IAEA
International Atomic Energy Agency
Atoms for Peace and Development

IAEA's work on the disposition of DSRS

The US National Academies of Sciences Engineering and Medicine Committee on Disposition of Disused Sources

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The IAEA

- **Established in 1957**
- **171 Member States**
- **~ 2,500 multidisciplinary staff from more than 100 countries**

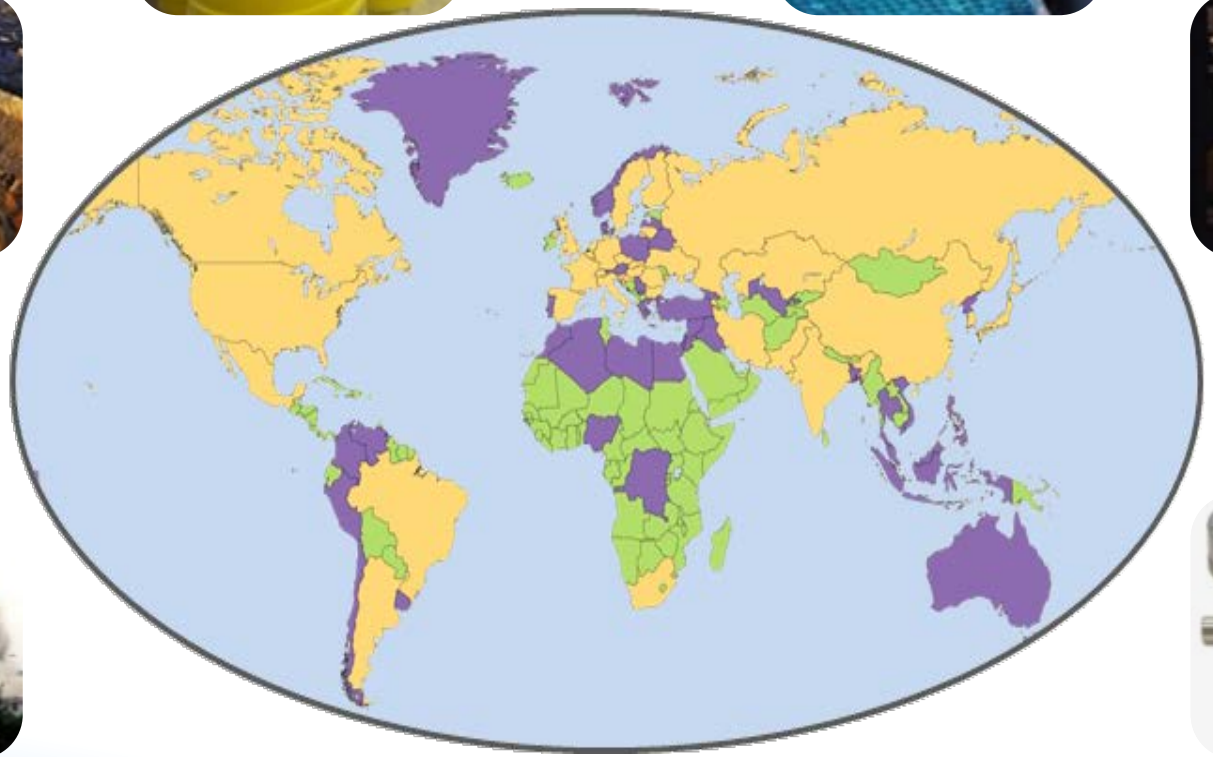
ATOMS FOR PEACE AND DEVELOPMENT

Safeguards and Verification

Safety, Security

Science and Technology

Radioactive Waste



The management of radioactive waste is a global topic, with proven solutions.

Nuclear power plants

Research reactors

Use of radioactive sources (only)

Definition of Disposition

- disposition, *n.*
  - ***4*** **a.** The action of disposing of, putting away, getting rid of, making over, etc. (see DISPOSE *v.* 8); bestowal; *spec.* in *Law*, the action of disposing; bestowal or conveyance by deed or will.
    - Oxford English Dictionary

- For the purposes of this presentation, to include . . .
  - Conditioning
  - Recyling
  - Repatriation, **and**
  - Disposal

- Will also cover some IAEA programmes which support the wider objective (reducing hazard, whilst maintaining benefits)

