End of Life Management for Radioactive Sources

9 September 2020

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National Nuclear Security Administration

Presentation Overview

- What is radioactive source end-of-life management, and why is it important?
- Global challenges to disused sealed radioactive source (DSRS) management.
- ORS Mission to Enhance DSRS Management in the U.S.
- ORS Mission to Enhance DSRS Management Internationally.

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Office of Radiological Security (ORS)

MISSION: The Office of Radiological Security enhances global security by preventing high activity radioactive materials from use in acts of terrorism.

PROTECT

Protect radioactive sources used for vital medical, research, and commercial purposes.

REMOVE

Remove and dispose of disused radioactive sources.

REDUCE

Reduce the global reliance on high-activity radioactive sources by promoting the adoption and development of non-radioisotopic alternative technologies.

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Terminology	
Long-term Storage	Holding of radioactive sources in a facility that provides for their containment, *with the intention of retrieval.*
Short-term Storage	Storage at a facility/with a licensee in conjunction with the implementation of a chosen management option (return to a supplier, reuse, recycling, or long-term storage and disposal).
Disposition	Emplacement of waste in an appropriate facility *without the intention of retrieval*. This can include near surface and geological disposal facilities, including borehole disposal.
Return to a Supplier	Shipment to a supplier for further reuse, recycling, storage, or disposition. "A supplier" means any legal person to whom a licensee delegates duties in relation to the design, manufacture, production, or construction of a source.
Repatriation	Return or sending of disused source(s) to government possession. Usually funded by governments.

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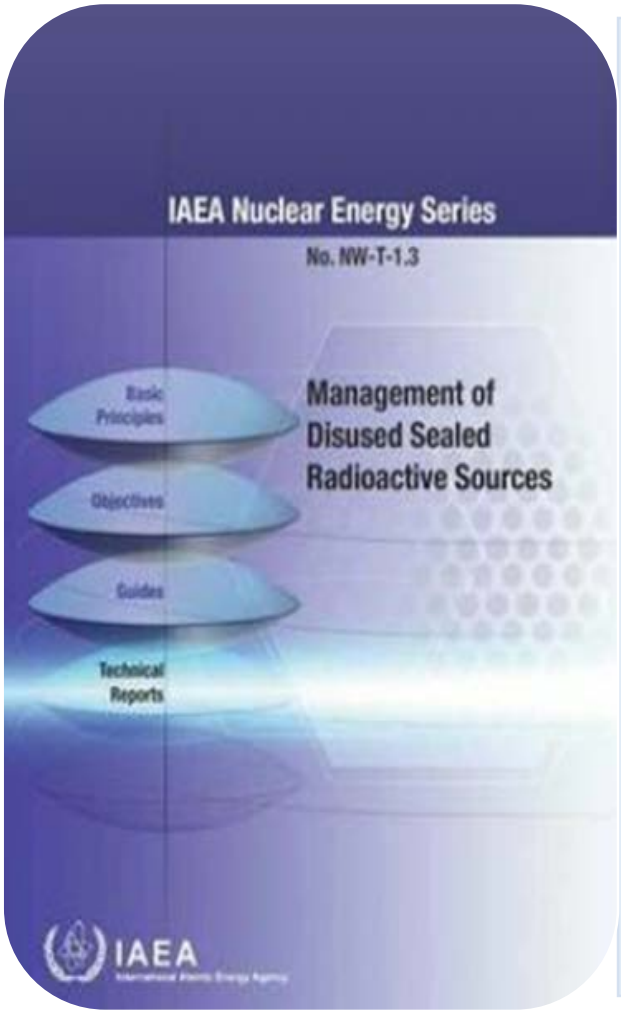
The International Community Agrees on Safety & Security for DSRS



- Regulatory control of sources throughout their life cycle will ensure continuity of control **when sources cease to be used and become potentially more vulnerable to loss**.
- The Code of Conduct [14] expects that every State should ensure that sealed sources are not stored for extended periods of time in facilities that have not been designed for the purpose of such storage. **Central storage of disused sources reduces the likelihood of loss**, particularly where generic regulatory control is applied.

