

End of Life Management of Sealed Radioactive Sources

On 17 July 2019, the VCDNP organised a panel discussion on the “End of Life Management of Radioactive Sources”. Thirty-four diplomats and technical experts from 19 International Atomic Energy Agency (IAEA) Member States attended the event. The panel comprised experts from Jordan, Sri Lanka, Kazakhstan and the IAEA.

The experts shared their experiences with the end of life management of disused sealed radioactive sources (DSRS). They shared success stories and highlighted the support provided by the IAEA and other international partners. Mr. Ian Gordon, Section Head of the IAEA Waste Technology Section, provided an overview of the range of services the Agency provides, including [IAEA guidance and technical publications](#) on the management of DSRS.

The discussions highlighted the inputs available from the IAEA and bilateral partners for addressing the challenges associated with managing DSRS. These inputs include guidance on developing and maintaining an inventory; access to information on effective conditioning of DSRS for more efficient storage; increasing the physical protection of storage facilities; and providing solutions for the repatriation of orphan sources. The panel also considered the imperative of finding a permanent solution for the disposal of radiological waste. [The borehole disposal system](#), to be implemented for the first time in Malaysia in the near future (subject to regulatory approval), has the potential of being one such solution.

The panel discussion was organised with the generous support from the International Science and Technology Center (ISTC) in Kazakhstan.



Discussion

End of Life Management of Sealed Radioactive Sources in Jordan

Dr. Ahmad Alsabbagh is the Commissioner for the Nuclear Fuel Cycle at the Jordan Atomic Energy Commission. In [his presentation](#), Dr. Alsabbagh provided an overview of the solutions employed by Jordan for management of DSRS and the support provided by its international partners. Jordan's radioactive waste comprises legacy sources, as well as



sources used in medical, agricultural, industrial and research applications. Jordan's management options include: returning DSRS to the supplier; managing DSRS in the national specialised facilities for radioactive waste management; and finding international or regional solutions for DSRS management and disposal.

Jordan currently favours the option of storing its DSRS in national specialised facilities for radioactive waste management. There are three main sites hosting radioactive waste, processing and storage facilities: the national centralised storage and treatment facilities (CSF) at the Jordan Atomic Energy Commission (JAEC); the Jordan Research and Training Reactor Radioactive-Waste Treatment Facility (RTF) (for spent fuel from its research reactor); and the storage pit for legacy radioactive waste at the National Hazardous Waste Disposal Site at Sewaqa.

A primary challenge that had to be overcome at the Sewaqa storage facility was that the facility, being in a remote location, did not have the physical security system and measures that were adequate to the level of anticipated threat. The requirements to overcome this challenge were to either upgrade security at the site or transfer the legacy sources to the CSF.

The JAEC collaborated with the IAEA to conduct an expert mission to assess the situation for DSRS at Sewaqa. The inventory was checked, dose rates were measured and retrieval options were studied. It was decided that the waste should be transferred to the CSF. In collaboration with the European Union (EU), the JAEC then developed a feasibility study for the transfer of radioactive waste at the Sewaqa site. Four different options were evaluated from both technical and financial points of view. The study found that the most viable option would be to transfer to the DSRS to the CSF for processing, characterisation and storage in dedicated storage facilities.

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 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 categories 3 through 5 sources from their original containers and in placing the sources in specialised storage capsules and containers.

To date, the JAEC has consolidated 184 of its 220 DSRS at the CSF, which was previously stored in 35, 20-litre drums into one container of the same size. The joint mission also trained Jordanian staff in the design and manufacturing of the specialised storage capsules and containers, as well as in the removal of sources from their original containers.

Recognising that interim storage is not a permanent solution for long-lived DSRS, the JAEC collaborated with the IAEA to pilot the Disused Sources Integrated Decision-making Evaluation (DSIDE) tool for Jordan's radioactive waste inventory to support informed decision-making on a permanent solution for its radioactive waste. DSIDE 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, costs, public acceptance and political support to indicate the preferred option. Borehole disposal was recommended as a preferred solution for managing Jordan's radioactive waste.

End of Life Management of Sealed Radioactive Sources in Kazakhstan

Mr. Timur Zhantikin, is the Director General of the Kazakhstan Nuclear Power Plants and previously held the position of Director General of the Atomic Energy Committee, Kazakhstan's regulatory authority. In [his presentation](#), he explained that disused sources are kept in several long-term storage areas in his country. With support from the IAEA, the US and France, Kazakhstan enhanced physical protection practices at 18 sites containing high-activity radioactive sources, such as oncology clinics. In addition, two sites with orphan sources were cleared and a radioactive material source registry was completed.



Mr. Zhantikin highlighted some of the challenges Kazakhstan faces in the management of its DSRS. Owners of radioactive sources in Kazakhstan are required by law to pay environmental release fees when DSRS are placed into storage. However, these fees can be larger than the initial price of a source. As a result, many DSRS are misplaced by owners seeking to save costs.

Kazakhstan has 13,000 sources on its national registry. Keeping track of such a large number of sources is challenging. The IAEA has developed a database for the registration of sources, but according to Mr Zhantikin it does not support the registration of a large number of sources. Mr. Gordon from the IAEA thanked Mr. Zhantikin for his comments, noted that the IAEA is developing new software and that the Agency would appreciate further feedback and suggestions in this regard.

