

## **Off-Site Source Recovery Project Expansion**

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### **ABSTRACT**

The mission of the Off-Site Source Recovery (OSR) Project at Los Alamos National Laboratory was expanded in 2004 by its program sponsor (Reference 1), the Office of Global Threat Reduction (NA-21), National Nuclear Security Administration (NNSA). The expansion increased the number of isotopes handled by the OSR Project to at least ten and removed the restriction that the project was only to handle Greater-Than-Class-C (GTCC) sealed sources. A further expansion also has occurred enabling the OSR Project to repatriate at-risk US-origin material from other countries on a case-by-case basis. This paper provides an update of the successes of the OSR Project in terms of its previously defined mission to recover predominantly actinide bearing sealed sources, and presents a summary of the additional nuclides, management plans for recovery, storage and disposal, and priorities and successes. Partnerships with other agencies to address associated problems are also discussed.

### **INTRODUCTION**

By 1972, U.S. manufacturers such as Monsanto had fabricated and distributed more than 2,000 PuBe neutron-generating sealed sources (Reference 1) and had begun manufacture and distribution of AmBe sources as well, all through a U.S. Atomic Energy Commission loan/lease program. When the loan/lease program closed in 1979, hundreds of these sources remained at their licensed locations, many in an unused and unsecured state. Due to the lack of disposal options, within fifty years after the emergence of the actinide radioactive sealed source, the country was faced with a glut of disused sealed sources with no disposal pathway. The Offsite Source Recovery (OSR) project was initiated in 1999 to recover and manage unwanted radioactive sealed sources from the public and private sector that presented a risk to public health, were excess and no longer wanted, and were a U.S. Department of Energy (DOE) responsibility. The OSR project is currently managed by the NNSA Office of Global Threat Reduction (NA-21).

### **PROGRAM EXPANSION – ADDITIONAL RADIONUCLIDES**

In March 2004, a memo from Paul Longworth to the DOE-Los Alamos Site Office (LASO) expanded the OSR Program scope to include “all concentrations” of Pu-238, Pu-239, Am-241, Cm-244, Sr-90, and Cs-137. It also added Cf-252, Co-60, Ir-192, and Ra-226 to the OSR scope (Reference 2). Previously, it had been believed that the OSR project would only need to address sealed sources exceeding GTCC quantities because commercial disposal capacity would exist for other isotopes. However, in practice, with

commercial disposal facilities being limited either to in-compact waste or to lower activities such as 45 Ci/drum or container, it became obvious that disposal was limited or non-existent for high-activity gamma-emitting sealed sources.

As a consequence of this expansion, the OSR Project began to work with private companies to recover and secure high-activity beta- and gamma-emitting sealed sources. This effort began in 2005 with recovery of three high-activity (400 Ci) sources from high schools in San Antonio, TX (Reference 3). To date, the OSR Project has recovered 74,000 Ci of Sr-90, 8,100 Ci of Cs-137, and 62,000 Ci of Co-60 (Reference 4). Much of this work is performed using contractors and manufacturers who can recycle material in some cases.

### **PROGRAM EXPANSION – INTERNATIONAL WORK**

The IAEA Code of Conduct on the Safety and Security of Radioactive Sources (Reference 5) sets forth scope, objectives, and basic principles and responsibilities for member states regarding radioactive sources. The OSR Project is one part of US efforts to comply with the Code of Conduct and foster good stewardship of radiological source inventories.

As previously mentioned, the U.S. has supplied sources to many countries around the world, many of which are disused and unwanted. On a case by case basis, the NNSA Office of Global Threat Reduction considers requests from host countries for assistance or removal of sources of U.S. origin. The objective is to utilize the existing infrastructure and capabilities of the domestic OSR Project to be able to accept similar U.S.-origin sources internationally. The effort to repatriate US-origin sealed sources began in 2005, with packaging of US-origin sealed sources being conducted in Latin America and Africa. Recent and current efforts in the OSR Project include repatriation of foreign-owned sealed sources of US origin from South Africa, Sudan, and Côte d'Ivoire, as well as packaging of sealed sources and planned repatriations from Uruguay, Australia, Italy, and other countries. In these endeavours, NNSA and the OSR Project are working with the IAEA to enhance its capability to return sources both to the United States. and to other countries of origin.

