

Experience with the Safe and Secure Management of Disused Sealed Radioactive Sources (DSRS)

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IAEA

International Atomic Energy Agency

Why do we need better management?

- **SRS found in virtually all countries – approximately two million devices containing sources in the US.**
- **A small percentage are not properly controlled.**
- **Approximately 375 sources or devices are lost or stolen in the US each year.**
- **Socio-political problems in many parts of the world.**

Examples of sealed radioactive sources



Common radionuclides

- Iridium-192
- Cobalt-60
- Caesium-137
- etc

Types of Dangerous Sources



Russian Co-60 teletherapy



Canadian self shielded irradiator

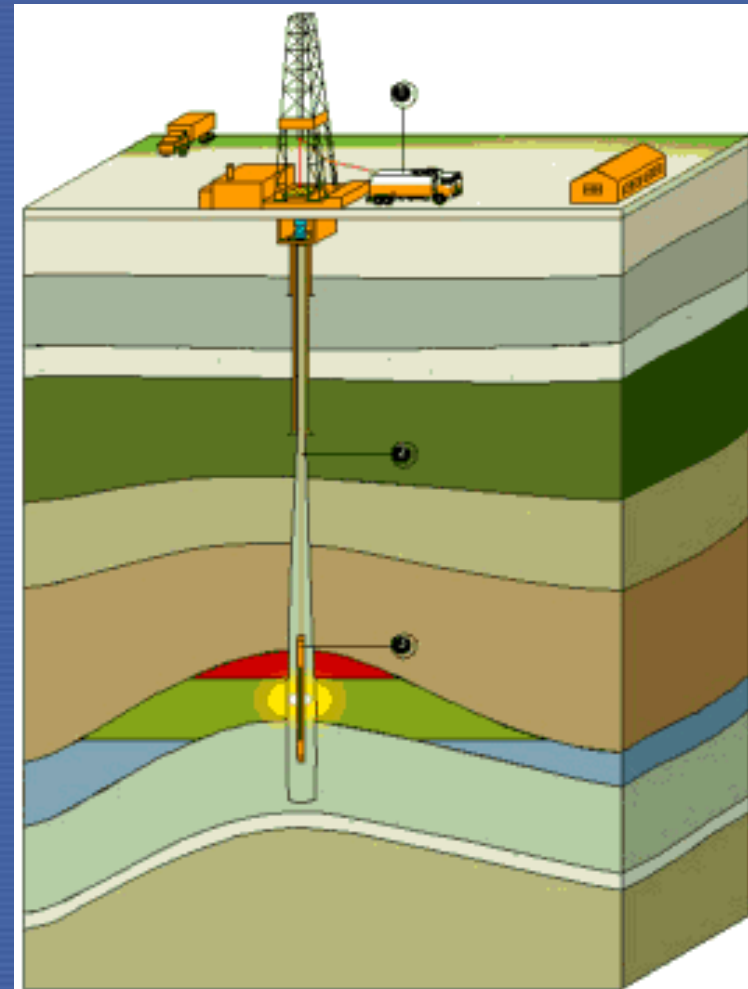
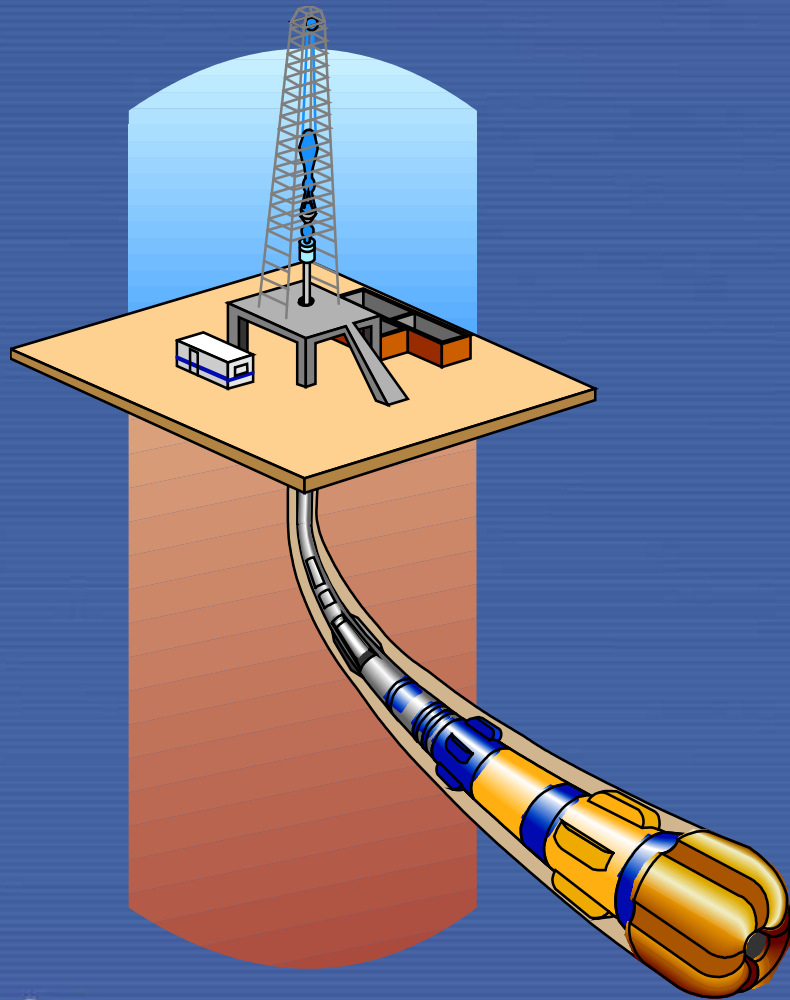
An Industrial Source