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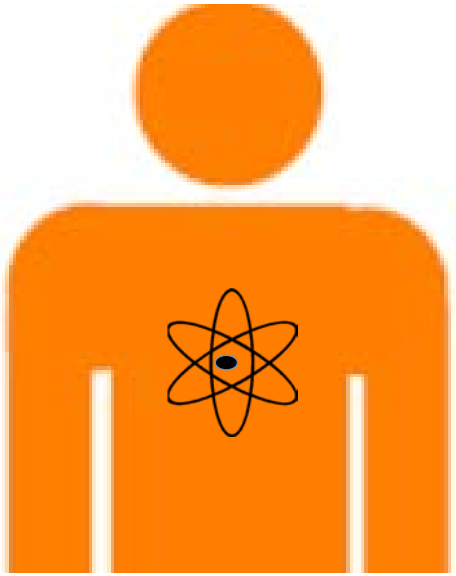
Challenges to DSRS Management

Some Source Users Unprepared to Support Removal

- Lack of information on costs, options, POCs
- Removal is expensive
- Some regulations do not define end-of-life requirements for licensees

Need Qualified Expertise, Equipment, Facilities

- Lack of vendors, trained staff
- Containers expensive and/or unavailable
- Countries lack storage/disposal facilities



ORS requires that an end-of-life management pathway be identified before embarking on an alternative technology replacement. To date, some ORS international alternative technology projects have been unable to progress due to a lack of and/or limitations with available storage and disposal solutions.

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Financial Preparedness

Costs for Source Removal

ORS/OSRP Domestic Removal
$100K-$175K

International
Costs vary widely depending on amount and type of material, distance traveled, etc.

Cost Factors

- Packaging
- Import/Export licensing
- Transport
- Storage/Disposal fees

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Financial Assurances

- Financial assurances are planning requirements for end of life management of sealed radioactive sources.
- "Each State should ensure that the regulatory body…Establishes regulatory provisions for acquisition and use of a radioactive source that include…Adequate financial provisions, where appropriate, to cover the costs of management once the radioactive source becomes disused, including the identification of responsibilities for implementing these provisions…" *IAEA Supplementary Guidance on Management of Disused Radioactive Sources, pg 8.*
- ORS does not have a comprehensive list of countries with financial assurance provisions and mechanisms. However, for example, UK, Norway, and France have reported that they have implemented financial provisions.
- Conclusions and Chair Recommendations from the 2017 IAEA "Code Meeting"

Financial Assurances in the US

- Current NRC financial assurance (FA) requirements are not intended to address sealed sources:
  - Aimed at decommissioning of facilities licensed to possess tens of thousands to millions of curies
- In 2016 the NRC Staff completed its assessment and recommended that the Commission approve rulemaking to address FA for Category 1 and 2 sources
- Some states have already implemented FA requirements and storage time limits:
  - Illinois and Florida have adopted FA
  - Texas has implemented two-year time limit for storage of disused sealed sources
- Conference of Radiation Control Program Directors (CRCPD) is currently updating its "suggested state regulations" on FA to address timely disposal of sealed sources

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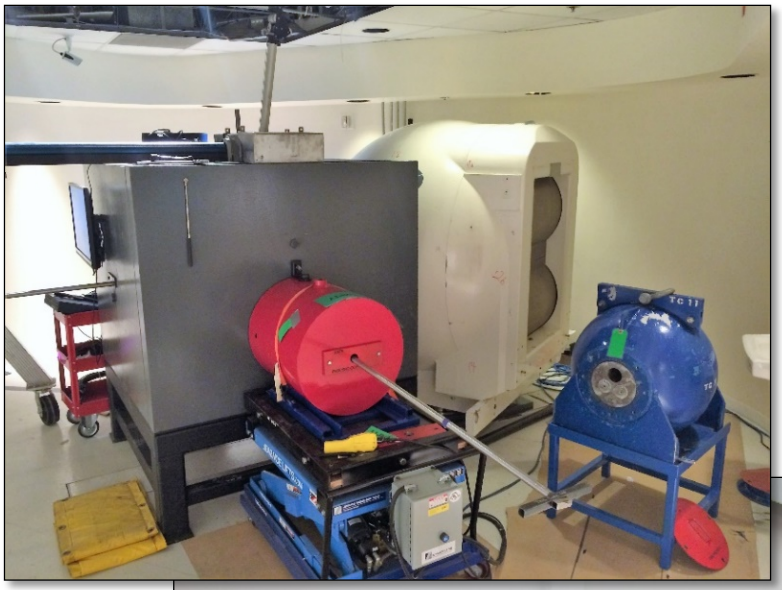
Technical Capability

