

**Paper No. 4052 Multijurisdictional Response to Lost and Stolen
Radioactive Material**

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Abstract

The United States (U.S.) framework for security and control of radioactive sources requires multijurisdictional coordination. Specifically, the national system for recovery of lost and stolen radioactive sources is a cooperative effort between the Federal government, State government, law enforcement agencies, and the private sector. This national system and its capabilities are founded on the principle of protecting both public health and national security. These programs address a wide range of situations involving excess or unwanted sealed sources, as well as lost, stolen, abandoned, or missing sources. The Nuclear Regulatory Commission (NRC), in partnership with Agreement State regulators, has enhanced the security and control measures for licensees across the U.S. with Category 1 and 2 quantities of radioactive sources listed in the International Atomic Energy Agency (IAEA) Code of Conduct on the Safety and Security of Radioactive Sources. Compliance with these measures minimizes the likelihood of loss or theft of such radioactive material. In the event of loss or theft, however, licensees have the primary responsibility to recover missing material and must provide timely incident reports to regulators. This paper will focus on past events, the various notifications, incident responses, and recovery operations of missing material that involves a multitude of agencies such as local law enforcement, State radiation control programs, the NRC, and the Federal Bureau of Investigation. A case study of a stolen radiography camera in Texas provides an illustrative example of the extensiveness of the processes related to theft of IAEA Category 2 quantity of radioactive material.

Introduction

The national system for recovery of lost and stolen sources is a cooperative and well-coordinated effort between the Federal Government, States, and private sector. It includes licensees authorized to possess and use radioactive sources; regulatory agencies, such as Agreement State¹ radiation control programs and the U.S. Nuclear Regulatory Commission (NRC); response agencies, including the Department of Energy (DOE), the Department of Homeland Security (DHS), and the Environmental Protection Agency (EPA); and Federal, State, and local law enforcement agencies (LLEA).

The system and its capabilities are founded on the principle of protecting public health and safety and national security. Programs are not designed to deal only with lost and stolen sources, but also address situations involving excess and unwanted sources as well as abandoned and missing sealed sources. These materials are commonly referred to as “orphan” sources. A number of Federal agencies have resources available to support local emergency operations to recover orphan sources when they are found. The response initiatives and the extent of multijurisdictional involvement is graded upon the type and activity of the orphaned source. A more extensive and coordinated response is put into place for the loss or theft of risk-significant radioactive material, which is defined in 10 CFR Part 37, “Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material,” as quantities or sources greater than or equal to Category 2². 10 CFR Part 37 establishes security requirements in the U.S. for the use and transport of Category 1 and 2 quantities of radioactive material.

Reporting Requirements

Reporting theft or loss of radioactive materials has been a long standing requirement for NRC and Agreement State licensees, and these reporting requirements are found in 10 CFR Part 20, “Standards for Protection Against Radiation”³. For risk-significant radioactive materials, 10 CFR Part 37

¹ Agreement States are those States that have entered into formal agreements with the NRC, pursuant to Section 274 of the Atomic Energy Act of 1954 (AEA) (Public Law 83 703), to regulate certain quantities of AEA material at facilities located within their borders. Under the Act, the U.S. Nuclear Regulatory Commission relinquishes to the States portions of its regulatory authority to license and regulate byproduct materials (radioisotopes), source materials (uranium and thorium), and certain quantities of special nuclear materials. Currently, there are 37 Agreement States.

² The Category 1 and 2 thresholds are based on the quantities established by the International Atomic Energy Agency (IAEA) in its *Code of Conduct on the Safety and Security of Radioactive Sources*, to which the United States made a political commitment and the NRC endorsed.

³ 10 CFR 20, Subpart M, requires licensees to report to the NRC (or appropriate Agreement State) immediately when the occurrence of any lost, stolen, or missing licensed material becomes known. Category 1 and 2 materials are included in the quantities of licensed material subject to this reporting requirement.

imposes reporting requirements⁴ beyond those of 10 CFR Part 20 related to attempted or actual theft, sabotage or diversion of material. The NRC collects the information related to these 10 CFR Part 20 and Part 37 event reports within the Nuclear Materials Events Database (NMED).

