

### The Role of International Programmes for the Effective Management of Disused Sources During a Technology Transition

Workshop on End-of-life Management In Support Of Radiological Security And Technology Transition 28-30 March 2023, Aix en Provence, France

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## The Role of IAEA in DSRS Management



- The IAEA coordinates a wide range of support to all its 175 Member States, towards the safe, secure and sustainable disposition of DSRS. This is in line with the IAEA's statutory objective (to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world) and statutory functions (including to foster the exchange of scientific and technical information)
- Our programme of activities is developed through discussion with our Member States and is formally approved by our General Conference.
- The programme is supported from within the Regular Budget and by greatly appreciated Extrabudgetary Contributions. In the field of DSRS, recent EB contributions have been received from USA, Canada, the European Commission, France, Norway,
- We work through Member State governments and also liaise with relevant organisations



## The Role of IAEA in DSRS Management



The primary challenges are

- demand for services continues to be high,
- maintaining a balance between responding to the immediate needs, and
- building a framework for the future

### The IAEA strategy is

- In the short term, to support Member States in the management of DSRS with a positive impact on safety and security
- In the longer term, to build capacity within Member States, so that they have autonomous capability inline with UNSDG and safety and security expectations

## Promoting Cradle to Grave Approach in Managing DSRS

Management options and technical solutions exist for the management of all types of DSRS Tools and Technology are available for MS to properly manage their DSRS in a safe secure and sustainable manner. Innovations ongoing Three options (1) reuse and recycling, (2) long-term storage of DSRS and disposal, (3) return to a supplier GUIDANCE ON THE MANAGEMENT OF DISUSED RADIOACTIVE SOURCES

弃用放射源管理导则

ORIENTATIONS SUR LA GESTION DES SOURCES RADIOACTIVES RETIRÉES DU SERVICE

РУКОВОДЯЩИЕ МАТЕРИАЛЫ ПО ОБРАЩЕНИЮ С ИЗЪЯТЫМИ ИЗ УПОТРЕБЛЕНИЯ РАДИОАКТИВНЫМИ ИСТОЧНИКАМИ

ORIENTACIONES SOBRE LA GESTIÓN DE LAS FUENTES RADIACTIVAS EN DESUSO

> إرشادات بشأن التصرف في المصادر المشيخة المهتلة

2018 EDITION

Guidance on the Management of Disused Radioactive Sources

Political Commitment from MS
For (2), DSRS should be conditioned in retrievable from safe, in a way that maintains flexibility to comply with future disposal concepts

## DSRS Management – Addressing the Past



Facilitating solutions and strategies for dealing with legacy DSRS



- Developing strategies for managing legacy DSRS (<sup>226</sup>Ra, old irradiators, RTGs, etc.)
- Assisting in recovering buried and immobilized DSRS

Address

the past

- Raise awareness of the management options for DSRS (return to a supplier, reuse and recycling and long term storage and disposal)
- Assisting MS in conditioning and safely store DSRS until endpoint is implemented.



ecent tions	NW-T-1.30 Management of Depleted Uranium Used as Shielding in Disused Radiation Devices	IAE
	NW-T-1.15 Management of Disused Radioactive Lightning Conductors and Their Associated Radioactive Sources	
	NW-T-1.3 Management of Disused Sealed Radioactive Sources (Russian translation)	
In drafting	Management of Cat 1-2 Sources	_
	Reuse and Recycling of Sources	
	Published in 2023/22	Published in 2023/22NW-T-1.30 Management of Depleted Uranium Used as Shielding in Disused Radiation DevicesNW-T-1.15 Management of Disused Radioactive Lightning Conductors and Their Associated Radioactive SourcesNW-T-1.3 Management of Disused Sealed Radioactive Sources (Russian translation)In draftingManagement of Cat 1-2 SourcesReuse and Recycling of Sources Conditioning of Cat 3-5 Sources



### a. The Global Radium-226 Management Initiative



Global demand for <sup>225</sup>Ac for targeted alpha therapy is recently increasing