Challenges

- Lack of skilled and available staff and vendors
- Arranging for equipment and transport
  - Containers are expensive and/or unavailable
  - Fewer transporters for DSRS
- Identifying a receiving supplier or storage/disposal facility
  - No in-country storage/disposal options, storage facility has insufficient space or rejects material



*"Many States **do not**, at present, have actual or planned disposal facilities and will need to make arrangements for long-term storage and disposal of their disused sources."*

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Remove Planning Considerations

- Make necessary regulatory notifications
- Contract for Qualified Service Provider
  - Room where the device is located
  - Route out of the building
  - Timing
  - Packaging and Transports
  - Storage/Disposal

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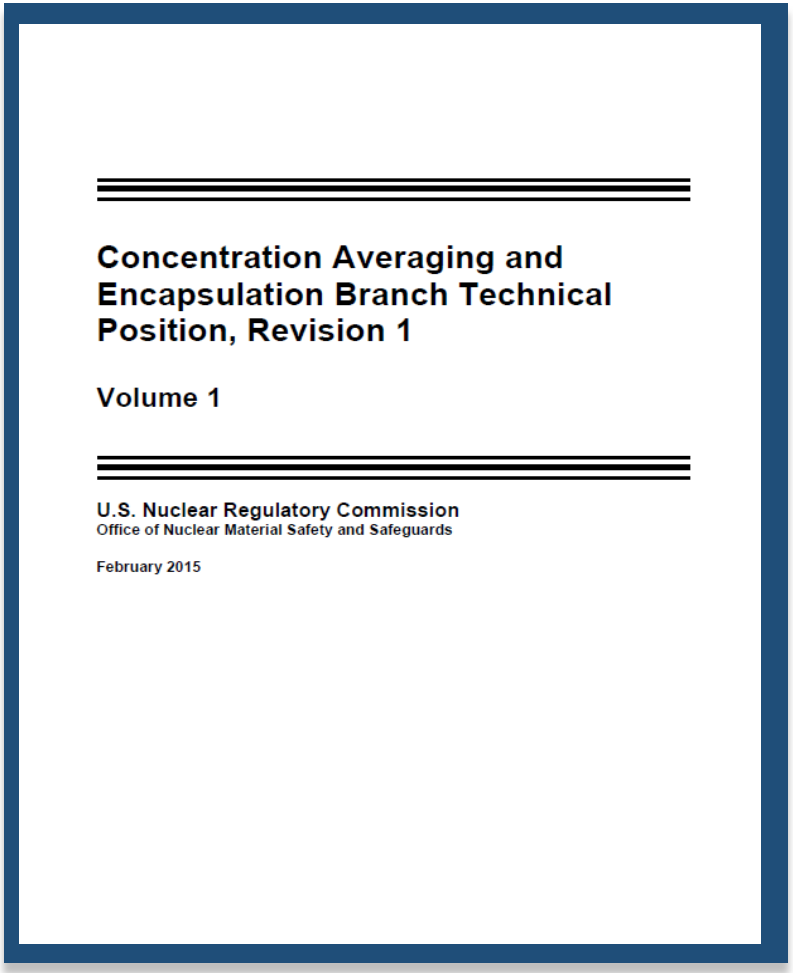
Commercial Sealed Source Disposal in the U.S.

- 2015 NRC revised disposal guidance:
  - "Concentration Averaging and Encapsulation Branch Technical Position" (BTP)
    - The 1995 version effectively set the 1.11TBq (30Ci) source disposal limit for both Co-60 and Cs-137
- Includes significantly revised sealed source disposal provisions
  - Cs-137 'generic' Class C limit for sealed sources increased from 1.11TBq (30Ci) to 4.81TBq (130Ci)
  - Co-60 sources addressed explicitly – no Class B/C limit
  - 'Alternative approach' provisions to potentially address higher-activity sources



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Commercial Sealed Source Disposal in the U.S.