The first US-origin source repatriation effort initiated was a proof of concept working with the IAEA and South Africa. Sources were moved by the IAEA from the Cote d'Ivoire and Sudan to South Africa, where they were consolidated with other U.S. origin Am-241 sources and then shipped to the U.S. The effort included cooperative training and information exchange efforts with IAEA. The opportunity to work with the IAEA and to ship sources to the U.S. was briefed to NA-21 management, and the OSR Project was authorized in April 2005 to carry out this effort. The IAEA identified the sources, moved them from the Sudan and the Cote d'Ivoir, and consolidated them at the Nuclear Energy Corporation in South Africa (NECSA). OSR personnel traveled to NECSA as part of an IAEA consultation, and the occasion of the packaging of the sources was used as an opportunity to conduct IAEA-sponsored training for representatives from more than 12 African nations. This operation would not have been possible without the cooperation

and support of the South African government in hosting the consolidation of sources, persons from multiple nations and the use of a government contracted organization and facilities for the recovery and training demonstrations.

Another effort was initiated by a request from Uruguay to the IAEA to take back a U.S. origin Pu-239 source. That request was received at NA-21 and the OSR project was authorized to package the source, which it completed in October 2005. For the Uruguay recovery, IAEA coordinated the recovery effort, and established a consultation in Uruguay. Representatives from Brazil and Argentina were invited to observe the packaging of the source. NA-21 has recently obtained funding from the State Department to work with IAEA to develop regional source consolidation capacity in South America, including Uruguay.

In addition to international recovery efforts, the OSR project is working with IAEA to develop a catalog of sealed sources and devices and a portable hot cell for use in removing high activity sources from devices in the field for ease of transport. The IAEA International Catalogue of Sealed Radioactive Sources (the Catalogue) provides vital information for a wide range of individuals and organizations on industrially manufactured radioactive sources and devices, facilitating source/device identification based on limited information available (or "found") for given items (Reference 6). Such information is useful for safe handling and disposition of these items. This searchable database of sealed sources and source-containing devices currently contains information on 6,800 source models in separate modules for devices and source. The OSR Project has participated in IAEA consultancies supporting the development of the Catalogue, including consideration of design and policy issues. OSR Project staff have also supplied data on hundreds of sources and devices of US and Canadian origin to the Catalogue that was obtained during normal Project operations.

OSR staff have also participated with IAEA in the design, development of procedures, and training of personnel for the Spent High Activity Radioactive Source (SHARS) conditioning facility, a portable hot cell that will use sand as shielding material (Figure 1). The conceptual design is for a facility, shielded and offering remote handling capabilities, that could be deployed to countries having limited resources for the safe handling of high activity sources (Reference 7). Using the conditioning facility, the sources could be removed from their existing packaging configuration, and placed into a shielded storage container for long term isolation and maintenance on site in a safe and secure configuration. The conceptual packaging configuration design would also lend itself to future repackaging for shipment to storage or disposal facilities as they become available without the need for further remote handling operations.