 $^{226}$ Ra $(\gamma,n)^{125}$ Ra  $(T_{1/2} = 15 d) \rightarrow ^{225}$ Ac

Cyclotron: Irradiation of Radium-226 with medium energy protons (16 MeV): Ra-226 (p.2n) Ac-225

Linear Accelerator: Irradiation of Radium-226 with high energy protons and photonuclear transmutation . Ra-226 (y,n) Ra-225 -Ac-225

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#### **Targeted Alpha** Therapy



Legacy stocks of <sup>226</sup>Ra Long-term management challenge



INTERNATIONAL ATOMIC ENERGY AGENCY

IAEA-TECDOC-886

interim storage of spent radium sources

(4)

June 1996

IAFA







0.66 mg/cm 0.33 mg/cm 0.86 mg/cm 0

177	//////////////////////////////////////	

United States Patent Kabal mal.







ACCOUNT OF THE PERSON APPENDIX

In one aspect, the disclosed subject matter described herein provides a method for purifying Radium (Ra) for target preparation for 225Ac production from a radioactive source. the method comprising: a) determining the quality of the Ra material to be purified; b) contacting the radioactive source with a mineral acid such that Ra is leached from the radioactive source into the mineral acid to generate a leached pool; c) separating Ra from Ba, Sr, and Pb in the leached pool by extraction chromatography to generate one or more Ra con-

### **The Global Radium-226 Management Initiative**



The role of IAEA:

- Promote and facilitate the global recycling of DSRS, specifically <sup>226</sup>Ra to produce <sup>225</sup>Ac for use in Nuclear Medicine
- Facilitate the coordination and safe and secure transference from the current location in countries with disused <sup>226</sup>Ra sources (holders) to countries with suitable recycling facilities and capabilities (recipients), and to gather and disseminate experience and good practice in implementing such transfers.
- To support the Ac-225 radiopharmaceuticals production for cancer treatment. CRP: Production and Quality Control of Actinium-225 Radiopharmaceuticals (F22075, launched Feb 2022)

Involved parties (recipient companies/countries) will cover the packaging/transportation costs.

Financial contributions are welcomed!

Rough estimation:

A conditioning operation and transport could cost 25 to 30K. Take EUR 30K per operation. We have 40 holders of Ra226. 40X30K = **1.2 million EUR to assist MS in conditioning the Ra226 for international transportation**. Assumption: the transport packages will be sent to and back by the recipient companies/countries

### **b. IAEA Disused Sources Removal**



IAEA Facilitates Safe and Secure Removal of Disused Sealed Radioactive Source in Bahrain

Sarah Henry, IAEA Department of Nuclear Safety and Security



IAEA assists MS, upon request, to remove DSRS to an authorized recipient

#### Since 2009

- 84 devices removed totaling 282 sources
- Scheduled for 2023 2024
  - 68 additional sources/devices planned

Operation in Chile



# **Challenges in Source Removals**



- Initial information from the end users can be a challenge. If the devices are legacy, there may be little information.
- "One-Off" devices can be a management challenge.
- The IAEA needs more qualified service providers. IAEA service providers are excellent, but resource limited.





## c. Disposition of DSRS

Borehole Disposal Concept (BDC): The IAEA introduced BDC in 2011, an engineered barrier system, based on the use of stainless steel capsules and buries in a borehole at depths greater than 30 meters. For small inventory country, this technology is attractive and technologically-viable.

Technological and Engineering Support by the IAEA

Design and **Fabrication of the** Mobile Tool Kit Facility by the IAEA - shipped and arrived in

Malaysia March 2019

Continuous Improvement of the Technology

- The DSRS are first conditioned into disposal capsules (3 mm thick stainless steel), which are then placed into a container (6mm thick, stainless steel, lined with a cement-based containment barrier).
- · These disposal containers are disposed of in a borehole (diameter: ca. 26 cm; depth: 10s to 100s metres)
- The borehole is closed by backfilling it with a cementitious backfill material.







