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OSRP Source Repatriations-Case Studies: Brazil, Ecuador, Uruguay

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The Global Threat Reduction Initiative's (GTRI) Offsite Source Recovery Project (OSRP) began recovering excess and unwanted radioactive sealed sources (sources) in 1999. As of February 2012, the project had recovered over 30,000 sources totaling over 820,000 Ci. OSRP grew out of early efforts at Los Alamos National Laboratory (LANL) to recover disused excess Plutonium-239 (Pu-239) sources that were distributed in the 1960s and 1970s under the Atoms for Peace Program. Source recovery was initially considered a waste management activity. However, after the 9/11 terrorist attacks, the interagency community began to recognize that excess and unwanted radioactive sealed sources pose a national security threat, particularly those that lack a disposition path. After OSRP's transfer to the U.S. National Nuclear Security Administration (NNSA) to be part of GTRI, its mission was expanded to include all disused sealed sources that might require national security consideration.

Recognizing the transnational threat posed by porous borders and the ubiquitous nature of sources, GTRI/OSRP repatriates U.S. origin sources based on threat reduction prioritization criteria. For example, several recent challenging source repatriation missions have been conducted by GTRI/OSRP in South America. These include the repatriation of a significant amount of Cs-137 and other isotopes from Brazil; re-packaging of conditioned Ra-226 sources in Ecuador for future repatriation; and, multilateral cooperation in the consolidation and export of Canadian, US, and Indian Co-60/Cs-137 sources from Uruguay.

In addition, cooperation with regulators and private source owners in other countries presents opportunities for GTRI/OSRP to exchange best practices for managing disused sources. These positive experiences often result in long-term cooperation and information sharing with key foreign counterparts. International source recovery operations are essential to the preservation of U.S. national security interests. They are also mutually beneficial for fostering positive relationships with other governments and private industry, and demonstrate that responsible end-of-life options are given to legacy U.S.-origin sources in other countries. GTRI/OSRP does not take back sources that have a viable path for commercial disposal. Most US origin sources

were sold commercially and were not provided by the US government. Below is a synopsis of cooperative efforts with Brazil, Ecuador, and Uruguay.[i]

Ecuador

Bilateral sealed source recovery efforts in Latin America began in December 2006 when GTRI received an unofficial source inventory from the former Ecuadorian Atomic Energy Commission (CEEA), now known as the Ministry of Electricity and Renewable Energy (MEER). MEER requested assistance in the repatriation of disused sources of varying isotopes. These sources were stored at a MEER facility outside of Quito. In February 2007, GTRI/OSRP sent a representative to conduct a site assessment. The MEER facility also housed a number of Schlumberger manufactured sources and so a company representative accompanied GTRI/OSRP to assist with identifying and making arrangement for the return of the company's sources. In late 2007, a GTRI/OSRP team traveled to Ecuador to package 36 sources totaling ~8 curies which were later repatriated to the U.S. In 2009, a team of technicians from GTRI/OSRP and the Centro de Desenvolvimento da Tecnologia Nuclear in Brazil returned to Ecuador to re-package radium sources previously conditioned by the IAEA so they may one day be shipped in a compliant manner to their country of origin.[ii]

Radium brachytherapy sources were the first sources to be manufactured and until the 1960s were distributed and used for decades to effectively treat certain types of cancer. Thousands of such radium sources have become excess and unwanted, oftentimes in countries with loose regulatory control and inadequate or non-existent long term storage or disposal facilities. Many radium sources leak due to radon gas build up with subsequent capsule pressurization and rupture. The IAEA initiated a campaign in the 1990s to condition and stabilize thousands of such disused sources in developing countries. While these pro-active efforts resulted in more secure and safer source storage configurations, the packaging does not allow them to be transported in compliance with regulations. The 2009 repackaging effort demonstrated successful multilateral cooperation in efforts towards more secure storage and repatriation.

In 2009, GTRI also provided MEER a comprehensive suite of contamination survey equipment and reading instruments that could be used to count and log fixed contamination. GTRI/OSRP staff then provided training on the use of the instruments.

Brazil

GTRI cooperation with the Centro de Desenvolvimento da Tecnologia Nuclear (CDTN) in Belo Horizonte and with the Institute for Energy and Nuclear Research (IPEN) in Sao Paulo began in 2007 through an IAEA-led Latin American Regional Partnership to identify, condition, and recover disused sources. This effort was funded by the Department of State's Nonproliferation

and Disarmament Fund (NDF) in addition to in-kind contributions from GTRI.[iii] The first objective of this project was to repatriate excess and unwanted U.S.-origin plutonium/beryllium (PuBe) neutron sources. The second objective was to demonstrate the feasibility of cooperative efforts to return unwanted, vulnerable radiological sources to their country of origin or to the United States for secure storage and disposition. The initial priority of the first ever U.S. repatriation of a plutonium beryllium (PuBe) neutron source expanded after provision of the Brazilian source inventory showed there was a significant amount of other U.S. origin material on-site. Acquiring a source inventory from another country's regulator provides GTRI/OSRP with preliminary data to begin characterization of the sources, determine their eligibility for disposition in the U.S., and assists in preparations for the final packaging mission.