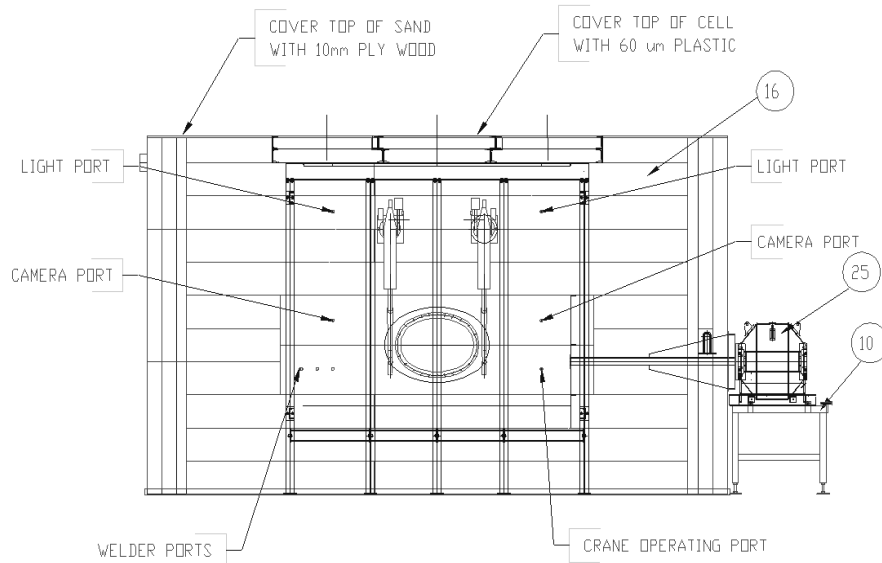


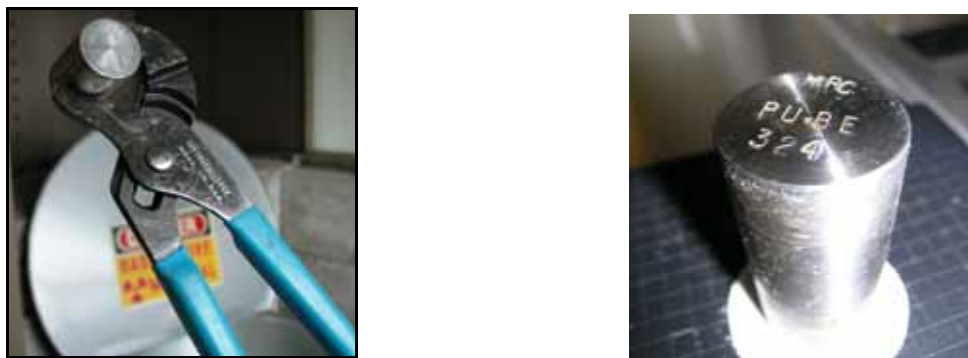
Figure 1. Portable Spent High Activity Radioactive Source conditioning facility.

## RECENT ACCOMPLISHMENTS

The OSR Project has accomplished several important objectives recently related to securing and disposing of radiological material, including recovery of almost 14,000 sealed sources since 1999 (Reference 4). These milestones are discussed below.

### Completion of Pu-239 Domestic Campaign

In June 2006, the OSR Project completed a major sealed source recovery and disposition objective by recovering and securing all known non-governmental excess and unwanted Plutonium-239/Beryllium (Pu-239/Be) neutron sealed sources (Figure 2) from within the U.S. Recoveries included unused sources from universities and commercial/industrial licensees. By the end of FY06, the OSR Project had disposed of about 270 PuBe sources containing more than 8900g of Pu.



**Figure 2. PuBe neutron sources manufactured in the 1960s.**

Initial OSRP efforts focused on locating, packaging, recovering, and storing unwanted Pu-239/Be sources from universities and other institutions. Later efforts focused on a permanent disposition pathway. The DOE General Counsel determined in 2003 that all Pu-239 sources were eligible for disposal at WIPP, allowing the OSRP to begin final disposition of the excess domestic sources. Packaging, transporting, characterizing, and meeting WIPP waste acceptance requirements required an extended, concerted team effort. The OSRP collected the sources at 140 different sites, consolidated the inventory into about 120 drums, assembled the required paperwork for WIPP, and disposed of the drums to WIPP. Additional Pu-239/Be sources were manufactured and distributed but are currently in use; the OSR Project will likely recover these materials at a slower rate over the next several years.

### **Type A Fissile Certification of S300 Pipe Overpack Container**

The OSR Project has applied to the Nuclear Regulatory Commission (NRC) for a Type A fissile certification for the S300 pipe overpack container (Figure 3). Obtaining this certification is essential for both efficient domestic operations and recovery of US-origin actinide sources from foreign locations. The application was submitted in August 2006 and NRC had completed the initial review and provided questions within two months. It is anticipated that the certification will be awarded by January 2007. The container could then be used internationally where multilateral certificates of compliance are obtained.