Overview – Impact timing

Now

- Support and capacity building towards . . .
  - Inventory, Conditioning, Recycling & Repatriation
  - Developing a Policy and a Strategy
  - Borehole disposal – pilot projects

Coming years

- QTC (Qualified Technical Centres)
- Open Source designs
  - MHC, MTKF, Borehole Disposal, storage

Longer term

- Alternative technologies
- Evolving frameworks to support effective end of life management

- IAEA Code of Conduct (including Supplementary Guidance)
- IAEA Technical publications, e-learning, databases, Professional Networks, Conferences, etc.
- IAEA Safety Standards and Security Guidance
- Joint Convention on the Safety of Radioactive Waste and the Safety of Spent Nuclear Fuel

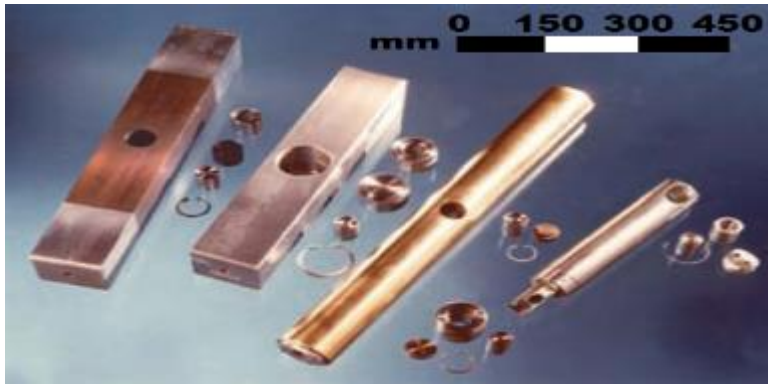
The IAEA's Role in DSRS Disposition

- The IAEA coordinates a wide range of support to all its 171 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 Canada, the European Commission, France and USA.
- We work through Member State governments and also liaise with relevant organisations involved in the topic, for example, WINS, ISSPA, etc.
- The IAEA's strengths include . . . Neutrality, extensive technical knowledge, global reach and respected convening capability.
- The primary challenges are
  - That the demand for services continues to be high and
  - Maintaining a balance between responding to the immediate needs and building a framework for the future

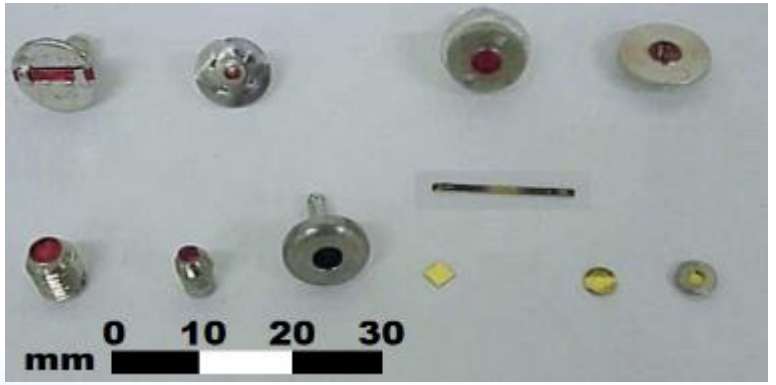
Disused sealed radioactive sources

- Millions of sealed radioactive sources (SRS) are used worldwide in agriculture, industry, medicine and various research areas and deliver great benefits.
- Despite their predominantly small physical size, many sources contain high concentrations of radionuclides (industrial and medical sources are typically in the GBq to PBq range).
- Sources that are no longer in use are referred to as disused sealed radioactive sources (DSRS).
- Even when a source is declared as disused, it may still be significantly radioactive and potentially hazardous to human health and the environment. It may also pose a security concern.

