NRC officials stated NRC will evaluate 1) the merits and practicality of time limits and fees for sources not actively being used and 2) authorities required to establish an orphan source fund. NRC staff are also currently developing a regulatory basis for a rulemaking that would consider whether financial assurance requirements should be extended to category 3 sources. However, in December 2021, the Commission opted not to amend its regulations to require inclusion of category 3 sources in NSTS.

Source: GAO reports, GAO interviews with NRC officials, and NRC documentation. | GAO-24-107014

[a]A category 1 quantity of a given radionuclide—the most dangerous—is defined as an amount 1,000 times or more than the amount necessary to cause permanent human injury; a category 2 quantity is defined as an amount at least 10 times but less than 1,000 times the amount necessary to cause permanent human injury.

Table 3: Selected GAO Radiological Security Recommendations to the National Nuclear Security Administration (NNSA)

Report	Agency recommendation	Status
Nuclear Nonproliferation: Additional Actions Needed to Improve Security of Radiological Sources at U.S. Medical Facilities, GAO-12-925	The NNSA Administrator, in consultation with the Chairman of the Nuclear Regulatory Commission (NRC) and agreement state officials, should increase outreach efforts to promote awareness of and participation in NNSA's security upgrade program. Special attention should be given to medical facilities in urban areas or in close proximity to urban areas that contain medical equipment with high-risk radiological sources.	Closed – Implemented In May 2014, NRC published "Physical Security Best Practices for the Protection of Risk-Significant Radioactive Material," which includes a comprehensive appendix on NNSA's voluntary security upgrade program. In August 2016, NNSA officials told us they increased outreach efforts to promote awareness of and participation in the program.
Nuclear Nonproliferation: Additional Actions Needed to Increase the Security of U.S. Industrial Radiological Sources, GAO-14-293	The Administrator of NNSA, the Chairman of NRC, and the Secretary of the Department of Homeland Security (DHS) should review their existing collaboration mechanism for opportunities to enhance collaboration, especially in the development and implementation of new technologies.	Closed – Implemented In March 2015, DHS, NRC, and NNSA issued a joint statement affirming that they reviewed their existing collaboration mechanisms in response to our recommendation. These efforts included collaboration on efforts regarding radiological materials, nuclear security, and the Global Nuclear Detection Architecture (an interagency radiological security framework); updating the Nuclear Defense Research and Development Roadmap; and DHS use of details from both NNSA and NRC when working on-site to enhance collaboration between offices.
Combating Nuclear Smuggling: NNSA's Detection and Deterrence Program Is Addressing Challenges but Should Improve Its Program Plan, GAO-16-460	The Administrator of the NNSA should direct the Office of Nuclear Smuggling Detection and Deterrence (NSDD) to develop a more detailed program plan that clearly articulates when and how it will achieve its goals, including completing key activities such as the deployment of radiation detection equipment to partner countries and having these countries fully fund the sustainment and maintenance of this equipment. The plan could include measurable goals for all of NSDD's key activities and performance measures that align with these goals, criteria and guidance for identifying partner countries that may require additional financial assistance, determining when changing conditions may warrant adjusting program activities, or identifying any program activities that could help maintain sustainability.	Closed – Implemented NNSA concurred with the recommendation. In February 2017, NSDD issued a revised program plan that more clearly articulates how and when it will achieve its goals and complete key activities. The plan also provides additional guidance on factors the program will take into consideration to determine whether or not a partner country may require additional financial assistance to operate, maintain, and sustain the NSDD-provided radiation detection equipment.

Source: GAO reports and documentation. | GAO-24-107014

Table 4: Selected GAO Radiological Security Recommendations to Department of Homeland Security (DHS) Countering Weapons of Mass Destruction Office (CWMD)

