

The Conference of Radiation Control Program Directors provides technical and financial assistance for disposition of disused and unwanted radioactive sources.

Comprehensive Review of CRCPD Efforts in the Disposition of Disused Radioactive Sources

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Abstract: The Conference of Radiation Control Program Directors (CRCPD), a national non-profit, non-governmental organization dedicated to radiation protection, established a National Radioactive Material Disposition Program to assist state radiation control programs, licensees, and members of the public in managing orphan sources and otherwise unwanted or disused radioactive material. The program consists of several services including technical assistance with disposition options; financial assistance to radiation control programs for the disposition of orphan sources; and the Source Collection and Threat Reduction (SCATR) Program for financial and logistical assistance in the disposal of unwanted sources. For the past 18 years, the CRCPD has partnered with the Department of Energy's National Nuclear Security Administration (NNSA) to provide outreach to licensees and assistance in the disposal of disused sources, through the SCATR Program. The overarching goal of the SCATR Program is to design and execute a comprehensive and cost-effective process for identifying and reducing the threat of diversion of radioactive material for misuse, focusing on those sources that have a commercial disposal path. During the time the program has been in place, the scope has expanded to include higher activity sources, such as irradiators, and source collections in unusual circumstances. Progress toward the goals, disposal and transportation issues, and ancillary concerns

being addressed by CRCPD are discussed. *Health Phys.* 128:233–239; 2025

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INTRODUCTION

RADIOACTIVE MATERIALS are widely used by hospitals, clinics, academic institutions, industrial radiographers, manufacturers, and governmental institutions. Both the use of these materials and their disposal are regulated by Federal and State authorities. However, often there are unused sources that remain in storage long beyond the limits set within the radioactive material license. In addition, sources may be abandoned, found by members of the public or radiation control agencies, and may or may not have traceability back to a responsible party.

In 2001, CRCPD established the National Orphan Radioactive Material Disposition Program, the purpose of which was to financially assist and provide technical guidance to

state radiation control programs in the disposition of discrete orphan radioactive material. The goal was to reduce the number of discrete radioactive sources and devices that are abandoned or improperly disposed of and thereby reduce the risk of unnecessary radiation exposure to the public and/or contamination of the environment. With funding from the US Environmental Protection Agency and, since 2003, from the US Nuclear Regulatory Commission, CRCPD has been able to assist radiation control programs in the disposition of sources deemed to be “orphan” (US NRC 2021)

Storage of unused radioactive sources for decades or longer may occur, though US Nuclear Regulatory Commission (US NRC) regulations state that a licensee must notify the US NRC and begin a decommissioning plan if no principal activities under the license have been conducted for 24 months [10 CFR 30.36(d)]. When these radiation sources are no longer needed, they may be returned to manufacturers, transferred to another licensee, stored, or sent for disposal. While the entire system is regulated to achieve public health objectives, if sources are not recycled for beneficial reuse or sent for disposal in a timely fashion after they are no longer needed, they inherently pose a level of risk of being diverted from storage for possible

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misuse—either through negligence, non-compliance with license requirements, loss, or theft. While disposition is delayed, the risks increase with time.

The expense of recycling or disposal is often cited as the licensee's reason to retain radioactive materials in storage that are no longer needed or useful. From a public health standpoint, the threat of diversion remains—and increases with time.

All too often radioactive material that represents a significant public health threat is discovered in scrap metal, municipal waste, a home, or elsewhere abandoned. In September 2003, the Board of Governors of the International Atomic Energy Agency (IAEA) approved a Code of Conduct on the Safety and Security of Radioactive Sources (IAEA 2004) along with a statement on “non-proliferation of weapons of mass destruction—securing radioactive sources” in which it encouraged all countries to strengthen controls on radioactive sources and observe the Code of Conduct. Following the 9/11 terrorist attack in the United States, the United States government emphasized efforts to ensure radioactive source security as a preventative measure. The Energy Policy Act of 2005 (P.L. 109-58 2005) directed the Task Force on Radiation Source Protection and Security to evaluate and provide recommendations relating to the security of radiation sources in the United States from potential terrorist threats, including acts of sabotage, theft, or use of a radiation source in an attack (USNRC 2023).

The US Department of Energy established the Offsite Source Recovery Program (OSRP) in the mid-1990s, originally to recover US-origin sealed sources comprising Greater than Class C (GTCC) low-level radioactive waste. However, following the events of 9/11/2001, the goals of the program expanded from health and safety and environmental concerns to addressing both safety and security requirements. As a result, OSRP moved from

the US DOE Office of Environmental Management to the National Nuclear Security Administration (NNSA) in 2003. OSRP removes excess, unwanted, or disused US-origin radioactive sealed sources that pose a potential risk to national security, health, and safety. Their focus is on high-activity, high-risk sources, many of which lack permanent disposition paths because the material is excluded from commercial disposal or disposal is unaffordable to the licensee (USDOE 2023).