Cs sources

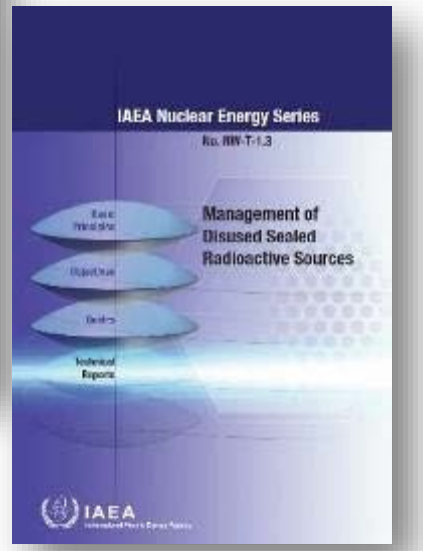


Co sources



Am sources

DSRS management

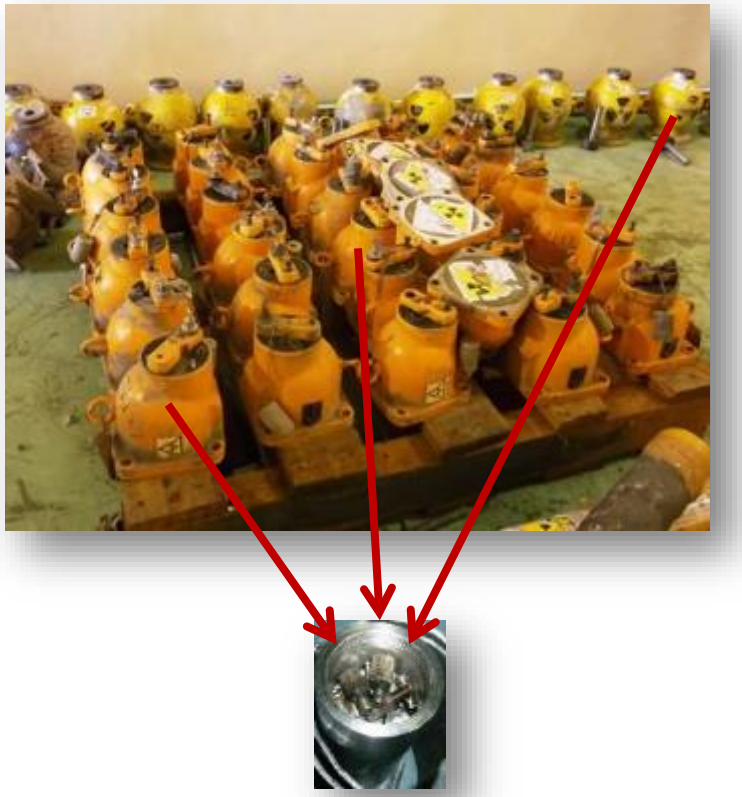


- A range of options exists for DSRS management, including reuse, return to a supplier, storage and disposal.
- The IAEA strategy is:
  - In the short term, to support Member States in the management of DSRS, with a positive impact on safety and security
  - In the longer term, to build capacity within Member States, so that they have autonomous capability in line with UN SDG and safety and security expectations.
- The IAEA supports Member States in their DSRS management through:
  - Capacity building through publications, professional Networks, e-learning, training and reviews – both regulatory, strategic and operational.
  - Field operations to train on the dismantling of devices containing DSRS and conditioning the DSRS
  - Providing a platform to develop ‘open source’ designs for tools and technologies for DSRS Management, including providing support to borehole disposal of DSRS
  - Code of Conduct, (including Supplementary Guidance), Safety Standards and Security Guidance

Practical Support to Member States

Before

After



- Understanding the inventory
- Dealing with the unexpected
- Building human and organisational capacity

