International Initiatives for Supporting Repatriation and Recycling of Disused Sealed Radioactive Sources (DSRS) in Member States

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17 September 2014
Outline

• Available methods for managing DSRS
• IAEA process for prioritizing projects and selecting appropriate technical options for each Member State (MS)
• Accomplishments of IAEA NEFW-WTS source management team operations with IAEA MS
• Challenges and future activities
Why is better management of DSRS needed?

- DSRS in virtually all countries – millions in use and disused around the world.
- Some sources not properly controlled – lack of safe, secure, and sustainable management options for the long-term
- Loss of control and theft (many observed by IAEA staff at storage facilities in MS)
- Common scenario - dangerous source obtained by someone who is unaware of the hazard.
Risk and Consequence

- Possibility of malicious use
- Socio-political problems can preclude proper long-term management
- Serious consequences of exposures
- Radiation emergencies involving sources “can occur anywhere” - many that resulted in serious injuries or deaths “involved dangerous orphan radioactive sources.”
Eventually, sources became *unneeded* and *disused*; where no disposal path exists, they are often simply *abandoned*!
Options for Managing Cat 1-2 DSRS

- Return to supplier;
- Transfer of existing DSRS from user facilities to centralized long-term storage;
- Recycling or re-use wherever possible;
- Temporary storage (may not satisfy the requirements for extended storage);
- Interim storage under proper regulatory requirements and with adequate infrastructure;
- Disposal in near-surface repositories (where they can accept DSRS), deep geologic repositories, or boreholes.
Options for Managing Cat 3-5 DSRS

- Similar to those for Cat 1-2, but recycling/reuse is less available and sources are often in gauges.
- Decay in storage is an option for sources with short lived isotopes.
- Procedures and equipment needed to safely handle Cat 3-5 sources different from that needed for Cat 1-2 sources.
- Storage and disposal can be problematic due to very long half-life of some commonly used isotopes: Ra-226, Am-241.
Options for Category 3-5 Sources

- Retrievable conditioning by emplacement of the whole source-containing devices (such as gauges) in concrete-lined drums or other robust containers with adequate shielding to meet dose limits;
- Removal of sources from such devices/gauges and conditioning of the bare sources in shielded containers (not recommended unless country has a large inventory of gauges and appropriate infrastructure).
- CAUTION – disassembling equipment can breach a source and cause contamination with resultant dose to personnel.
Prioritization scheme is used to make decisions about direct assistance to MS in managing Category 1-2 DSRS.

- Considers the security situation in the country, sustainability of possible options, and cost.
Prioritization and Selection, cont’d

• Security situation evaluation includes:

• Total activity of DSRS present, isotopes involved,

• Potential threats such as governmental instability or armed insurgent groups,

• Infrastructure maturity such as existence/effectiveness of regulations and national storage facilities, and

• Political commitment to the Code of Conduct.
Prioritization and Selection, cont’d

- Sustainability - Removal to country of origin when possible is considered to be the most sustainable option.
- Conditioned and unconditioned long term storage are considered progressively less sustainable.
- Disposal also among the most sustainable options, but not yet available for sources in most countries.
Prioritization and Selection, cont’d

• Cost must be considered in the prioritization of work, given the funding constraints. The availability and amount of funding is an important and sometimes limiting factor.

• NOTE:
Prioritization requires data on DSRS inventories!
Cooperating Organizations and Countries for DSRS Management

- Extrabudgetary contributions to IAEA from the European Union, Canada, France, Germany, and the US for operations involving Category 1-2 sources and aggregations,
- Extrabudgetary donations supporting the salaries of cost-free technical experts
- Technical experts who support fact-finding missions and training courses and develop technical guidance documents.
- IAEA Technical Cooperation support for source conditioning projects, especially Cat 3-5 DSRS
IAEA NEFW-WTS Operations

• Secure, remove, or “…return to original supplier radioactive sources which are outside of regulatory control” (2010-2013 NSP) and vulnerable sources
• Conduct hands on training exercises on the search and securing of orphan sources
• Conduct training, characterization and actual conditioning operations on Cat 3-5 sources for safe and secure longer-term storage (most recently in Morocco).
• Condition and remove higher-activity sources and aggregations (Cat 1-3) – funded by contributions to the NSF
Recycling of Cat 2 Irradiator
Type B(U) transport container
French Repatriation Operation
Technologies developed through IAEA – Mobile Hot cell

**Mobile Hot Cell** – used to remove and condition high activity sources in devices
Technologies - Long Term Storage Shield
Generic Post-Closure Safety Assessment demonstrated that the concept provides an appropriate degree of long-term safety for the vast majority of systems, scenarios, and radionuclides.
New - Interface of MHC and BDC

- Fenced in Disposal Site and Building (if required)
- Transport, Conditioning and Disposal Vehicle
- Borehole
- Stratigraphic Units
- Waste Packages
IAEA NEFW-WTS Operations

- Provided technical support and specifications for a new US DoE Type B(U) shipping container to allow for shipment of the long term storage shield and some common devices, may be available for use in recycling and repatriation efforts.
- Work with suppliers, recyclers and service company providers to find suitable handling and transport options.
- Ongoing updates to International Catalogue to facilitate identification of unknown devices and sources.
DoE Type B(U) – 435 - B
Accomplishments - Source Recovery Activities

Thousands of DSRS recovered and safely conditioned for storage in secure national facilities in MS:

• Since 2006, 250 DSRS (92 Cat 1-2) sources repatriated to country of origin or other supplier from 16 countries for recycling or secure storage and disposal;
• Since 2006, more than 8,400 DSRS conditioned in more than 20 countries for storage, including more than 100 Cat 1-2 sources;
• Conditioning/removal projects currently underway in 8 countries (Middle East, Africa, and Central and South America)
Challenges

- Lack of authorized transport containers
- Difficulty in logistics for moving/transport containers with DSRS, many airlines will not carry radioactive material
- Security and political situation in MS
- All of these factors result in high costs, $100,000 - $200,000 per DSRS
Conclusions and Future Work

- IAEA uses a prioritized approach for providing direct assistance to countries in managing their DSRS and will continue this work with donor and MS support.
- Need to find additional options and resources for transport, repatriation and recycling in order to remove DSRS from unsecured locations.
- Assist in easing logistics hurdles between MS.
- Sustainable solutions and predictable funding are needed.
Questions?

- NEFW Waste Technology Section Source Management Team:
- International Catalogue of Sealed Radioactive Source and Devices
  http://nucleus.iaea.org/CIR/CIR/ICSRS.html
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<th>Year</th>
<th>Publication</th>
<th>Number</th>
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<tr>
<td>1990</td>
<td>Handling, Conditioning and Disposal of Spent SS (Tech Manual)</td>
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<td>1995</td>
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<td>Notification and Authorization for Use of RS- Supplement</td>
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