Reporting Results

Most reports of lost or stolen material involve small or short-lived radioactive sources that are not a significant risk to public health or useful for terrorist purposes. As a result, most reports of lost or stolen sources do not result in the need to initiate emergency response efforts.

Between the timeframe of issuance of the majority of Security Orders⁵ and including early implementation of 10 CFR Part 37 (October 1, 2005 – March 18, 2016), there have been 34 events involving the loss or theft of risk-significant radioactive material which were reported in NMED.

Although the number of risk-significant lost and stolen radioactive sources is very low given the large number of sources in use and in transit in the United States (approximately 77,000 Category 1 and 2 sources), the NRC takes each of these events very seriously. The NRC, in partnership with the Agreement State regulators, has enhanced the security and control measures of these sources as a means of further reducing the number of those lost and stolen. These measures are in place for all licensees throughout the United States. The NRC and the Agreement States routinely inspect those licensees to verify compliance with these requirements.

⁴ 10 CFR 37.57 requires licensees to (1) immediately notify the LLEA after determining that an unauthorized entry resulted in an actual or attempted theft, sabotage, or diversion of a Category 1 or Category 2 quantity of radioactive material and (2) assess any suspicious activity related to possible theft, sabotage, or diversion of Category 1 or Category 2 quantities of radioactive material and notify the LLEA as appropriate. For events or activities in which the LLEA is notified, licensees are also required to make a report to the NRC and/or the appropriate Agreement State authority within 4 hours.

⁵ Security Orders were imposed on different classes of licensees, phased in from highest to lowest risk. As the NRC and Agreement States made efforts toward the long-term security provisions necessary to ensure public health and safety, the additional security requirements imposed by the Orders were used as the starting basis for the development of 10 CFR Part 37, which was published on March 19, 2013. NRC licensees were required to implement 10 CFR Part 37 no later than March 19, 2014, and the Agreement States implemented 10 CFR Part 37-compatible requirements on or before March 19, 2016. The Orders have since been rescinded, and have been effectively replaced by 10 CFR Part 37-compatible requirements.

Theft of Category 1 and 2 Radioactive Materials

Since May 2006, there have been zero thefts of Category 1 radioactive materials and six thefts of Category 2 radioactive materials. All six reported thefts of Category 2 radioactive materials were of radiography cameras containing Iridium-192 (Ir-192):

- In 2006, a truck was stolen with a radiography device on board. While transporting the radiography device, the radiographers stopped at a gas station/convenience store. One radiographer went into the store and left the other radiographer with the vehicle and device. While the first radiographer was in the store, the second radiographer decided to go into the store as well, leaving the vehicle unlocked with the keys on the floorboards. The vehicle, along with the source, was stolen. The perpetrator was apprehended and the vehicle and intact device were recovered by local police.
- In 2006, a truck was stolen with a radiography device on board. While the radiographer rested at a hotel, the device was stored in the vehicle in the parking lot. The keys to the vehicle and the darkroom were left in the vehicle door, and the vehicle immobilization device and monitoring system were not activated. The abandoned vehicle and intact device were later recovered by local police.
- In 2011, a truck was broken into and a radiography device stolen. Radiographers locked the device in the darkroom and locked the darkroom, but the vehicle's tailgate was left unlocked, and the alarm was not activated. The radiographers were staying in a hotel overnight and parked the truck storing the device in the parking lot. During the night, the darkroom was broken into and the device stolen. The device has not been recovered. Response efforts to this event are described in further detail in the Case Study section of this paper.
- In 2012, a truck was broken into and a radiography device stolen. The radiographer returned to the company's main location and failed to transfer the radiography device from the truck to the company storage vault. Several vehicles at the company were broken into, and the device was among the items stolen. Surveillance video at the company identified the vehicle of the perpetrator. The device was recovered intact by police in the vehicle at the perpetrator's residence.
- In 2015, a truck was stolen with a radiography device on board. While transporting the radiography device, the radiography crew stopped at a convenience store. The crew went inside the store and left the keys within the unlocked vehicle. The radiography company used their truck Global Positioning System tracking device to locate the vehicle, and the perpetrators abandoned the vehicle when the radiographers showed up. The device was recovered intact.