CRCPD is a 501(c)(3) non-profit organization whose membership consists of the state, county, city, and territorial agencies across the United States that regulate radiation within their jurisdictions, as well as other individuals who have an interest in radiation protection issues. CRCPD's mission is “to promote consistency in addressing and resolving radiation protection issues, to encourage high standards of quality in radiation protection programs, and to provide leadership in radiation safety and education.” (crcpd.org)

In 2006, the NNSA partnered with the CRCPD through a cooperative agreement to establish a Source Collection and Threat Reduction (SCATR) Program to support the consolidation and disposal of commercially disposable radioactive sealed sources. The common goal of both programs is to collect sources being stored and not used that pose a threat to public health and safety and could potentially be used for malicious intent. Since CRCPD provides guidance to and works with radiation control programs throughout the country, the SCATR program fits with the mission and capabilities of the organization.

OVERVIEW OF THE CRCPD SCATR PROGRAM ACTIVITIES

The scope of the SCATR Program is to design and execute a comprehensive and cost-effective process for identifying and reducing the threat

of diversion of radioactive material for misuse. The Source Collection and Threat Reduction (SCATR) Program supplements DOE's OSRP program by focusing on sealed sources that have commercial disposal paths. The goal of this project is to collect and commercially dispose of sealed sources no longer in use, which could individually or in aggregate be used maliciously. The CRCPD works closely with state regulators to assist with the identification of licensees with unwanted sources and the encouragement of those licensees to dispose of their unwanted sources. This program is directly relevant to homeland security in that it removes unwanted and often obsolete radioactive materials and minimizes the opportunities for the diversion of radioactive sources for malicious purposes.

Under the cooperative agreement with NNSA, CRCPD administers the program and provides coordination and contracting with waste brokers for packaging, transportation, and disposal, and funds for the activities through cost-sharing with the participating licensees. Most of the outreach work, broker contracting, and coordination with licensees and user groups is conducted by CRCPD staff. A CRCPD volunteer committee provides guidance on the implementation and operation of activities regarding both orphan sources and other unwanted radioactive material, including the SCATR program (CRCPD 2023a).

To be eligible for disposal under SCATR, the source must be registered with the Off-site Source Recovery Program (OSRP). The registration form can be downloaded at the OSRP website. Examples of sources eligible for disposal via SCATR include cesium-137 and radium-226 brachytherapy sources, strontium-90 eye applicators, low activity sources that exceed the US NRC 120-day half-life limit for decay-in-storage, long half-life industrial sources and calibration sources, gauges, radiography sources, leaking sealed sources which were formerly categorized as sealed

sources, and liquid sources in ampoules or sealed glass tubes which are less than a few tens of milliliters. Sources not eligible for this program include materials such as scaled pipe, loose radioactive materials, sources exempt from licensure, liquid sources in ampoules or sealed vials greater than a few milliliters, and any source not meeting the US NRC's basic definition of a sealed source (CRCPD 2023b).

The process used to conduct the program as well as unique collections and disposals are described below.

Outreach to identify candidate radioactive materials

CRCPD invited its members, made up of directors and technical staff from the state, local, and territorial radiation control agencies in the US, to assist in finding licensees that would be potential participants. CRCPD also worked with several organizations to assist in identifying licensees with disused sources that would qualify for financial assistance under the program. The outreach mechanisms included presentations at CRCPD's annual conferences, articles in newsletters, and brochures describing the SCATR program for radiation control programs to send to their licensees. In addition, CRCPD reached out to major professional groups, including the Health Physics Society, the American Association of Physicists in Medicine, the Society of Nuclear Medicine and Molecular Imaging, and the Institute of Scrap Recycling Industries, through exhibits, presentations, and the provision of written materials at national conferences and other meetings. CRCPD representatives also presented information on SCATR at low-level waste compact commission meetings. Information about SCATR and OSRP was also posted on both the NNSA and CRCPD websites.

Initial pilot project

The CRCPD SCATR program began in 2007. The initial mechanism for collection and partial funding of

disposals included an option for CRCPD to contract with a commercial broker directly or for a state to arrange for a collection within their jurisdiction under an agreement with CRCPD. In the latter option, the state would need to arrange for and certify the proper disposal of unwanted material in the agreement with CRCPD (including taking ownership of the sources collected), collect the fees involved from the licensees, and be reimbursed for the shared costs. The State of Florida was chosen to pilot the project through a state agreement, because the radiation control program had access to a location where sources could be temporarily stored from the collection and was able to take ownership of the sources for disposal. The State contracted with a broker to pick up the sources at the collection site, package them, and transport the waste for disposal at a low-level radioactive waste facility.