- Revised NRC guidance has increased the availability of disposal for more Cat 1 and 2 sealed sources.
- In recent years ORS in conjunction with CRCPD, facilitated the commercial disposal of two Cs-137 irradiators
  - The first disposal at US Ecology in Washington cost approximately $100,000
  - The second disposal at Waste Control Specialist in Texas cost approximately $550,000
  - There have been no additional disposals of Cat 1 and 2 devices, even with increased access.
- The lack of financial assurances for most Cat 1 and 2 sources and disposal requirements for disused sources, in addition to government supported disposal results in a system where licensees are unable or unwilling to dispose of these sources.
  - Notably, ORS offers a self ship option to licensees for disposal of Cat 1 and 2 devices that is rarely used.

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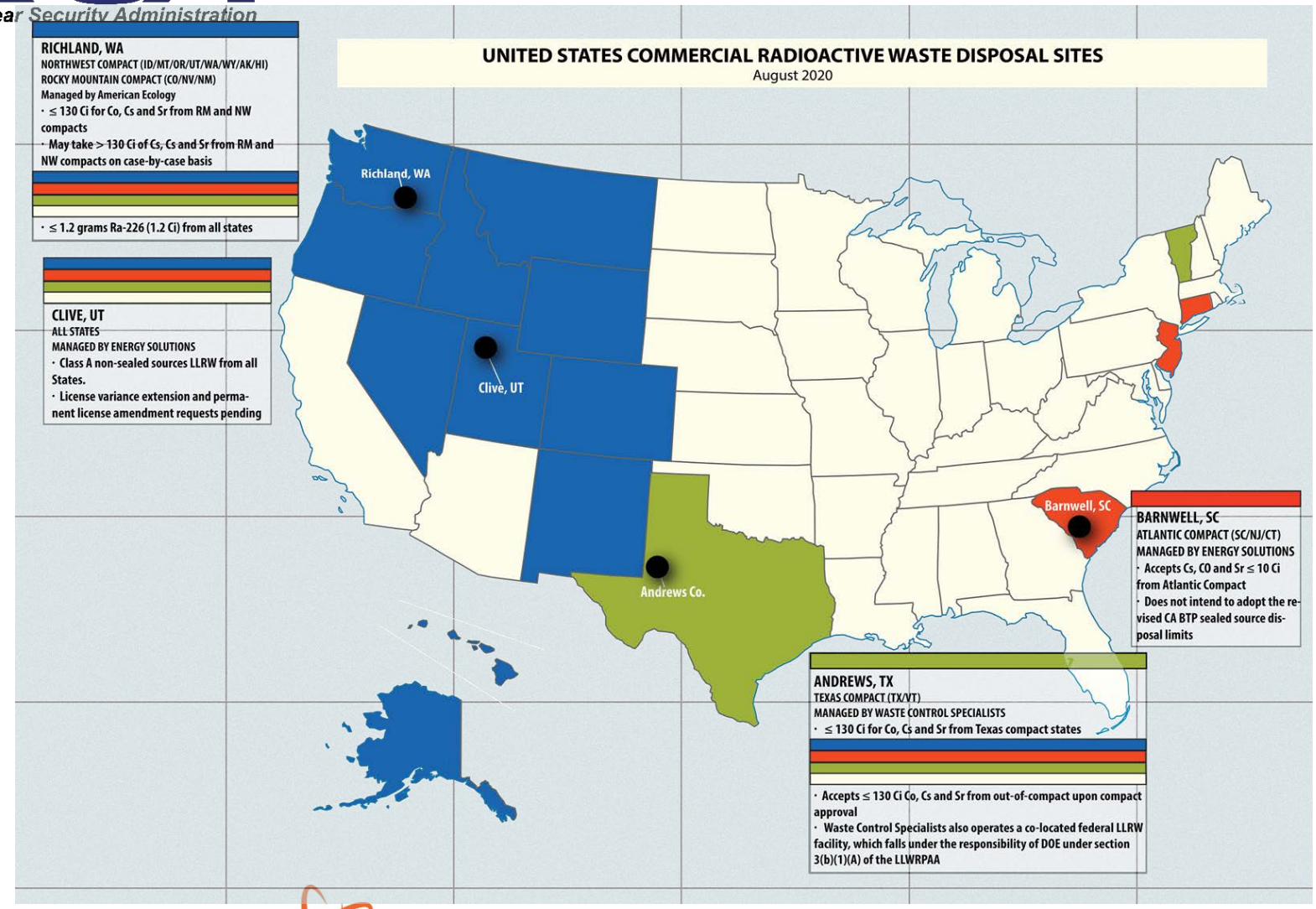