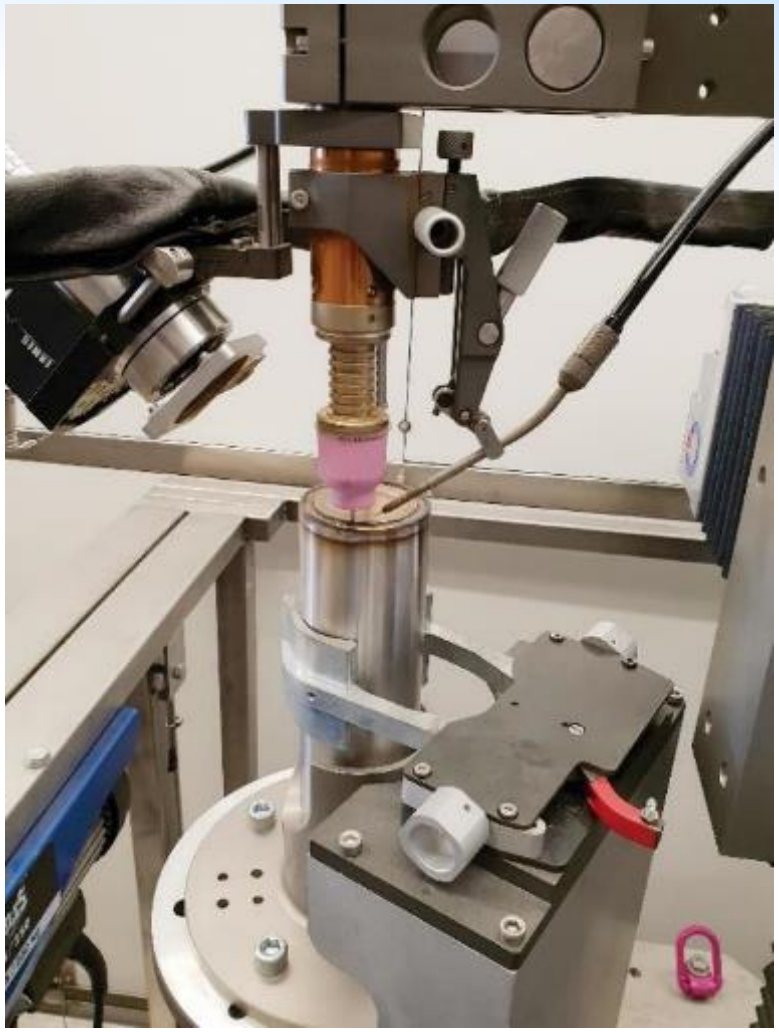
Mobile Tool Kit Facility – MTKF

Exterior

Interior – Dismantling Zone

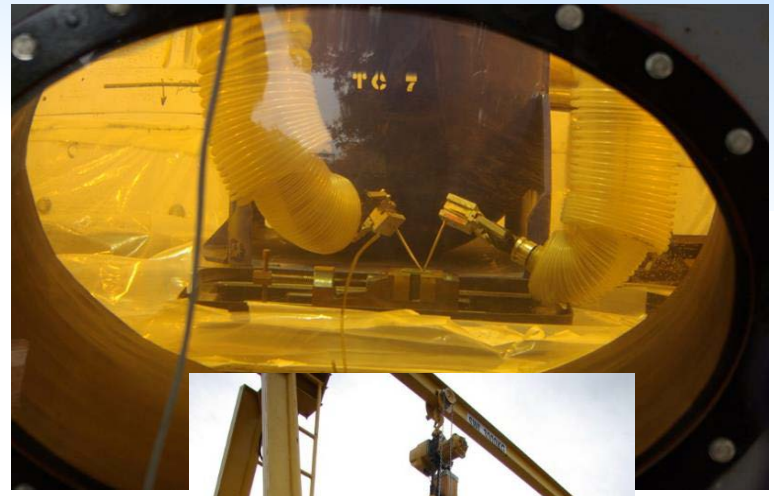
Mobile Tool Kit Facility – MTKF

Interior – Characterisation Zone



Interior – Welding

Open source designs for tools and technologies



The IAEA / NECSA Mobile Hot Cell

Storage solutions

Cameroon

Qualified Technical Centres for the Management of DSRS

- The vision is to scale up the support for safe and secure management of DSRS
  - Strengthen existing capacity of some MS to support others and make support more sustainable
- Expands the support that can be readily provided and meet the many needs of MS

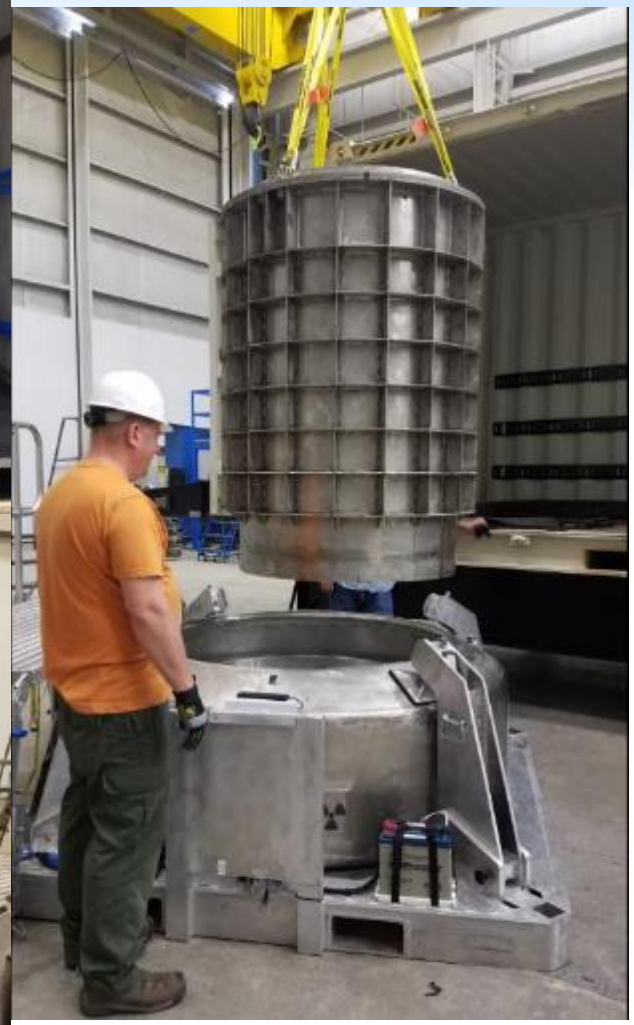
Qualified Technical Centres for DSRS Management