- In 2015, an employee theft occurred. A radiographer with a vehicle and device did not report to the job site, and attempts to contact him were unsuccessful. The company contacted family members and co-workers, checked travel routes, and checked the job site for the no-show radiographer. Late that evening the radiographer drove to his father's house in the vehicle with the device. The vehicle and intact device were returned to the company's Radiation Safety Officer by the radiographer's father.

These events exemplify that all of the thefts were attributed to compliance issues and that crimes of opportunity can occur when sources are not secured properly in accordance with regulations.

Other Reportable Category 1 and 2 Radioactive Materials Events

Events that can impact public health and safety but do not have a correlation to criminal or suspicious activity are also reported and tracked. This includes incidents where sources have fallen off/out of a truck, been left at a job site, left in a vehicle, lost by the shipping company, or were otherwise unattended. Although there is a common perception that sources being left unattended is a frequent occurrence, given the number of radioactive sources in use and in transit in the United States, incidents are actually not very common. Not including the six actual thefts discussed above, since 2006, there have been 29 such incidents reported that involved risk-significant radioactive material. Some of these reports were of instances where devices were inadvertently left unattended for some period of time (e.g., left at a jobsite, or left unlocked in storage, etc.) but were retrieved. Often, they resulted from shipments that were not received when anticipated but were ultimately located and delivered correctly (13 of the 29 events). Of this population of events, there were only two that involved Category 1 quantities of radioactive material, both of which were shipping errors. All of these sources were ultimately accounted for and none of these events were security-related.

Response

The existing regulatory framework requires licensees to secure and control radioactive material at all times to reduce the potential for lost or stolen sources. This framework requires routine inventory checks to ensure early discovery of lost or stolen sources. Timely reporting is also required for lost or stolen sources so that recovery operations may be initiated as soon as possible. Federal, State, and local Governments frequently work together to investigate and recover lost or stolen sources. The

Nuclear/Radiological Incident Annex of the National Response Plan⁶ describes the coordinated response by U.S. Federal Government agencies to incidents involving radioactive material. In response to reports of lost or stolen risk-significant radioactive sources, the NRC Headquarters Operations Center⁷ follows set procedures for acquiring information and determining the seriousness of the incident. The NRC or Agreement State authority conducts an assessment to determine the appropriate response, and, for instances of loss or theft of risk-significant radioactive materials, typically conducts a reactive inspection. The NRC and/or Agreement State regulator evaluates each report to ensure that appropriate entities are notified (beyond LLEA) such as the Federal Bureau of Investigation (FBI) and DHS, and to use combined intelligence capabilities to track trends in activities that could lead to malicious activities against the United States. Agreement State radiation control programs must transmit reports of a theft or loss of risk-significant radioactive sources to the NRC within 24 hours of the initial report, but the Agreement State radiation control programs make their own assessment of the seriousness of the incident and the potential need for Federal assistance.

If the lost or stolen source is risk significant, there will be additional NRC Headquarters Operations Center response procedures implemented. This response action is to provide situational awareness to internal NRC organizations and external agencies that have expertise and authority to take further actions if deemed necessary.

The owner/licensee of a lost or stolen radioactive source is primarily responsible for mitigating the consequences of the loss of material control and for providing notification and appropriate protective action recommendations to State, local, and/or tribal Government officials to minimize the radiological hazard to the public. The owner/licensee of a lost or stolen radioactive source has primary responsibility for actions within the licensee's facility boundary or work area and may also have responsibilities for response and recovery activities under applicable legal obligations. State, local, and tribal Governments are responsible for determining and implementing measures to protect life, property, and the environment in those areas outside the incident location.

⁶ The Nuclear/Radiological Incident Annex to the National Response Framework describes the policies, situations, concepts of operations, and responsibilities of the Federal departments and agencies governing the immediate response and short-term recovery activities for incidents involving release of radioactive materials to address the consequences of the event. These incidents may occur on Federal-owned or -licensed facilities, privately owned property, urban centers, or other areas and may vary in severity from the small to the catastrophic. The incidents may result from inadvertent or deliberate acts. The document applies to incidents where the nature and scope of the incident requires a Federal response to supplement the State, tribal, or local incident response.

⁷ The NRC Headquarters Operations Center is the primary center of communication and coordination among the NRC, its licensees, State and tribal agencies, and other Federal agencies, regarding operating events involving nuclear reactors or materials. It is located in Rockville, MD, and is staffed 24 hours a day by employees trained to receive and evaluate event reports and coordinate incident response activities.