The first packaging mission in Brazil (2007) resulted in the repatriation of over a hundred sources consisting of Ra-226, Pu-238, Pu-239, Cs-137 and Am-241Be. The material was added to a ship that was also being used for repatriating U.S. origin spent nuclear fuel (low and high enriched uranium) from Brazil and Argentina as part of another GTRI program. This export method is convenient because sources add a negligible amount of radioactivity to spent fuel and ships carrying spent fuel are accustomed to radioactive shipments resulting in much diminished concerns of a denial of the shipment. Many of these sources had already been identified as eligible for repatriation through previous OSRP and IAEA site survey trips. Site survey trips to locations with large numbers of sources are valuable in that they provide an opportunity to gather and document field data to compare with the site's initial source inventory. This also provides a visual verification of the sources that helps OSRP familiarize itself with the facility and regulator, which facilitates more effective pre-planning for the mission. Although not all site survey missions result in the repatriation of the sources, such missions provide a better understanding of disused source security needs in the region.

A follow-up recovery mission and shipment in 2011 increased the scope of work resulting in the packaging and repatriation of over 800 Cs-137 and Co-60 sources totaling over 100 Ci. For OSRP, this recovery was unprecedented in the number of sources repatriated to the U.S. Field packaging required an extended two week period of significant staffing and contract support in challenging environmental and operational conditions. Pre-recovery planning for any international mission is far more complicated than a domestic source recovery and requires meticulous attention to detail. Pre-recovery work plans are developed to document packaging procedures, shielding and safety requirements, and contractor/regulatory responsibilities, as well as to ensure timely and proper importation of equipment through customs arrangements and U.S. embassy assistance. Post-recovery planning to ensure a timely, cost effective, and compliant shipment can be equally challenging. In addition to delays due to international events, regulations can also be a complicating factor. These tend to differ in each country, and

often vary according to the isotope, activity, and many other factors, any of which may involve unforeseen requirements such as security escorts and customs duties.

Uruguay

In November 2008, the IAEA led a source assessment mission to Uruguay in support of the Latin American Regional Partnership. IAEA experts, at the request of the Uruguayan National Regulatory Authority, identified 13 self-shielded Co-60 and Cs-137 teletherapy irradiators, which contained sources from the U.S. and Canada, and one GC-4000 (Gamma Chamber) blood irradiator from India (15 Co-60 sources) totaling 2,111 Ci. In May 2010, the sources were safely removed from their devices using a mobile hot-cell, packaged in Type B containers, and were later shipped to a consolidation facility in the U.S. and are pending final disposition.

GTRI and the U.S. consolidation facility agreed to temporarily store the Canadian and Indian sources with the understanding that the sources would eventually be shipped to those countries. The IAEA played an integral role in this operation by acquiring a mobile-hot cell to remove and package the sources. The hot cell, owned by the Nuclear Energy Corporation of South Africa (NECSA), was shipped to Uruguay, assembled at the site, and then disassembled and returned to NECSA at the conclusion of operations. The packaging operation, including assembly/disassembly of the hot cell, took about five weeks.

In 2011, representatives from the Indian Board of Radiation and Isotope Technology (BRIT), GTRI/OSRP, and the IAEA met at the U.S. consolidation facility to visually examine the sources and confirm dose to curie measurements. LANL played a supporting role in providing packaging data and two Type A containers for shipment to India, along with satisfying documentation requirements to officially transfer ownership of the sources. This cooperative effort with Uruguay resulted in the first OSRP repatriation of sources to India and a basis for establishing a working relationship with BRIT, a significant source manufacturer.

Conclusion

Bilateral and multilateral efforts have been successful in removing hundreds of U.S.origin sealed radioactive sources from Latin American countries to the U.S. As many disused sources remain in the region, and since repatriation is not always an option, GTRI will continue to work with those countries to ensure that these sources are stored securely for the long-term. Successful Latin America operations should serve as a model for other regional cooperation in the repatriation of sealed sources, encouraging other source exporting countries to implement similar programs.

Securing and removing sources, both domestically and internationally, is crucial to strengthening the life-cycle management of radioactive sources worldwide. Such efforts not only prevent these materials from being used maliciously, but also address public health and safety concerns, and undergird the IAEA Code of Conduct on the Safety and Security of Radioactive Sources.

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[i] Previous similar work was also conducted by GTRI/OSRP in Chile, Peru, Brazil and Ecuador. Refer to Greenberg, Ray Jr. et al."Global Threat Reduction Source Recovery Efforts in Latin America," *INMM Annual Meeting*, LA-UR 08-04529.

[ii] Source conditioning generally involves techniques employed to place sources with undesirable radiological characteristics into safe and secure containment. A couple examples are unsealed or contaminated/leaking sources.

[iii] The scope of the Latin American regional partnership was intended to address radioactive sealed sources in five countries: Argentina, Brazil, Colombia, Uruguay, and Venezuela. Project implementation was coordinated with the IAEA Division of Nuclear Fuel Cycle and Waste Technology and the IAEA Office of Nuclear Security.The U.S. pursued the Latin American Regional Partnership as a pilot program to reduce the number of unwanted and disused radioactive sources that could be used by terrorists for malicious purposes, such as a RDD.