Report	Agency recommendation	Status
Combating Nuclear Smuggling: Lessons Learned from Cancelled Radiation Portal Monitor Program Could Help Future Acquisitions, GAO-13-256	For cancelled acquisition programs, the Secretary of Homeland Security should make lessons learned reviews an institutional requirement, such as through an agency directive or order or other appropriate means.	Closed – Implemented In November 2014, DHS issued its "Lessons Learned Standard Operating Procedure." This document, combined with Management Directive 102-01, makes conducting lesson learned reviews a formal requirement for DHS acquisitions.
GAO-13-256	For cancelled acquisition programs, the Secretary of Homeland Security should put documented processes in place to ensure that component agencies conduct timely lessons learned reviews.	Closed – Implemented In November 2014, DHS issued its "Lessons Learned Standard Operating Procedure." This document, combined with Management Directive 102-01, makes conducting lesson learned reviews a formal requirement for DHS acquisitions. This document also sets the expectation that component agency program managers provide any lessons learned to their Component Acquisition Executive if lessons learned are observed during any/all phases of the acquisition life cycle.
GAO-13-256	For cancelled acquisition programs, the Secretary of Homeland Security should prepare and submit lessons learned reports.	Closed – Implemented In November 2014, DHS issued its "Lessons Learned Standard Operating Procedure." This document, combined with Management Directive 102-01, makes conducting lesson learned reviews a formal requirement for DHS acquisitions, and establishes a process for component DHS agencies to prepare and submit lessons learned reports.
GAO-13-256	For cancelled acquisition programs, the Secretary of Homeland Security should complete and implement plans to disseminate lessons learned reports throughout the department.	Closed – Implemented In November 2014, DHS issued its "Lessons Learned Standard Operating Procedure." This document, combined with Management Directive 102-01, makes conducting lesson learned reviews a formal requirement for DHS acquisitions, and implements a process to disseminate lessons learned throughout the department.
Nuclear Nonproliferation: Additional Actions Needed to Increase the Security of U.S. Industrial Radiological Sources, GAO-14-293	The Administrator of the National Nuclear Security Administration (NNSA), the Chairman of the Nuclear Regulatory Commission (NRC), and the Secretary of Homeland Security should review their existing collaboration mechanism for opportunities to enhance collaboration, especially in the development and implementation of new technologies.	Closed – Implemented In March 2015, DHS, NRC, and NNSA issued a joint statement affirming that they reviewed their existing collaboration mechanisms in response to our recommendation. These efforts included collaboration on efforts regarding radiological materials, nuclear security, and the Global Nuclear Detection Architecture (GNDA), an interagency radiological security framework; updating the Nuclear Defense Research and Development Roadmap; and DHS use of details from both NNSA and NRC when working on-site to enhance collaboration between offices.

Report	Agency recommendation	Status
Combating Nuclear Smuggling: DHS Research and Development on Radiation Detection Technology Could Be Strengthened, GAO-15-263	The Secretary of Homeland Security should instruct the Director of the Domestic Nuclear Detection Office (DNDO)[a] to develop a systematic approach for evaluating how the outcomes of its research and development projects collectively contribute to addressing the overall research challenges of the directorate that conducts research and development related to radiation and nuclear detection to support the GNDA, the Transformational and Applied Research Directorate.	Closed – Implemented The Transformational and Applied Research Roadmap and Implementation Strategy for fiscal years 2016 through 2021 outlines a strategy for evaluating the outcomes of the Directorate's research portfolio. Specifically, the Directorate will sponsor a biennial independent review of its entire research and development portfolio using an assessment framework consisting of ten metrics tied to impact and feasibility
GAO-15-263	The Secretary of Homeland Security should instruct the Director of DNDO to document the Transformational and Applied Research Directorate's rationale for prioritizing and selecting research topics.	Closed – Implemented The Transformational and Applied Research Roadmap and Implementation Strategy for fiscal years 2016 through 2021 describes priorities and the rationale for selecting its research topics.
GAO-15-263	The Secretary of Homeland Security should instruct the Director of DNDO to develop documentation, such as a research road map and strategy, that clearly defines how the Transformational and Applied Research Directorate's research investments align with its research challenges and gaps in the GNDA and describes how the Directorate will address its research challenges.	Closed – Implemented On November 25, 2015, DNDO published the Transformational and Applied Research Roadmap and Implementation Strategy for fiscal years 2016 through 2021. This strategy describes how research projects in the Directorate are selected, monitored, and evaluated, and how the Directorate's research investments are related to its research challenges and gaps in the GNDA.
Combating Nuclear Terrorism: DHS Should Address Limitations to Its Program to Secure Key Cities, GAO-19-327	For cities partnered with the metropolitan radiological security program, Securing the Cities (STC), the Assistant Secretary of CWMD should ensure that the Office regularly collects detailed information from cities on expenditures made using program funds and compares that information to approved purchase plans to ensure that these funds were spent as approved, consistent with program goals, and that the expenditures are in keeping with the objectives of the program.	Closed – Implemented In October 2021, CWMD provided GAO with its Securing the Cities Annual Program Expenditures Review Plan. This plan lays out a review process to ensure expenditures are consistent with approved purchase plans and overall STC program goals and objectives. Among other things, the plan directs the STC National Program Office to monitor expenditures from each of the STC program regions. On a quarterly basis, the STC National Program Office assesses regional offices' expenditures against respective budgets and purchase plans by expenditures across award object categories.
GAO-19-327	The Assistant Secretary of CWMD should more fully assess cities' performance by collecting information from cities on achieving key performance metrics and STC program milestones and enforcing reporting requirements on performance during exercises.	Closed – Implemented In June 2021, CWMD issued its STC Implementation Plan that lays out key performance metrics, program milestones, and expected deliverables that CWMD will collect from each city in the program. Additionally, CWMD is developing a Homeland Security Exercise and Evaluation Program that will be consistent with its Multi-Year Training and Exercise Plan.
GAO-19-327	The Assistant Secretary of CWMD should analyze risks related to sustaining detection capabilities, work with cities to address these risks, and enforce sustainment planning requirements for future cities.	Closed – Implemented In June 2021, CWMD issued its STC Implementation Plan. That plan provides that CWMD will take responsibility for funding sustainment activities for the technologies deployed by the STC program.