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Two Cf-252 (0.2TBq or 5.4Ci)

A Well Logging Source



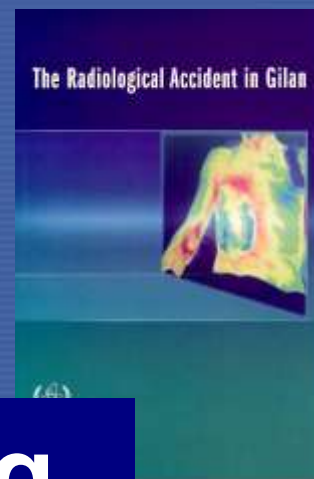
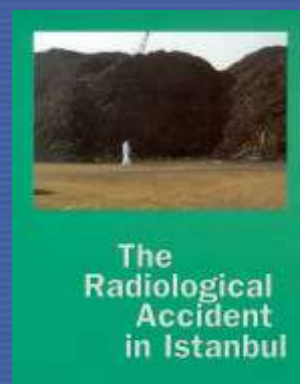
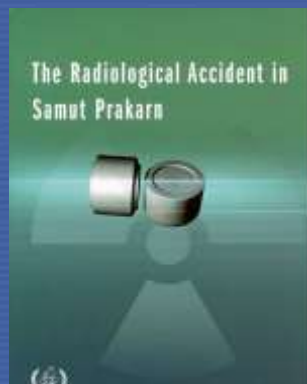
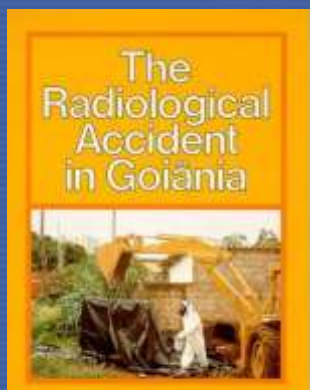
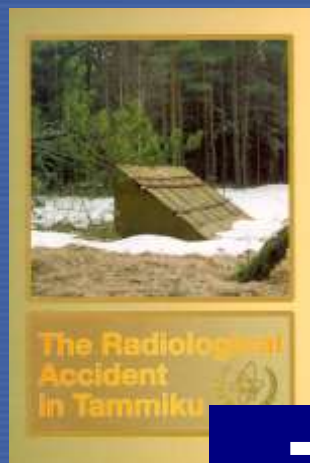
LOGGING OPERATION

- Logging Unit
- Conductor Wireline
- Logging Instrument

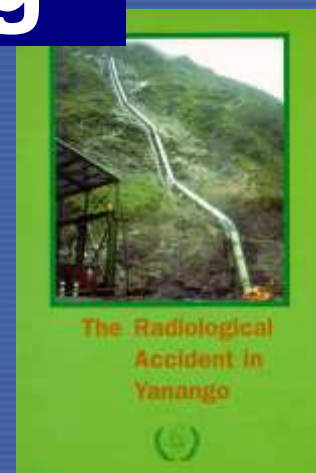
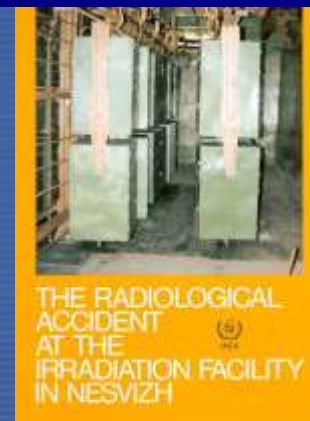
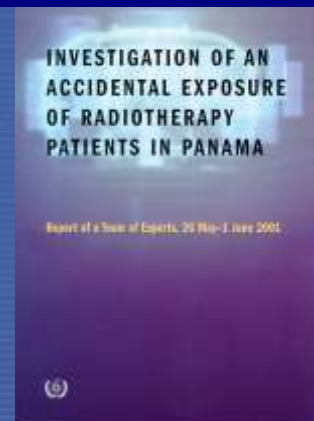
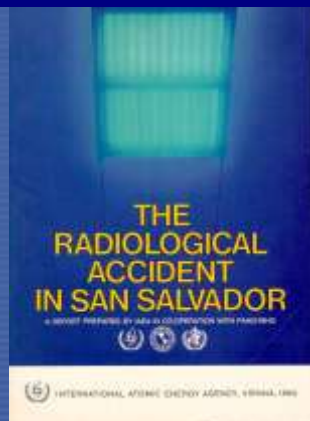
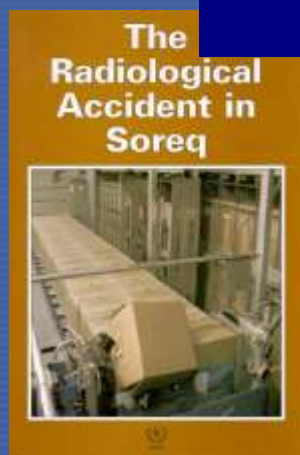
IAEA Conference 2003