This project was very successful in that approximately 2,500 sources were disposed of. However, the pilot also put a strain on state resources. The state contribution to the effort was the equivalent of 0.25 FTE for six months, postage, goods, and services more than 400 emails, and over 70 telephone calls. The pilot also revealed several lessons learned in approaching future collections. These included:

1. CRCPD should consider directly contracting with waste brokers for collection, packaging, transporting, and disposing of sources due to limited state resources, lack of burial permits, and no centralized storage locations in most states;
2. Limit federal resources to longer-lived isotopes; and
3. Look for other mechanisms for the disposition of certain sources, such as the return of gauges to manufacturers.

Based on the lessons learned, it was determined that for future

disposals, the CRCPD would contract directly with the broker. It was also determined that the broker would take on the role of collecting and packaging the sealed sources before transportation and disposal (Klinger 2008).

Challenges in lack of disposal options

In 2008, the Barnwell disposal site in South Carolina closed to waste disposal from locations out-of-compact. This limited the ability to collect and dispose of sources in the SCATR program to only those in the Atlantic Compact for disposal at Barnwell and those in the Northwest and Rocky Mountain Compacts for disposal at the US Ecology facility in Richland, WA. Radium sources were also allowed to be disposed of at the Richland facility from out-of-compact. For the next four years, this closure created a situation where 36 states, Guam, and Puerto Rico did not have any pathway for disposal of their low-level radioactive waste (LLRW). In May 2012, the Waste Control Specialists LLRW facility opened in Texas and a disposal pathway was restored. Also, during the period starting in the summer of 2013 through the summer of 2014, a nationwide collection of Class A sources was conducted. These were allowed to be disposed of at the Energy Solutions site near Clive, UT.

Puerto Rico collection

Through a cooperative effort between CRCPD, US NRC, and US DOE/NNSA to assist Puerto Rico after the 2017 damage from Hurricanes Irma and Maria, a large source collection took place in December 2018 and April 2019 in Puerto Rico. The locations from which sources were collected were primarily medical facilities, though sites also included university, industrial, and federal facilities. Though most sources were in the San Juan area, other sources were collected across the island. The range of services needed for this disposal project

included packaging, supplies, manifesting, labeling, transportation, processing, and disposal. In December 2018, 420 sources were collected from 21 locations with a total activity of 2.09 Curies. In April 2019, 157 sources were collected from 26 locations with a total activity of approximately 3 Curies. There was also mixed waste and solid waste as part of the collection. Collection locations are shown on the map in Fig. 1.

Challenges experienced with the Puerto Rico source collection included driving through tight narrow streets and the licensees' inability to pay their portion of the funding. Because of the hurricane, some facilities had been severely damaged and/or abandoned, and several facilities had declared bankruptcy. Some of these facilities had been ransacked but, fortunately, the sources had been stored safely and all radioactive material was located. Some facilities canceled their collection due to a lack of funds, and five facilities did not pay their portion. CRCPD was able to provide additional financial support to two facilities.

The method of transportation to be used to move the sources for disposal off the island was also a question to be addressed. It was decided not to use air freight due to the dose rate limits, waste limits,

and high costs. Instead, transportation by ship was chosen as it was less expensive and allowed a higher dose rate and the ability to send all waste streams identified. For sea transportation, the CRCPD's contracted waste broker was able to obtain a secure unit in which to collect and transport all containers. During the initial December 2018 collection, there were additional challenges with the marine shipment including language barriers and misinformation provided by the trucking company and the port director. The US NRC was able to assist with these challenges through the provision of a contact within the Department of Transportation who provided a liaison on the island to assist. Customs and Border Protection (CBP) also provided extensive support including a safe secure central location to store the truck and the Sea-Land Container with 24-hour monitoring near the dock. In return, CBP radioactive sources and waste were included in the collection at no cost to them. Because the CRCPD conducted this disposal in two phases, the word spread about the disposal opportunity following the initial December 2018 collection and there were more participants during the second round in April 2019 (McBurney et al. 2022).

