

End of Life Management of Sealed Radioactive Sources

Facts About Disused Sealed Radioactive Sources (DSRS)

- * Radioactive sources have many uses, including in science, agriculture, medicine and industry. A **sealed radioactive source** is radioactive material that is: (1) permanently sealed in a capsule or closely bonded; (2) in solid form; and (3) not exempt from regulatory control.
- * Once it is no longer used or intended to be used for the purpose for which it was authorised, it becomes a **disused sealed radioactive source**, or **DSRS**.
- * Safe and secure disposal of DSRS, and their proper management and regulation while they await disposal, is critical to mitigating the risk of intentional or accidental harm to people or the environment and, therefore, critical to their continued use for peaceful purposes.
- * Countries have several options for managing DSRS: Decay in storage for short lived radionuclides; Reuse or Recycling; Repatriation/removal to authorised recipient; Consolidation and conditioning into shielded containers; Longer term storage pending disposal; Disposal.
- * If a source is not under regulatory control, because it never has been or because it was abandoned, lost, misplaced, stolen or transferred without proper authorisation, it is an **orphan source**.
- * If a source predates effective regulatory requirements and was either not disposed of or was not disposed of in an appropriate manner, it is a **legacy source**.



The DSRS are depicted here in their original containers that are bulky and deteriorated. These sources are usually stored in 200-litre drums.

Support Provided by the IAEA

- * The International Atomic Energy Agency (IAEA) helps countries to develop technologies for DSRS management, as well as disposal techniques. It provides support and guidance to Member States for managing their waste through many mechanisms, including:
 - ⇒ Training and expert missions.
 - ⇒ Technical guidance documents that help Member States with best practices.
 - ⇒ Identification and development of technology for DSRS management, which makes these technologies publicly available and readily accessible to Member States. One of these technologies, an in-field radiation-shielded facility called a mobile hot cell, is used by countries that do not have the resources to remove and condition high-activity DSRS.
 - ⇒ Identification and support of the development of technologies for the disposal of DSRS. The IAEA has developed the Borehole Disposal System and is supporting two Member States in its implementation. This system is currently the most promising technology to help dispose of all categories of DSRS. It can be constructed in a short time, within a small land area and with little infrastructure. The first borehole system is set for implementation in Malaysia in 2020. Ghana has also made significant progress in this regard.
 - ⇒ Development of a decision-aiding tool, Disused Sources Integrated Decision-Evaluation Support (DSIDES) to assist Member States in determining the best options for managing DSRS, taking into account their particular situation based on inventory (types and number of sources), facilities and resources available.



Once removed from the original devices, the DSRS are placed into specialised capsules and consolidated into specialised containers that increase safety, security and optimise storage space.

For More Information

- * Security of Radioactive Sources. International Atomic Energy Agency. September 2003. https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1165_web.pdf.
- * Code of Conduct on the Safety and Security of Radioactive Sources. International Atomic Energy Agency. January 2004. https://www-pub.iaea.org/MTCD/publications/PDF/Code-2004_web.pdf.
- * Guidance on the Management of Disused Radioactive Sources. International Atomic Energy Agency. April 2018. https://www-pub.iaea.org/MTCD/Publications/PDF/Guidance_on_the_Management_web.pdf.



Jordan's radioactive waste comprises **legacy sources**, as well as sources previously used in medical, agricultural, industrial and research applications. DSRS in Jordan are primarily managed by storing them in specialised facilities until solutions are found for their disposal.

Jordan's legacy radioactive waste was located at a remote national hazardous waste disposal facility, which did not have physical security measures in place commensurate with the level of anticipated threat. At Jordan's invitation, the IAEA conducted an expert mission and concluded that Jordan's DSRS should be moved to the national centralised storage and treatment facilities (CSF).

The next challenge was to reduce the large volume of category 3 through 5 DSRS at the CSF to make room for the legacy sources. In another joint expert mission, the IAEA and the Jordan Atomic Energy Commission (JAEC) conducted a consolidation operation for DSRS located at the CSF. To reduce the storage space and increase the security of the stored DSRS, the IAEA supported Jordan in removing the sources at the CSF from their original devices and placing them in specialised storage capsules and containers (depicted on page one). At CSF, 220 DSRS were stored in 35, 200-litre drums. To date, the JAEC has consolidated 184 of these sources into one storage container.

Recognising that interim storage is not a permanent solution for category 1 and 2 DSRS, the JAEC collaborated with the IAEA to pilot the Disused Sources Integrated Decision-Evaluation Support (DSIDES) tool for Jordan's radioactive waste inventory to support informed decision-making on a permanent solution for its radioactive waste. DSIDES is a multi-attribute utility methodology that can be used to compare options for DSRS disposition, combining a full range of factors such as safety and security, cost, public acceptance and political support, in order to indicate the preferred option. Borehole disposal was recommended as a preferred solution for permanently, economically and safely disposing of Jordan's DSRS.



Sri Lanka has no disposal facilities for DSRS. Sri Lanka's Atomic Energy Regulatory Council requires that all category 1 and 2 sources be repatriated to the manufacturer for disposal as a condition of import. DSRS requiring repatriation are not only limited to sources under regulatory control, but also include **orphan sources**, which pose significant challenges in Sri Lanka.

The original manufacturers of orphan sources are usually unknown, and there is no paperwork to identify them. Sending the disused sources back to their manufactures is therefore not an option. Furthermore the containers for these sources are often damaged and freight companies are unwilling to transport the sources. Moreover, Sri Lanka lacked the training required to locate and dismantle orphan sources.

With the support of the US Department of Energy, Sri Lanka carried out orphan source search programmes at 14 sites, from which 15 radioactive sources were retrieved. The IAEA assisted Sri Lanka with separating and dismantling the DSRS while providing training to build national capacity to conduct these activities. Sri Lanka and its international partners also developed a process for repatriating orphan DSRS, which involved the use of pre-approved transport packages with one-time transportation certificates. These sources were transferred to Los Alamos Laboratories in the US for disposal.

The IAEA provided support to Sri Lanka through two technical cooperation projects, including a regional training course for DSRS. The US provided additional support through its Global Material Security Program.

 Key Takeaways

- * All countries enjoy the benefits of sealed radioactive sources in health, industry and agriculture. Countries must, however, take responsibility for managing the waste produced by these sources in a safe and secure manner.
- * Strict regulatory control of sealed radioactive sources is essential, as is improved accountancy for radioactive sources and monitoring of their movement inside countries and across borders.
- * The IAEA Supplementary Guidance on the Management of Disused Radioactive Sources provides the basis for policies and strategies for managing DSRS .
- * Countries with nuclear power plants may have more resources to deal with radioactive waste, whereas countries without nuclear power infrastructure often face significant challenges in the end of life management of radioactive sources.
- * The IAEA and international partners support countries in the sustainable, end of life management of sealed radioactive sources through training, support for the development of regulatory infrastructure, support for improved accountancy and control, and the development and sharing of technologies and methodologies.
- * The international community is working to ensure a sustainable, safe and secure way to dispose of radioactive waste is achieved, including disposal of DSRS. Currently the borehole disposal system is an option for countries with small inventories consisting mostly of DSRS.

 For Further Reading

Please see full report at: <https://vcdnp.org/end-of-life-management-of-sealed-radioactive-sources/>