The NRC also maintains close communications with nuclear regulators in Canada and Mexico as part of a trilateral agreement with these countries. Specifically, government officials in those countries receive notice of all lost or stolen sources occurring in States contiguous to U.S. international borders with Canada or Mexico. Also, at legal ports of entry, Customs and Border Protection (CBP) and Immigration and Customs Enforcement (ICE) officials will interdict when lost or stolen sources are identified. For maritime scenarios, the Global Maritime Operational Threat Response Coordination Center, which is comprised of multiple United States Federal agencies, will respond. For lost or stolen sources in an international scenario, the State Department will monitor the event to determine if a threat exists for the United States that would trigger further action.

The responsibilities of the NRC, EPA, DOE, States, and other Federal agencies often overlap when dealing with lost or stolen sources in both the private and public sectors. This overlap affords a strong partnership allowing each agency to provide unique resources when responding to a radiological incident. In accordance with the National Response Plan, the NRC is usually the coordinating agency, with DOE and EPA acting as cooperating agencies in non-Agreement States. Agreement State radiation control programs have the lead when responding to reports of lost or stolen material within their State.

The National Response Plan designates the EPA as the coordinating agency for emergency response to incidents involving unknown radiological materials or materials not licensed or owned by a Federal agency or an Agreement State. If the source involved in an incident is traced to an NRC licensee, the NRC is the lead for response. If the source is traced to an Agreement State licensee, the Agreement State radiation control program has the lead. If the source involved in an incident is traced to DOE or Department of Defense ownership, those agencies have the lead for response. In a terrorist event such as a radiological dispersal device, the FBI would have the initial role as coordinating agency. The FBI operates both as a law enforcement and a domestic intelligence agency, and it is the lead investigative agency for the Federal Government.

The Domestic Nuclear Detection Office (DNDO) of DHS coordinates domestic efforts to detect and report instances of illicit trafficking. DNDO reviews and disseminates information related to lost and stolen radioactive sources and intelligence reports that identify cases of illicit trafficking and ensures that the appropriate domestic response protocols are implemented. On the front-end, DNDO also coordinates efforts to build an architecture capable of detecting lost and stolen sources. DNDO's efforts also include testing existing detectors, improving technology for detection of illicit trafficking of nuclear and radioactive material, and providing training on the use of detector systems.

Each of these Federal agencies can provide emergency response support to States and municipalities for radiological incidents upon request. Trained teams at a number of DOE sites, EPA laboratories,

military bases, and other government programs and facilities provide support such as; response coordination and logistics support, monitoring and assessment, law enforcement and forensics support, aerial measurements and detection, decontamination and waste disposal, medical treatment, and health physics consultation. The level of Federal response to a specific incident varies based on the resources and ability of State, local, and tribal officials to respond, the type and/or amount of radioactive material involved, and the extent of the actual or potential impact on the public and the environment.

In situations where lost or abandoned radioactive material is found, State radiation control programs, LLEA, or EPA can take immediate actions to secure the material. The NRC cannot take possession of material, but it can facilitate the disposition and efforts to identify an owner. If an owner cannot be established, the NRC or Agreement State radiation control program can request that DOE or EPA recover and dispose of the material. Proactively, the National Nuclear Security Administration (NNSA)/DOE operates the Offsite Source Recovery Project (OSRP), which recovers registered unwanted, abandoned, or orphaned domestic radioactive sealed sources that could pose a security or public health and safety threat to prevent loss or theft. Recovered sources are moved to safe and secure storage or disposal. In the history of OSRP, there have been very few incidents where sealed sources required recovery because they were lost or abandoned by the licensee.

Given the specifics of each event or incident, including the material type and location, different assets will be utilized by the local, State, and Federal authorities. The incident included in the following case study shows how certain resources and multiple authorities can work together to safeguard public health and safety. Effort has been made to present actions in the order in which they occurred, but often multiple contacts and actions were occurring simultaneously.