Demonstration of Disposal of Higher Activity Sources under the SCATR Program

A major milestone that greatly assisted in disposals was the revision of the US NRC's Branch Technical Position on Concentration Averaging and Encapsulation, published in May 2015. This allowed LLRW sites to be able to accept packages with higher activities than had previously been allowed for disposal up to the Class C limits, with acceptable justification. In 2017, the SCATR program disposed of a ^{137}Cs source with an activity greater than the newly designated generic maximum activity (130 Ci) at the Northwest Compact commercial disposal site for low-level radioactive waste using the US NRC's Branch Technical Position. Another similar disposal was made at the Texas/Vermont Compact commercial disposal site in 2019. The two disposals demonstrated the ability to dispose of quantities greater than the generic level but less than the Class C limit (McBurney et al. 2022).

Cost-sharing

The CRCPD uses the SCATR agreement to pay a portion of the disposal costs for sources, but licensees are also responsible for their cost-share part. Currently, up to 50% of the disposal cost is provided



FIG. 1. Collection locations for the Puerto Rico SCATR project (courtesy of J. McCormick, Bionomics).

for higher activity sources,² and for routine SCATR sources 40% cost share is provided. The cost of disposal is controlled by volume, isotope, activity, and type of transport package required. A Type B shipping package can be more than twice as expensive as a Type A package and there are occasions when allowing a source to decay to levels acceptable in Type A has occurred. High rental costs for Type B packages add a challenge to the disposal of sources that require Type B packaging. The SCATR broker used by CRCPD has been able to reduce the cost of transportation of these sources by identifying a vendor with a less costly and readily available Type B package for rental.

Sources disposed of under the SCATR program

Through September 2023, under the SCATR program, CRCPD has collected and disposed of 40,399 sources containing a total of 73.12 TBq of activity. These numbers do not include an additional 34,113 spent industrial radiography sources (approximately 1.26 MBq each) that were also collected and disposed of under the SCATR program, totaling approximately 42.8 GBq of additional activity. The spent industrial radiography sources were from only two companies and were not representative of the number of sources CRCPD would normally collect in a year. The number of sources disposed of under the program by year is shown in Fig. 2. Activities disposed of by year are shown in Fig. 3.

In recent years the US DOE/NNSA and CRCPD have worked to use SCATR for larger sources of cesium (>4.8 TBq). Several large irradiators (>14.8 TBq) were removed through the SCATR project. From 2017 through September 2023, 13 large ¹³⁷Cs sources totaling 55.23 TBq of activity; 54 ⁶⁰Co sources totaling 2.13 TBq of activity; and eight ⁹⁰Sr sources totaling 444 GBq of activity were disposed of using the higher activity criteria for packaging and cost-sharing.

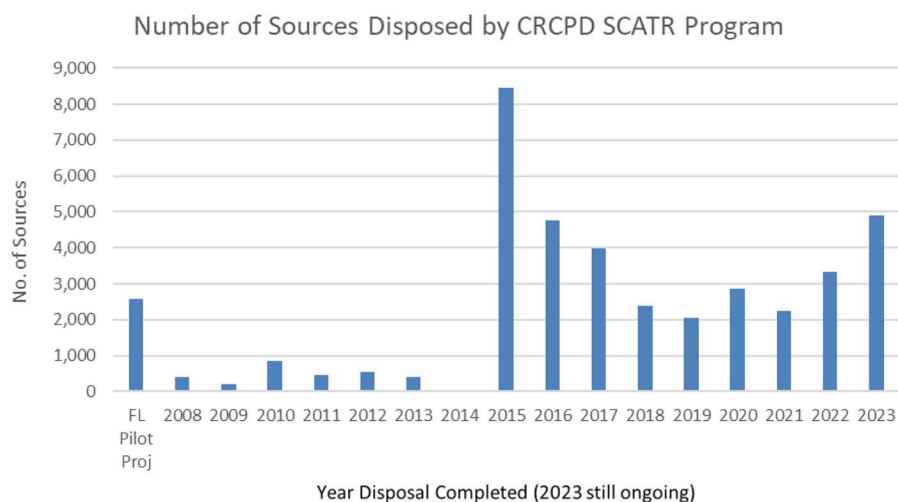


FIG. 2. Number of radioactive sources disposed of by year under the SCATR Program.

SCATR has been very successful over the years in ensuring the safe disposal of these materials. There are still many sources needing disposal potentially at risk for malicious use. CRCPD continues to coordinate with regulators and licensees to identify potential sources for disposal.