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Foreign Origin Americium

- There are an estimated 39,000 Am-241 sealed sources in the U.S. now that NNSA cannot recover and dispose due to restrictions in current legislation.
  - 7,500 of these have reached the end of their working life. Because there is no disposal path, users must store these disused sources indefinitely. This creates additional risk of theft or loss.
  - The number of disused sources is expected to grow to 20,000 by 2025.
- These sources cannot be disposed of because:
  - The current interpretation of the Land Withdrawal Act **only includes** waste generated by **U.S.** atomic energy defense activities, and that recovery of these sealed sources containing proliferation attractive foreign-origin material is not an eligible atomic energy defense activity.
  - The majority of Am-241 sources in the United States have the same properties as other Am-241 being disposed at WIPP, but do not originate from the U.S. weapons program.
  - NNSA anticipates that the disposal of the ~7,500 disused sources annually would take up only an additional six cubic meters of WIPP's disposal capacity, which is less than 0.003%.

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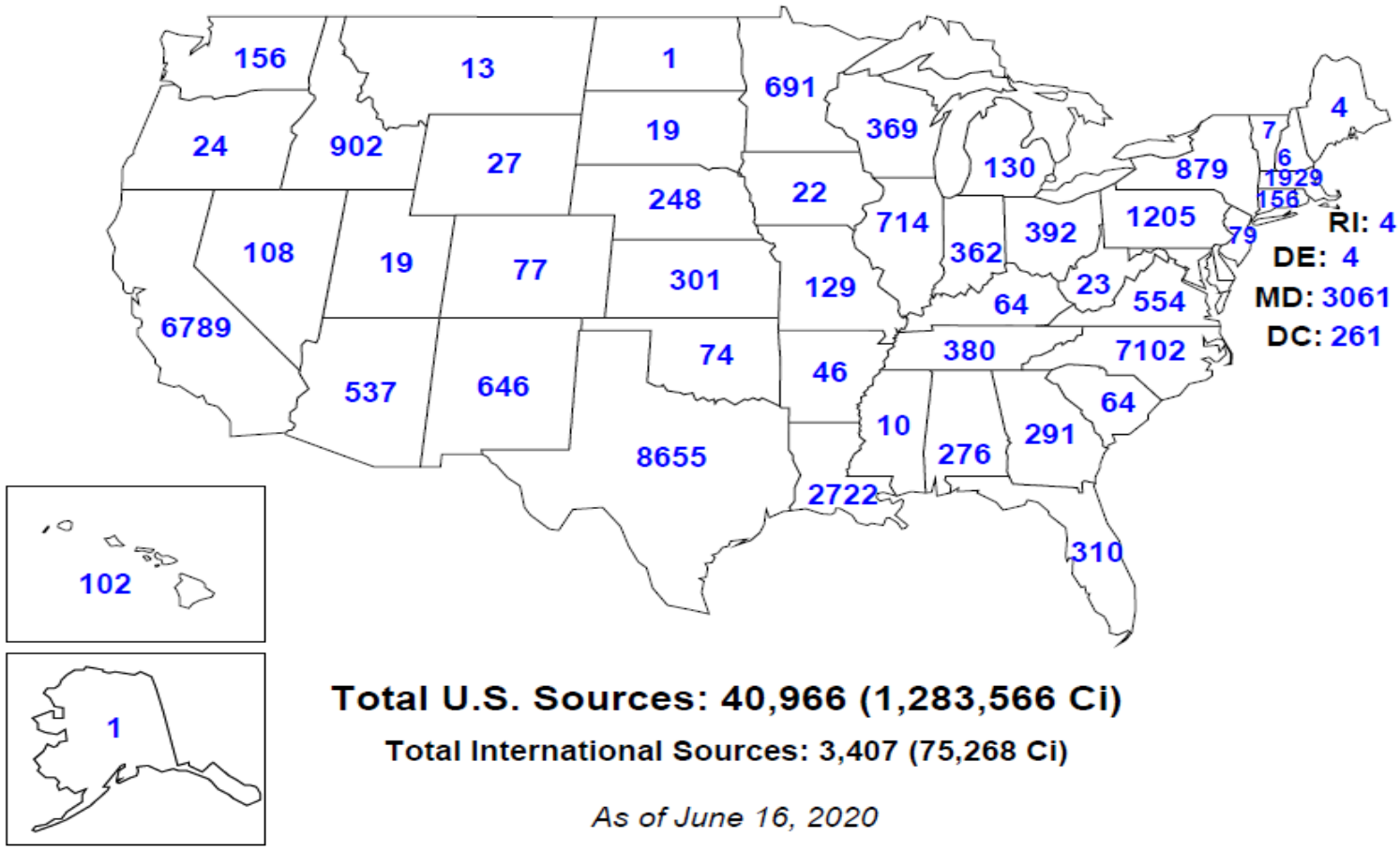
OSR Project Recoveries to Date