Case Study: Search and Recovery Efforts by the State of Texas to Locate Stolen Radiography Camera Source

On July 19, 2011, a radiography camera containing a 33.7 curie Ir-192 (Category 2) source was stolen from a radiography truck in a hotel parking lot. The radiographers were staying in a hotel overnight and stored the device in the truck parked in the parking lot. The radiographers locked the device in the darkroom and locked the darkroom, as a means to comply with having two independent physical controls that form tangible barriers to secure the material from unauthorized removal when the device is not under direct control and constant surveillance by the licensee. However, the vehicle's tailgate was left unlocked, and the intrusion detection system was not activated. Overnight, the darkroom was broken into and the device and other tools were stolen.

The licensee contacted their regulatory authority, the Texas Department of State Health Services (DSHS), and the LLEA, the Austin Police Department (APD), who responded to the scene. The

DSHS also notified the Texas Association of Pawnbrokers and the Institute of Scrap Recycling Industries, since it is not uncommon for expensive looking equipment to be stolen without the thieves' full understanding of its radiological nature. This type of equipment is sometimes dumped or sold to pawn shops, scrapyards, and landfill operators. The radiography company also performed searches with portable instruments from vehicles and offered a reward for the missing source. Drive-by searches for the camera were also conducted by the DSHS and the 6th National Guard Civil Support Team (6CST), with high priority for government buildings.

DSHS notified the NRC Headquarters Operation Center immediately as required. Later in the day DSHS also contacted the FBI, who had previously been contacted by APD and was aware of the situation. A press release was also created by DSHS.

A DSHS incident investigator was dispatched to the location shortly after the report was made by the licensee. At around this time, DOE called DSHS and offered their assistance. The incident investigator conferred with the radiographers and the APD, which was able to identify the thieves' vehicle type via security tapes.

In case the thieves or a member of the public presented to a medical facility with injuries that could be attributed to contact with the radioactive source, local hospital groups were alerted to the possibility. They were directed to DOE training on biological effects of radiation and to the Radiation Emergency Assistance Center in Oak Ridge, Tennessee, a national resource on radiation injury. Other local entities, such as Texas Department of Transportation, Austin Crime Stoppers, and Keep Austin Beautiful were advised to call in if anyone found the camera.

Consistent with the notification agreement that exists between the United States and Mexico, the NRC alerted Mexican authorities of the theft. Additionally, CBP was notified to be on the lookout for the camera being transported across the Mexican border. A DHS representative assigned to the incident and other Agreement State programs were also notified by DSHS about the event.

On week 2 of the search, the DOE/NNSA Radiation Assistance Program (RAP) performed a flyover using fixed wing detector aircraft. This aircraft flies a particular route and can be useful in locating sources along its path, provided there are no shielding or other issues. The APD used one of its helicopters as a secondary aerial search vehicle using a detector array from 6CST. Neither aerial search detected any points of concern.

During the investigation of the event, it was confirmed that the licensee did not comply with either corporate or regulatory security requirements. The investigation revealed that in addition to the tailgate of the vehicle not being locked, the mounting of the cable used to lock the camera's box to the

truck could be worked free without cutting or unlocking the cable. Finally, one of the radiographers had failed to reset the darkroom door alarm when he last left the truck. As a result of this incident the radiographer and the licensee were each cited for violations.

Despite the camera not being recovered, this case study exemplifies the considerable coordination that occurs at the local, State, and national level when dealing with risk-significant radioactive materials. Fortunately, this source was Ir-192 and was not newly installed. Due to the short half-life of Ir-192 (74 days), this source quickly decayed below the threshold deemed risk significant.

Conclusions

The NRC and the Agreement States' regulations establish a regulatory framework for safe and secure use of radioactive material. They have established regulatory controls to minimize the likelihood of loss or theft of risk-significant radioactive material. A majority of losses and thefts identified are due to non-compliance on the part of the licensee with existing requirements and often reflect crimes of opportunity. In the event of losses or thefts, licensees have the primary responsibility to recover missing material and report to the appropriate authorities. The actual recovery of the missing material may involve a multitude of agencies such as LLEA, State radiation control programs, the NRC, the FBI, and various other Federal Government agencies. In most cases, due to the extensive coordination amongst various agencies and stakeholders, the material is retrieved quickly and without further incident. The combination of a robust national regulatory program for risk-significant radioactive materials and the formal response framework in place in the United States is very effective in protecting public health and safety and in providing for the security of these sources.

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