- Building on existing capability in MS
- Providing a range of services, available within their own MS, regionally and beyond.
- Sustainable operations, in terms of both personnel and funding.
- Focused on regions with the highest unserved demand for DSRS services.
- Requirements, based on international standards, peer reviewed through the IAEA, using a transparent and rigorous process

Sharing Solutions – Building Capacity - Involvement

IAEA 435-B Package (USA/9355/B(U)-96)

- The IAEA accepted for use the US DOE/NNSA provided Type B package, the 435-B (USA/9355/B(U)-96, serial #3), in July 2019.
- The 435-B package:
  - Will allow Member States to access a compliant Type B package for transportation of high activity DSRS.
  - Should provide a cost savings for the agency, and in turn the Member States, to allow for increased capacity for the IAEA to assist Member States in the end-of-life management of high activity DSRS.
  - Allows for the compliant transport of the Long Term Storage Shield (LTSS), which interfaces with the IAEA Mobile Hot Cell (end-to-end solution).
- IAEA in final stages of the development of a Quality Management Plan to guide the use of the package by experienced and qualified service providers.
- Engaging currently with IAEA service providers to promote registered users and provide training with NNSA assistance.
- Service providers, upon training completion and registering as users of the 435-B package, will be contracted to operate the package for IAEA DSRS removal projects.



Range and Number of Dispositions Supported

Removal of High Activity DSRS for reuse/recycling

In the past six years (2014-2019) the IAEA coordinated and successfully implemented a dozen source removal projects.

(Albania, North Macedonia, Bolivia, Ecuador, Paraguay, Lebanon, Uruguay, Peru, Tunisia, Honduras, Morocco, Costa Rica).

As a result: a total of 155 disused high activity sources (in 50 devices – teletherapy units, irradiators) were removed for reuse and/or recycling.

15 ongoing projects: Tunisia*, Cyprus*, Bahrain*, Cambodia, Congo, Croatia, Nicaragua, Slovenia, Liberia, Burkina Faso, Algeria, Dominican Republic, Chile, Jordan and Nepal.

**ready for source removal implementation (contracts awarded)*

Conditioning of DSRS for safe/secure storage and later disposal

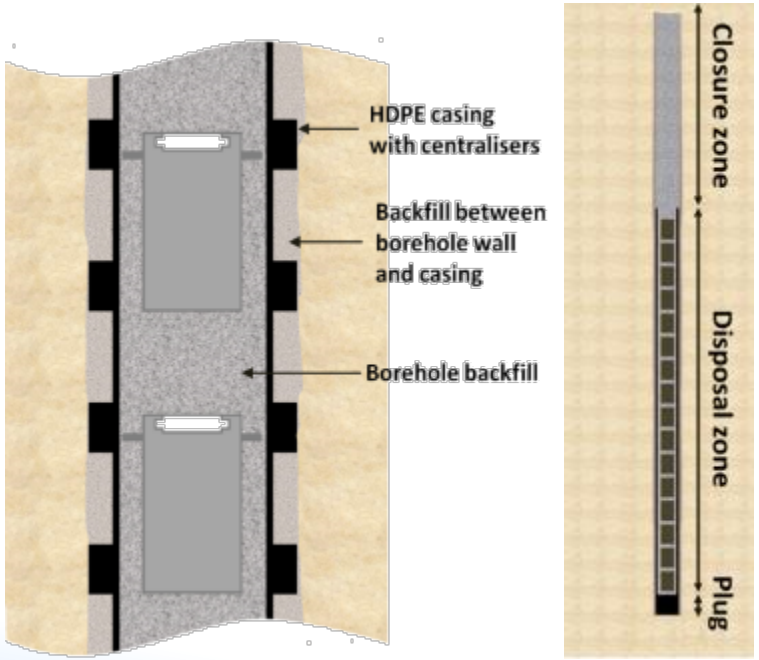
In the past six years (2014-2019) the IAEA assisted over 20 Member States in the dismantling of nuclear gauges and recovering and conditioning the DSRS.