Total U.S. Sources: 40,966 (1,283,566 Ci)

Total International Sources: 3,407 (75,268 Ci)

As of June 16, 2020

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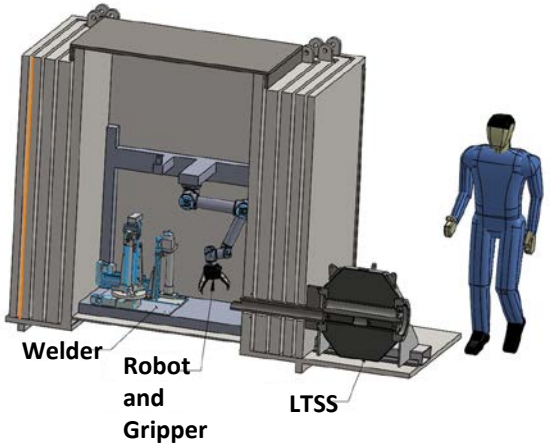
Invest in Technologies and Solutions that enhance U.S., IAEA, and partner end of life management capacities

U.S.

International



Mobile Hot Cell

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ORS Mission to Enhance DSRS Management Internationally

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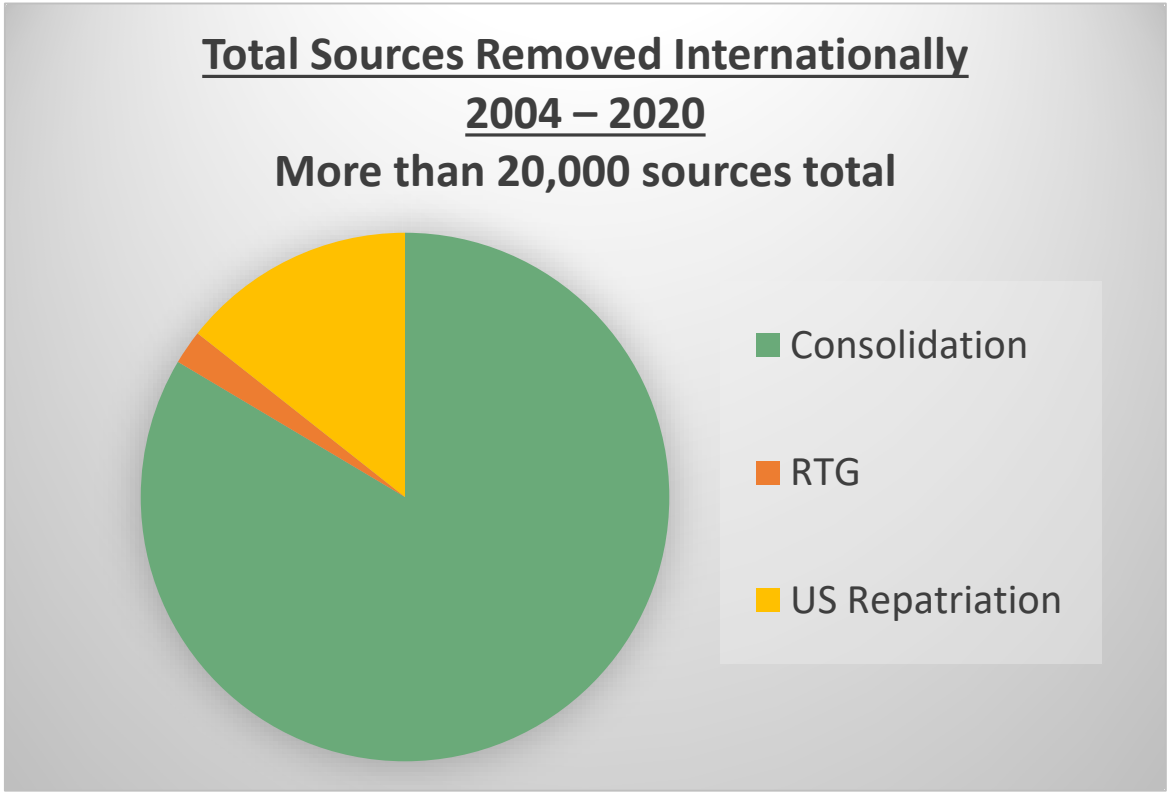
Implement removals on a case by case basis to reduce the risk of theft, loss, abandonment