ADDITIONAL CRCPD SOURCE DISPOSAL EFFORTS

Foreign-origin transuranic radioactive material

As part of their charges, the CRCPD E-34 “Committee for Unwanted Radioactive Materials” considered the problem of disposing of transuranic materials from foreign origin radioactive material and produced a white paper, “Disposition of Foreign Origin Radioactive Material,” CRCPD Publication #21-2 (Klinger et al. 2021). This type of material has been classified as greater than Class C (GTCC) with the passage of Public Law 99-240. In addition, GTCC sources with sufficient activity (3.7 kBq g^{-1} , approximately 1.85 GBq) became unacceptable for near-surface disposal. Transuranic sources that could be traced back to generation in Atomic Energy Defense-related activities are able to be disposed of

²Any single source containing an activity of 370 or more GBq or a package containing 740 or more GBq or requiring a Type B shipping container.

with OSRP in the Waste Isolation Pilot Plant (WIPP). Since 1998, OSRP has collected over 31,000 transuranic sources representing an activity of approximately 1,258 TBq. However, OSRP cannot accept transuranic sources containing foreign-origin radioactive material because it is not allowed at WIPP, even if blended. WIPP is the only geologic repository in the U.S. Only congressional action can provide a pathway to the disposal of foreign-origin transuranic sources at the WIPP.

The committee also assessed how many foreign-origin radioactive material sources existed that could not be disposed of and found that a majority are below US NRC Category 2 limits and not tracked in the US NRC’s national source tracking system. As an example, the US Department of Energy estimates that there are 39,000 ²⁴¹Am sources in the US containing foreign origin ²⁴¹Am.

While the higher-risk sources are slowly removed from the public domain, these foreign-origin radioactive material sources are continuing to increase in number. The committee identified options for foreign origin sources including storing the sources at the licensee’s site, returning foreign origin sources to the manufacturer, storing them at state facilities or commercial brokers, holding them until US DOE develops a new

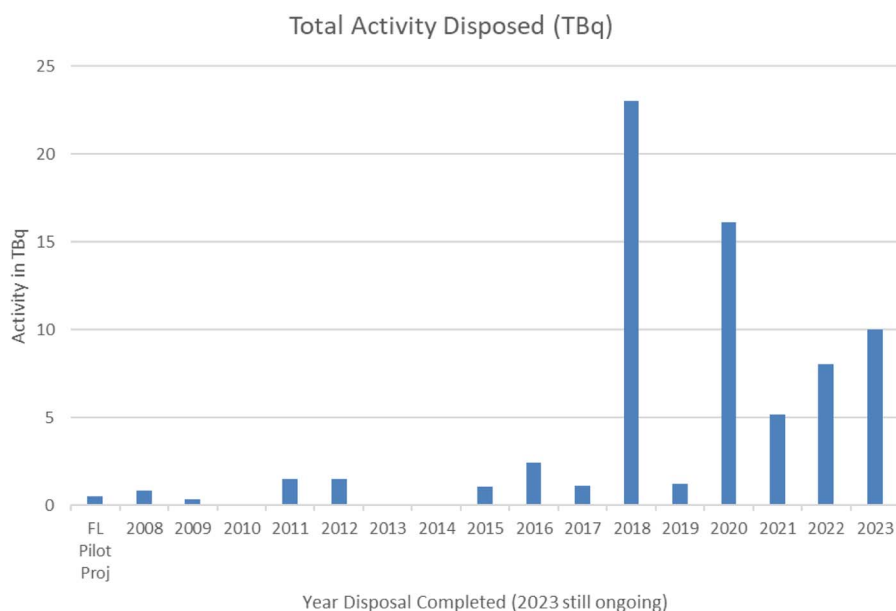


FIG. 3. Total activity of radioactive sources disposed of by year under the SCATR Program.

GTCC disposal site or congressional action addressing the issue.

Radioactive sources in scrap and solid waste

CRCPD has established a liaison with both the Institute of Scrap Recycling Industries, Inc. (ISRI), as well as the Solid Waste Association of North America (SWANA). Coordination with ISRI and SWANA continues to address the issue of lost sources and what to do if they show up at a recycling facility or solid waste landfill. A joint project between ISRI and CRCPD resulted in the development of a video targeted toward the scrap industry providing education on what to do when a radiation alarm goes off at their facility (CRCPD 2019).

CRCPD continues to work with the US Department of Transportation on a program allowing special transport permits for material that is discovered at scrap yards and solid waste facilities. With the permit, the material can be transported back to the owner before full characterization, which significantly helps both entities.

CONCLUSION

Despite the ongoing efforts, radioactive sources are still at risk

for malicious uses. CRCPD continues to look for new partners with whom to work to address issues associated with lost or unwanted radioactive sources. The orphan source program, the SCATR program, and coordination with industry groups and government agencies in developing both regulatory and non-regulatory solutions are all being used to enhance safety and security by the reduction of the number of disused and unwanted radioactive sources in the United States.

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