(Malaysia, Bangladesh, Philippines, Chile, Peru, Paraguay, Uruguay, Sri Lanka, Cuba, Indonesia, Thailand, Honduras, Ghana, Viet Nam, Jordan, Malta, Mauritius, Uganda, Zimbabwe, Senegal, Egypt etc).

As a result: a total of over 4,200 disused sealed sources (recovered from thousands of devices) were conditioned for safe/secure storage, and further options (disposal, reuse/recycling).

Borehole Disposal of DSRS

- 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.



Borehole Disposal of DSRS – Malaysia and Ghana

- In 2019, Nuklear Malaysia obtained a license for the borehole disposal of their inventory of ca. 13,000 DSRS (total activity: ca. 1 TBq).
- The Ghanaian Atomic Energy Commission is preparing a license application for the borehole disposal of their DSRS inventory.
- The projects receive financial support of Global Affairs Canada (a governmental organisation) and IAEA Technical Cooperation.
- The IAEA provide assistances to the regulators and implementers in Member States. The implementer and regulator retain responsibilities for the respective duties (safety case preparation, licensing, etc.)

Borehole Disposal - CRP

Coordinated Research Project - (T22002) – Link and link

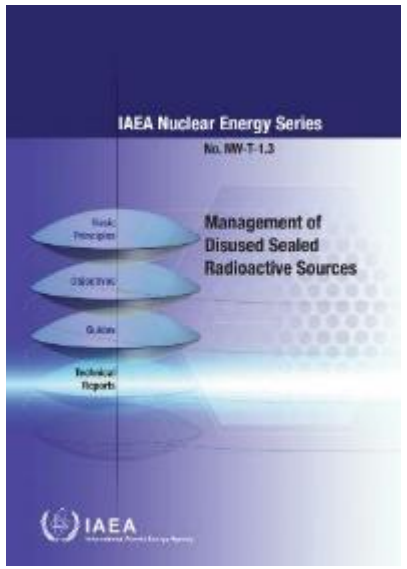
- The pilot projects in Malaysia and Ghana have crystallised wide interest in the borehole disposal concept for DSRS.
- To support future borehole disposal projects, an IAEA Coordinated Research Project is now running to develop a standardised framework for the borehole disposal of DSRS (and small quantities 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.

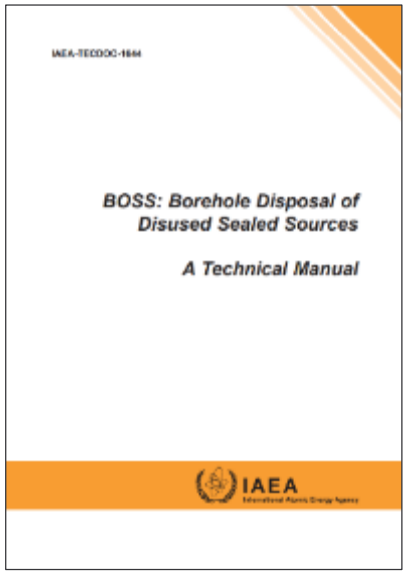
Cost and Timing Considerations

- Disposition costs vary substantially, according to the category/number of sources, condition and accessibility, and the chosen disposition pathway. For the highest category sources, repatriation from remote locations can cost up to $250,000.
- When the IAEA is involved, the process of DSRS disposition typically starts with an approach by a Member State, seeking assistance. From this point, a technical assessment is made, in cooperation with the Member State. Some or all of the work may be sub-contracted, which involves open procurement. Timelines vary, but are typically from one to three years.
- The reasons for inappropriate disposition include lack of funding, lack of access to relevant information and services and more pressing priorities within the country.
- The IAEA may, in certain circumstances, provide financial support, through Extrabudgetary Projects and through the Technical Cooperation Programme.