Transfer Cask (also used during

emplacement)

Mobile Tool Kit Facility (MTKF)

Working area in the MTKF

- Welding Machine
- **Optimizing Backfill Cement Formulae**
- CRP: Developing a Framework for the Effective Implementation of a Borehole Disposal System (T22002) 2019-2022
- iii. Encourage innovation in Mobile Tool Kit Facility and Mobile Hot Cell
- Documenting the experience in Malaysia for future iv. development

## Disposition of DSRS – Coordinated Research Project

- The pilot projects in Malaysia and Ghana have crystallised wide interest in the borehole disposal concept for DSRS.
- To support future borehole disposal projects, an IAEA Coordinated Research Project is now running to develop a standardised framework for the borehole disposal of DSRS (and small quantities of low and intermediate-level waste other than DSRS).
- The goal of such a standardised framework is to develop a consistent, comprehensive and robust package of scientific and technical data, along with guidance, information, tools and training across all of the borehole disposal programme.
- This will reduce the need for each Member State to develop all materials from first principles and make the borehole disposal option more readily licensable and implementable.



## d. Tools and Technologies

Supporting tools:

- MTKF for Cat 3-5 DSRS conditioning and disposal
- MHC for Cat 1-2 DSRS conditioning and disposal
- Type B 435 Container
- Borehole disposal technology
- Standardized capsules and shielding containers for DSRS
- Technical Manuals and Set of documents supporting licensing
- ISO containers for storing DSRS
- DSRSNet
- QTC
- DSIDE



DSIDE Integrated decision making Evaluation of results for all scenarios; preferred scenario identified







Consultancy Meeting on the Usage of MHC (12-16 June 2023)



IAEA 435-B Package (USA/9355/B(U)-96) Consultancy Meeting on Training on the Use of 435-B (Q3 2023)

### e. DSRS Technical Centre Peer Review Mission

- The DSRS TeC peer review aims to increase and enlarge the accessible pool of resources and support for sustainable management of DSRS.
- The mission will review the **technical** proficiencies, operational processes and quality management.

ne / News / JAFA Presents New Peer Review Service for Disused Sealed Radioactive Sources Technical Centr

IAEA Presents New Peer Review Service for Disused Sealed Radioactes **Technical Centres** 

Lucy Ashton, IAEA Departm

SEP 29



Related stories



AFA Issues New Publication on Stakeholder Engagement Radioactive Waste Disposi

Making Progress in the Safe Management of Disused Sealed Radioactive Sources

Experts Safely Manage fter Revival of Cuba's Food Irradiation Services

### Scope of the Peer Review Mission

- Establishing SRS/DSRS inventory
- DSRS characterization
- Conditioning of Cat 1-2 DSRS
- Conditioning of Cat 3-5 DSRS

- Guidance and advice on end-of-life solutions (decay in storage, reuse, recycling, disposal)
- Support for preparation for international transport or removal

# **Coming up events**



22-26 May 2023

Technical Meeting on Lessons Learned from Removals of Category 1 and 2 Disused Sealed Radioactive Sources (virtual)

5-9 June 2023

Technical Meeting on the Global Radium-226 Management Initiative

28 Aug-01 Sept 2023

1<sup>st</sup> Network Meeting of DSRSnet,



30 Oct -3 Nov 2023

Technical Meeting on Tools and Equipment for the Management of Disused Sealed Radioactive Sources (virtual)

### **Ensuring Safety and Enabling Sustainability**

International Conference (06-10 November 2023, Vienna, Austria) to provide:

Forum for exchanging information and experiences on managing the relationship between safety and sustainability in the context of radioactive waste management, decommissioning, environmental protection, and remediation.

#### **Objectives:**

- Initiate and assist the necessary dialogue between the safety and sustainable development communities
- Consider how to address the interrelationships in an integrated way
- Identify practical approaches on how to manage the interrelationships in decision-making, from policymaking to implementation

Deadline for abstracts 30 April 2023



Home: International Conference on the Safety of Radioactive Waste Management, Decommissioning **Environmental Protection and Remediation:** Ensuring Safety and Enabling Sustainability | IAEA



6-10 November 2023

International Conference on Safety of Radioactive Waste Management, Decommissioning, Environmental Protection and Remediation





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Thank you!