Mr. Zhantikin noted that the international community needs to improve accountancy for radioactive sources and monitoring of their movement inside countries and across borders. Strict regulatory control and advanced technical measures, such as software and measurement instrumentation, are required. Finally, Mr. Zhantikin encouraged the international community to further investigate technical means and ways of safe disposal of DSRS and other radioactive waste.

End of Life Management of Sealed Radioactive Sources in Sri Lanka

Mr. Kapila De Silva, Deputy Director of Sri Lanka's Atomic Energy Regulatory Council (SLAERC) **presented on the management of DSRS in his country.**

Whilst storage facilities are adequate for managing DSRS, the accumulation of sources must be controlled. Sri Lanka has no disposal facilities for DSRS. SLAERC requires that



all category 1 and 2 radioactive sources be returned to the manufacturer for disposal as a condition for obtaining import approval of the sources.

DSRS requiring repatriation are not only limited to sources under regulatory control, but also include orphan sources. Sri Lanka has orphan sources that pose significant challenges. The original manufacturers of these 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 orphan sources are often damaged and freight companies are

unwilling to transport the sources. Sri Lanka is however successfully addressing these challenges with the help of its international partners. With the support of the US Department of Energy, Sri Lanka carried out orphan source search programs at 14 sites to date, 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.

The Role of the IAEA

Mr. Ian Gordon, Section Head of the Waste Technology Section at the IAEA, provided [an overview](#) of the work of the Agency on DSRS. The IAEA's long-term goal is for all Member States to have a sustainable capability to manage DSRS safely and securely. The IAEA provides safety standards, security guidance and practical solutions to enable the sustainable management of DSRS.



Countries have several options for managing DSRS: consolidation and conditioning, which is the removal of sources from devices, placing them in shielded containers (to meet dose limits) and holding in secure storage; reuse or recycling; decay storage (for those materials with short half-lives); return to an authorized supplier (repatriation); long-term secure storage pending disposal; and disposal.

Mr. Gordon explained that countries with nuclear power plants have more resources to deal with radioactive waste. Countries with small amounts of radioactive sources often face significant challenges as the DSRS, although small, pose a significant hazard as waste. The IAEA provides support and guidance to Member States for managing their waste through many mechanisms, including training and expert missions. Mr. Gordon focused on some of the technology that has been developed by the IAEA to support countries in their management and

disposal of radioactive waste. To this end, the IAEA identifies and develops technology for DSRS management, which makes these technologies open-source and readily accessible to Member States.

One of these technologies, the Mobile Hot Cell, is used by countries that do not have the facilities to remove and condition high-activity sources. The Mobile Hot Cell is a shielded radiation chamber that was conceived by the IAEA. It was manufactured by the South African Nuclear Energy Corporation, which owns and operates the facility. The technology can be easily transported and assembled in any country.

The IAEA has developed a decision-aiding methodology 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 in their wider national plans. The IAEA also identifies and supports the development of technologies for the disposal of DSRS. In addition, the IAEA is supporting two Member States in the implementation of the borehole disposal system. Subject to proper licensing, this system will be implemented for the first time in Malaysia in the near future.

Mr. Gordon provided an overview of the IAEA Code of Conduct on the Safety and Security of Radioactive Sources. The Code's provisions are aimed at ensuring that States have effective national legislation, regulations and a regulatory body, as well as effective import/export control of radioactive sources. The Supplementary Guidance on the Management of Disused Radioactive Sources provides further guidance regarding the establishment of a national policy and strategy for the management of disused sources. It also provides guidance on the implementation of management options, such as recycling and reuse, long-term storage pending disposal and the repatriation of sources.

Conclusion

The panel agreed that safe and secure management of DSRS is essential to protecting people and the environment. All countries enjoy the benefits of radioactive material in health, industry and agriculture. Countries must, however, take responsibility for managing the waste produced by these sources in a safe and secure manner. Whilst there are many challenges in this regard, the panel demonstrated effectively that solutions exist and that the IAEA and other international partners can support countries in the sustainable end of life management of these sources. The experts also noted that the policies and strategies for managing DSRS in their countries were based on the Supplementary Guidance on the Management of Disused Radioactive Sources.

The panel recognised that all current available options are not permanent solutions for long-lived sealed radioactive sources. A permanent solution must be

found where these sources can be disposed of permanently, economically and safely. The borehole disposal system has the potential of being one such solution.

The panel also recognised the importance of providing training to countries and enhancing their capacity to develop regulatory infrastructure and keep track of their sources. The panel emphasised the importance for the international community to continue to learn from one another's experiences in managing sealed radioactive sources throughout their lifetime.

IAEA resources

The following IAEA resources are available to support countries in the management of their DSRS:

E-Learning modules

The IAEA has developed and made available eLearning modules on DSRS management in several languages

<https://www.iaea.org/services/education-and-training/online-learning>;

<https://elearning.iaea.org/m2/course/index.php?categoryid=60>;

DSRSNet

Recently launched DSRSNet - a professional network for sharing practical experience, knowledge and international developments in the field of management of DSRS

<https://nucleus.iaea.org/sites/connect/DSRSpublic/Pages/default.aspx>

Publications

Guidance documents provide information for management methods and options for DSRS, application of tools and technologies and safety and security considerations.

<https://www.iaea.org/publications/10582/management-of-disused-sealed-radioactive-sources>