**Figure 3. S300 Pipe Overpack Container.**

### **First Repatriation of US-Origin Sealed Sources from Abroad**

As previously discussed, OSR project staff packaged US-origin sealed sources that were moved by the IAEA from the Sudan and Cote d'Ivoire to the NECSA facility in South Africa. As a result of this effort, the 68 sealed sources packaged by the OSR Project were repatriated to the US in January 2006 and will be disposed at the WIPP facility. For FY '07, a second round of repatriations in Africa and repatriation of material from Australia are planned. US-origin material may also be returned from Uruguay and Italy.

### **Defense Determination for US-origin Actinides and Backlog Disposal**

In May 2006, a defense determination was approved by DOE-CBFO for US-origin Am-241, Pu-238, and Pu-239 with resultant authorization for disposal at WIPP (Reference 8). Since this determination was made, a backlog of approximately 190 drums of waste Pu-238 sealed sources and 20 drums of waste Am-241 sealed sources has been disposed at WIPP (Reference 4).

### **NUCLIDE DISPOSITION PATHWAYS**

Even with the recovery and disposal milestones completed, the OSR project has not solved the problem of disused sources without a disposition pathway. Sources continue

to be produced for industrial and medical uses and disposition options for private source owners are decreasing, rather than increasing. As a result, disposal costs can be expected to increase at the same time that available disposal is expected to decrease. For actinide transuranic sources, the OSR project will continue to be the only disposal pathway for US-origin material unless either criteria for defense determinations or the WIPP-authorizing Land Withdrawal Act are changed. For high activity sources, the OSR project must continue to provide disposal for sealed sources that are too high in activity to be disposed commercially until non-compact-limited disposal exists for all activities.

In order to identify disused sources that require management by the program for threat reduction purposes, the OSR project has developed a website for disused source owners to register their sources to support disposition. Owners of excess or unwanted sealed sources are encouraged to register their sources at the website <http://osrp.lanl.gov>. The OSR Project is pursuing management options as outlined in Table I.

Table I. Disposition Pathways for Various Types of Sealed Sources

<b>Isotope</b>	<b>Disposition</b>
Cm-244	Storage at LANL, researching disposal options
Cf-252	ORNL, private facility disposal
Ra-226	Storage pending disposal – private facility (US Ecology)
Cs-137	Barnwell, US Ecology, NTS (GTCC)
Sr-90	NTS
Co-60	Storage pending disposal to allow decay
Ir-192	Decay in storage due to 72-day half life
DU	Private facility disposal
Am-241, Pu-238, Pu-239	WIPP

In addition, the OSR Project is working with the Conference of Radiation Control Program Directors, Inc. (CRCPD) to initiate the Source Collection and Threat Reduction (SCATR) Program. SCATR will identify, register, and arrange disposition of discrete sources of radiation that are individually less than Category 2 in radioactivity (as defined in the IAEA Code of Conduct (Reference 5)). The SCATR Program will address critical disposal needs of numerous private and non-federal public entities and reduce the threat of accidental or malicious misuse of radioactive material. The OSR Project is currently accepting registrations of smaller sources that will likely be managed under the SCATR program through the website listed above.

## **CONTINUING CHALLENGES**

Challenges in meeting the threat reduction mission of the OSR Project are numerous. These include the following:

- Lack of reasonable-cost disposal or end-of-life options
- Lack of internationally-approved transportation containers for high-activity source-containing devices

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- US regulations (10 CFR 871) prohibiting air transport of Pu into the US
- Lack of shippers who will carry fissile materials
- Reluctance on part of countries-of-origin to repatriate radiological materials, combined with increase international production of radiological material for use in sealed sources
- Lack of inventory information and control of radiological sealed sources

It is hoped that the combined efforts of the OSR Project and the IAEA in getting radiological materials repatriated and dispositioned in countries of origin will prevent such materials from being diverted for malicious uses.

## REFERENCES

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