Report	Agency recommendation	Status
GAO-19-327	The Assistant Secretary of CWMD should clearly communicate to cities how the existing STC program will operate until a new program is developed and implemented.	Closed – Implemented In June 2021, CWMD issued its STC Implementation Plan. That plan articulates how the program will operate. According to CWMD officials, the plan has been circulated to all of the STC cities in the program.
Countering Weapons of Mass Destruction: DHS Could Improve Its Acquisition of Key Technology and Coordination with Partners, GAO-22-104498	The Assistant Secretary for CWMD should coordinate with U.S. Customs and Border Protection (CBP) to reassess its current acquisition strategy for replacement radiation portal monitors—a piece of equipment that detects radiation—to ensure that the selected technology or technologies meet CBP's needs, including with respect to nuisance alarm rates.	Closed – Implemented CWMD reassessed its acquisition strategy and decided not to pursue a second phase of radiation portal monitor acquisition that CWMD had been pursuing when the report was issued. CWMD continues to acquire radiation portal monitors under the ongoing first phase of the acquisition and to pursue reduction of nuisance alarm rates.
GAO-22-104498	The Assistant Secretary for CWMD should specify, in the new strategic plan for the GNDA, steps to reconstitute the capability gap analysis function, a strategy for outreach to key stakeholders in reconstituting this function, and time frames for the completion of the capability gap assessments.	Open – Partially addressed In December 2022, CWMD provided us the GNDA strategy, which establishes goals for completion between 2023–2027. These include analyzing GNDA for vulnerabilities and capability gaps. It does not yet have specific time frames for completion nor say how it will conduct outreach to stakeholders at the federal, state, local, tribal, and territorial levels.
GAO-22-104498	The Assistant Secretary for CWMD should specify in CWMD's State, Local, Tribal, and Territorial Engagement Strategy how often CWMD will convene its state and local partners in the chemical, biological, radiological, and nuclear threat areas.	Closed – Implemented In July 2022, CWMD released its State, Local, Tribal, and Territorial Engagement Strategy Plan for fiscal years 2022–2025. It specifies that state, local, tribal, and territorial stakeholders across threat areas will convene at least annually. Additionally, CWMD will hold 10–15 exercises yearly for its biological security program, BioWatch; biannual technical sessions for BioWatch and STC radiological and nuclear partners; and one to two chemical defense workshops per year.
GAO-22-104498	The Assistant Secretary for CWMD should develop and document a formal process for resolving complaints about CWMD contractors.	Closed – Implemented As of November 2022, CWMD updated the grant agreements signed by state, local, tribal, and territorial partners beginning in fiscal year 2023 to include language that grant recipients do not have to tolerate any unprofessional behavior and to provide federal points of contact in CWMD to whom complaints may be reported.

Source: GAO reports and documentation. | GAO-24-107014

[a]The Domestic Nuclear Detection Office's functions were incorporated into the Countering Weapons of Mass Destruction Office in 2017.