ORS also facilitates international removals by sharing expertise (advisory groups on removal planning, training to service providers on packaging) and providing small containers.

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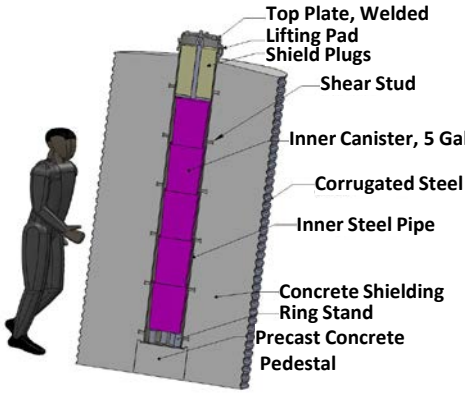
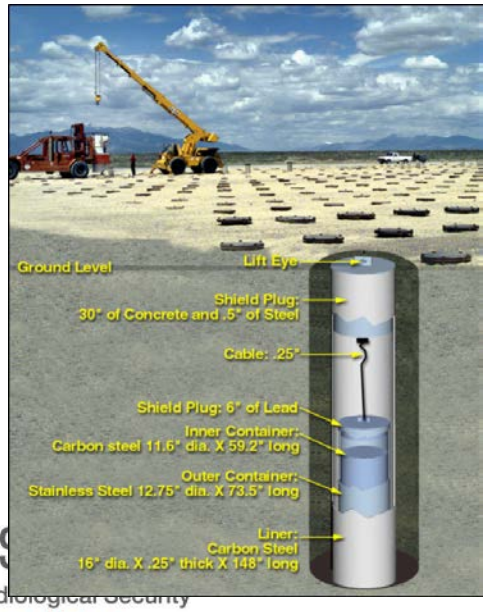
Invest in Sustainable Storage Solutions

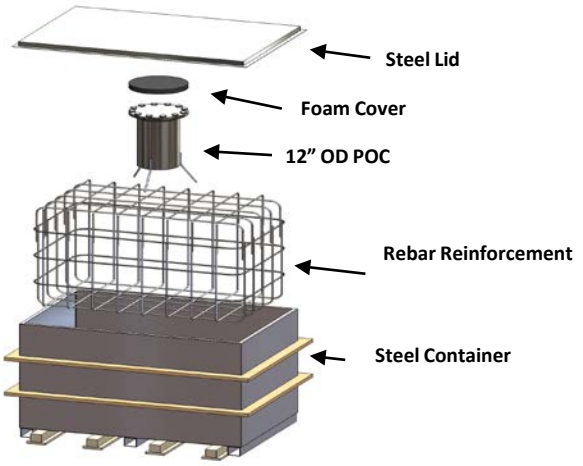
Construction of New Storage Buildings

- 26 facilities with cooperation ranging from new construction, facility expansions, and large renovation efforts
- ORS does not provide disposition facilities