IAEA work on DSRS management

- **IAEA publications**





- Professional networks - Link

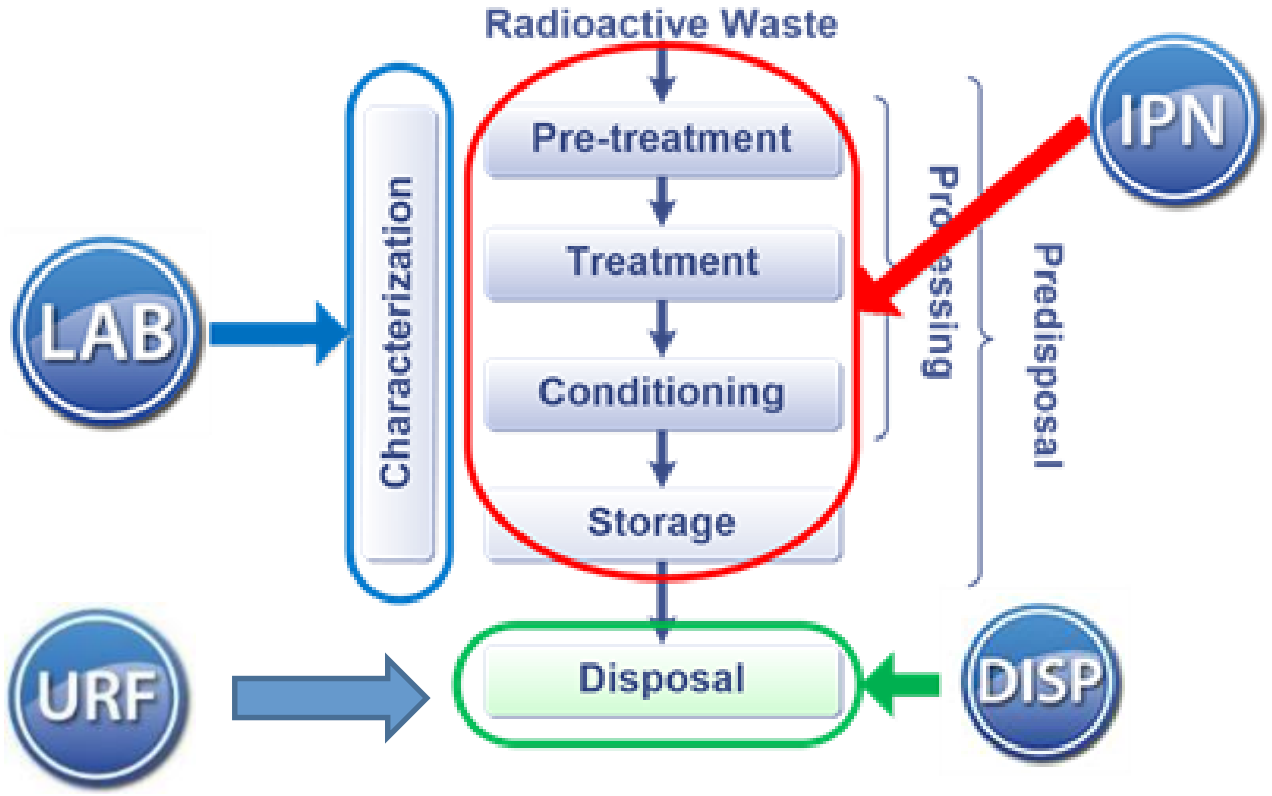
eTools:

- International Catalogue of SRS (ICSRS) – Link
- E-learning - Link

- Technical Cooperation Projects
- Workshops and technical meetings

IAEA Professional Networks - link

Launched Q4 / 2019 = DSRS-Net



IAEA work on DSRS management

Code of Conduct Guidance and Safety Standards

IAEA 60 Years
Atoms for Peace and Development

General Conference

GC(61)/23
Date: 12 September 2017

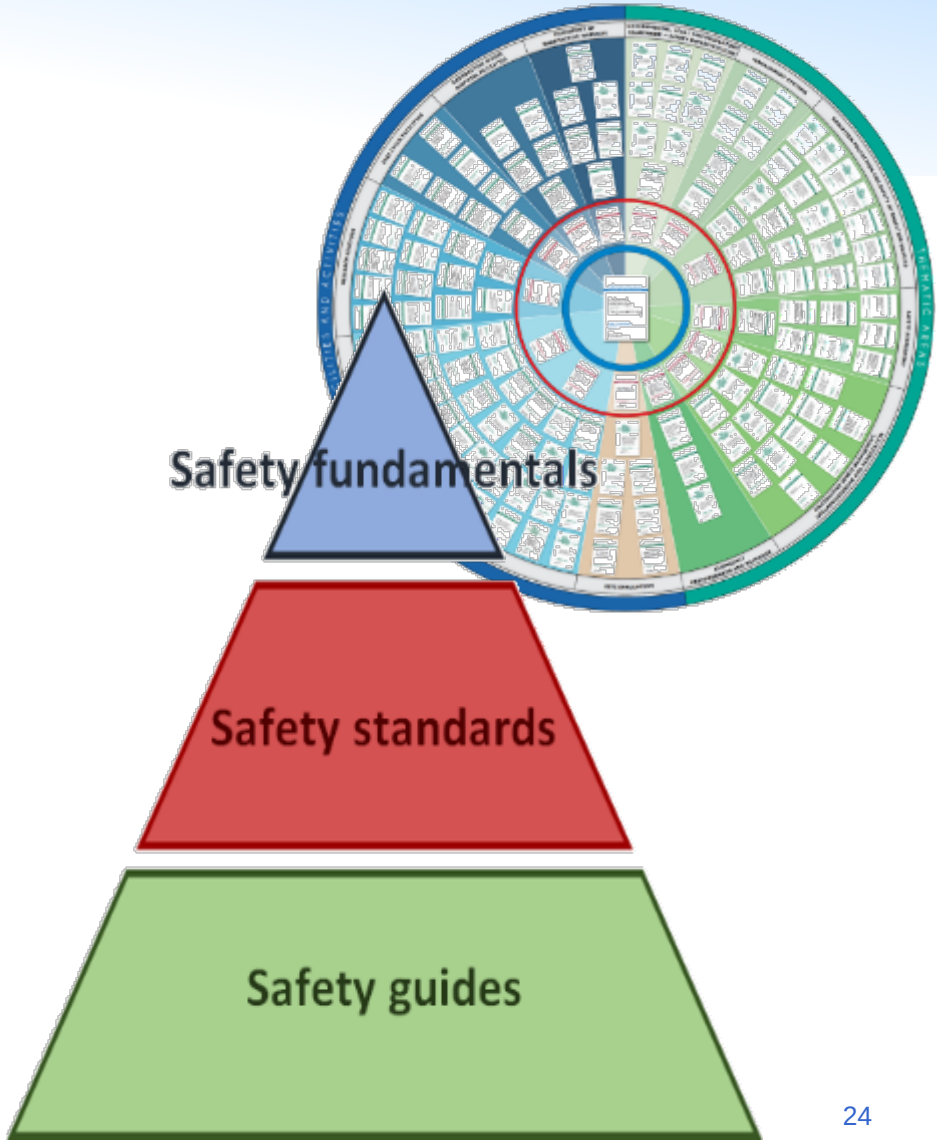
General Distribution
Original: English

Sixty-first regular session
Item 15 of the provisional agenda
(GC(61)/1, Add.1 and Corr.1, Add.2 and Add.3)

Code of Conduct on the Safety and Security of Radioactive Sources:

Guidance on the Management of Disused Radioactive Sources

Report by the Director General



"Each State should provide for the development of a national disposal programme for disused sources in a timely manner."

"The management of DSRS should be part of, or compatible with, the State's overall programme for safe and secure radioactive waste management."

IAEA International Conference

- ***Radioactive Waste Management – Solutions for a Sustainable Future***
  - 1-5 November 2021 (**twenty-one**), Vienna, Austria. CN-294
  - Seeking the best 60 papers and presentations on the most interesting solutions and examples of positive progress.
  - Likely deadline for abstracts = March 2021
  - Welcome cooperation from EC, OECD-NEA, WNA.

Conclusions

- DSRS disposition is a widespread challenge
- Solutions exist and good progress is being made
- The IAEA has a strong and extensive programme of support. This is underpinned by neutrality, global reach, convening capability and depth of experience
- Maintaining a balance between today's demands and the need to eliminate future legacies is crucial

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Thank you! And Stay Connected !

Professional Networks – link

eLearning – link

Videos:
- Two minute - link
- Ten minute – link

Nuclear Communicators' Toolbox - link