Table 5: Selected GAO Radiological Security Recommendations to U.S. Customs and Border Protection (CBP)

Report	Agency recommendation	Status
Nuclear Security: CBP Needs to Take Action to Ensure Imported Radiological Material Is Properly Licensed, GAO-18-214	The Commissioner of CBP should develop a monitoring system to help ensure officials comply with license verification policies and procedures.	Closed – Implemented In September 2020, CBP provided documentation outlining how it is augmenting its monitoring system to better adhere to license verification policies and procedures. The updated system centralizes monitoring license verification and provides officials within CBP's Laboratories and Scientific Services access to the license verification process without being prompted by Field Officers at point of entry.
GAO-18-214	The Commissioner of CBP should conduct a comprehensive assessment of information not included in the automated alert to determine what information is needed to identify licensable radiological material.	Closed – Implemented In January 2018, CBP provided GAO with "Assessment of Nuclear Security: CBP's Verification of Licenses for Radiological Materials." This analyzed CBP data related to radiological material shipments and license verification and incorporated feedback from identified CBP program offices.
GAO-18-214	The commissioner of CBP should develop a system that better identifies shipments of radiological material that pose the greatest risk and revise policies and procedures as necessary to verify licenses for these shipments.	Closed – Implemented In May 2021, CBP provided GAO documentation demonstrating that it had developed a tiered set of rules that better identifies shipments of radioactive material. The tiers allow for additional targeting of shipments of higher risk to verify licenses. CBP also provided us Directive 5290-015C, which was updated with policies and procedures for license verifications.

Source: GAO reports and documentation. | GAO-24-107014

Appendix II: Comments from the Nuclear Regulatory Commission

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

September 18, 2024

Allison Bawden, Director
Natural Resources and Environment Office
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20003

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION COMMENTS ON DRAFT REPORT GOVERNMENT ACCOUNTABILITY OFFICE REPORT GAO-24-107014, "PREVENTING A DIRTY BOMB: NUCLEAR REGULATORY COMMISSION HAS NOT TAKEN STEPS TO ADDRESS CERTAIN RADIOLOGICAL SECURITY RISKS"

Dear Director Bawden:

Thank you for the opportunity to review and comment on the United States Government Accountability Office (GAO) draft report GAO-24-107014, "Preventing a Dirty Bomb: Nuclear Regulatory Commission Has Not Taken Steps to Address Certain Radiological Security Risks," which was received on August 15, 2024.

The U.S. Nuclear Regulatory Commission (NRC) appreciates the GAO's work on this engagement and recognition of the NRC's current regulatory mission and role, and respects the GAO's decision to make two recommendations to Congress. We continue to consider prompt fatalities and deterministic health effects from radiation as the primary consequences of concern for the purposes of assessing risk. The NRC maintains that the current regulatory requirements provide safe and secure use of radioactive materials, regardless of their category. We encourage the GAO to consider the conclusions of the 2022 Radiation Source Protection and Security Task Force (Task Force), which is comprised of independent experts from 14 Federal agencies and one State organization, and whose reports represent the coordinated Federal consensus on source security in the United States. The Task Force has determined that the existing list of radioactive materials and activity thresholds remain appropriate as the framework for identifying sources that warrant enhanced security and protection. In the 2022 Task Force Report (Agencywide Documents Access and Management System (ADAMS) Accession No. ML22213A157), the Task Force also concluded that, "there are no significant gaps in the area of radioactive source protection and security that are not already being addressed through interagency cooperation and actions." The NRC staff also has comments and corrections to certain statements made in the draft report, which can be found in the enclosure.

A. Bawden 2

If you have any questions or need additional information, please contact me or have your staff contact John Jolicoeur, Executive Technical Assistant, Office of the Executive Director for Operations, at (301) 415-1642 or by email at John.Jolicoeur@nrc.gov.

Sincerely,

Mirela Gavrilas, PhD
Executive Director for Operations

Accessible Text for Appendix II: Comments from the Nuclear Regulatory Commission

September 18, 2024

Allison Bawden, Director
Natural Resources and Environment Office
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20003

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION COMMENTS ON DRAFT REPORT GOVERNMENT ACCOUNTABILITY OFFICE REPORT GAO-24-107014, “PREVENTING A DIRTY BOMB: NUCLEAR REGULATORY COMMISSION HAS NOT TAKEN STEPS TO ADDRESS CERTAIN RADIOLOGICAL SECURITY RISKS”

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Sincerely,

Mirela Gavrilas, PhD
Executive Director for Operations

Appendix III: GAO Contacts and Staff Acknowledgments

GAO Contacts

Allison Bawden, (202) 512-3841 or bawdena@gao.gov

Staff Acknowledgments

In addition to the contact named above, Ned Woodward (Assistant Director), David Wishard (Analyst in Charge), James Arp, Jeffrey Barron, William Bauder, Antoinette Capaccio, Michael Hoffman, Cindy Gilbert, Gwendolyn Kirby, Joseph Kirschbaum, Joseph Maher, Triana McNeil, Celia Rosario Mendive, Susan Murphy, Erin O'Brien, Sara Sullivan, Sarah Turpin, and Michael Volgman-Mercuri made key contributions to this report.

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