Scalable Long-term Storage





Low-cost Storage Unit

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IAEA Collaboration & Support

- ORS supports end of life management projects implemented by Nuclear Fuel Cycle and Waste Technology (NEFW) Section and the Division of Nuclear Security.
- Coordinate with NEFW and DNS on disused source recovery needs to reduce duplication of efforts.
- ORS supports participation in the development of relevant radioactive source management guidance, consultancy meetings, ad hoc groups.
- Provide a Type B container to IAEA to facilitate consolidation and removal activities in Member States.
- ORS encourages its partners to align national policy and capacity with IAEA guidance.

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In Conclusion

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There is a Link Between End of Life Management and Alternative Technologies

End of life management plans are crucial for security risk reduction in general, and are an integral part of planning for a transition to alternative technologies.

It is a best practice for licensees to begin planning – both administratively and financially – for source end-of-life-management at the time of source acquisition.

The question remains – How do licensees become better educated and prepared for elements of DSRS management? How can DSRS management become more affordable and accessible?

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Source Categories and Waste Classes

- Class A, B, and C waste:
  - Appropriate for "near surface disposal"
  - Four currently operational facilities – South Carolina, Texas, Utah, Washington
- Greater-than-Class C (GTCC) – disposal in a geologic (or similar) repository
  - DOE responsibility – provided its recommendation to Congress in 2017

Most Common Risk-Significant Sources

Type	Half-Life	IAEA Category 2*	NRC Waste Class at Category 2 Threshold	NRC Waste Class at Category 1 Threshold
Am-241	432.6 years	16Ci or .59Tbq	GTCC	GTCC
Cs-137	30.1 years	27Ci or 1Tbq	C	GTCC
Co-60	5.2 years	8Ci or .3Tbq	A	B
Ir-192	73.8 days	22Ci or .81Tbq	A	A

* IAEA Category 1 is 100x Category 2 for all sources.

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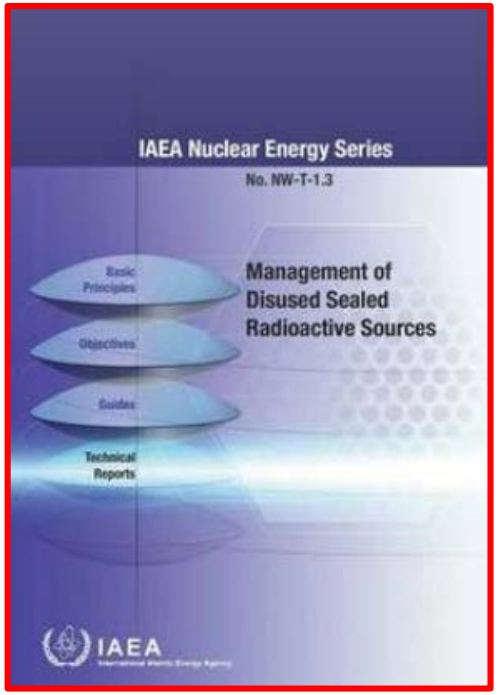

International Atomic Energy Agency
INFORMATION CIRCULAR

INF

INFCIRC/546
24 December 1997

GENERAL Distr.
Original: ARABIC, CHINESE ENGLISH, FRENCH, RUSSIAN and SPANISH

JOINT CONVENTION ON THE SAFETY OF SPENT FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

60 Years
IAEA Atoms for Peace and Development

Information Circular

INFCIRC/910
Date: 20 January 2017

General Distribution
Original: English, French

Communication dated 30 December 2016 received from the Permanent Mission of France concerning a Joint Statement on Strengthening the Security of High Activity Sealed Radioactive Sources

Joint Statement on Strengthening the Security of High Activity Sealed Radioactive Sources

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IAEA Guidance on Disused Source Management (2018)

- Supplementary Guidance to Code of Conduct on Safety and Security of Radioactive Sources
- Consolidates and provides further details on the management of disused and orphaned sources
- States can commit to implementing the guidance, but commitment not legally binding
- US announced “political commitment to meet the intent” of the Guidance in 2/2020
- As of 6/2020, 39 Member States have committed to the guidance

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