*"There is nothing [terrorists] would like better than to cause the panic that the detonation of a radiological dispersal device would create. We know from experience with **accidental releases** of radiological sources that they can cause widespread panic, economic hardship, and significant health concerns.... It is our responsibility to determine how to prevent such an attack in the first place, and how we should respond if, despite our best efforts, such an attack were to occur." - Energy Secretary Spencer Abraham*

IAEA Accident Reports



The Tip of the Iceberg



... and easily removable by the public! ...



... completely unsecured! ...



Where are the sources?



A Source Store!!!!



Eventually, sources became *unnneeded...and disused*;
...thousands have been simply abandoned!

An old chemical weapons bunker (WWII)



A source store becomes a general store!!!



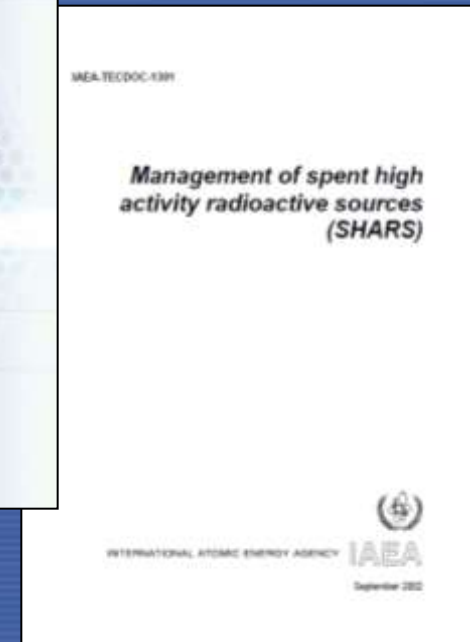
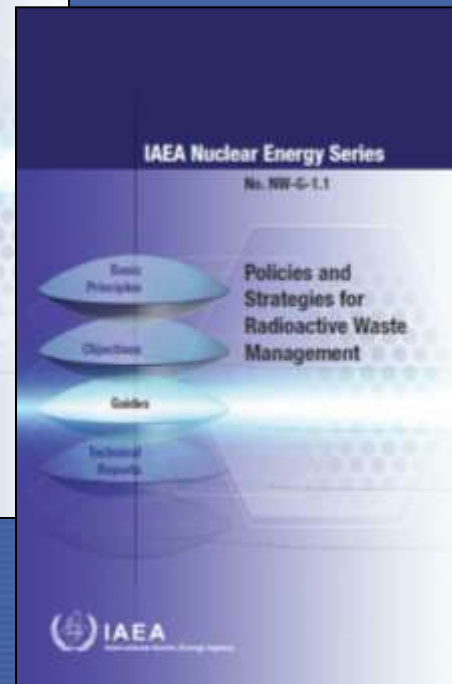
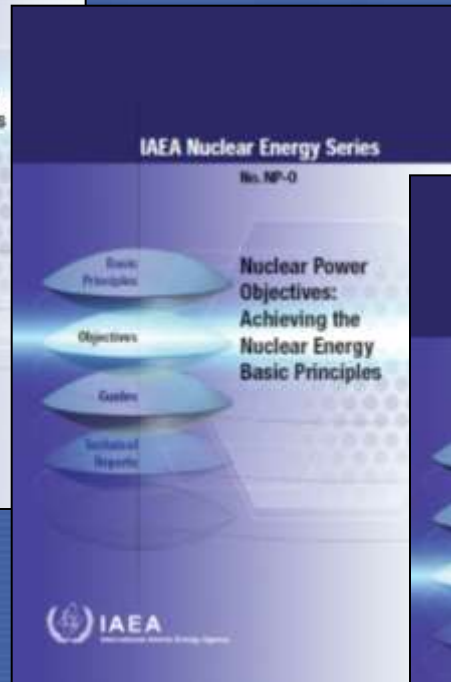
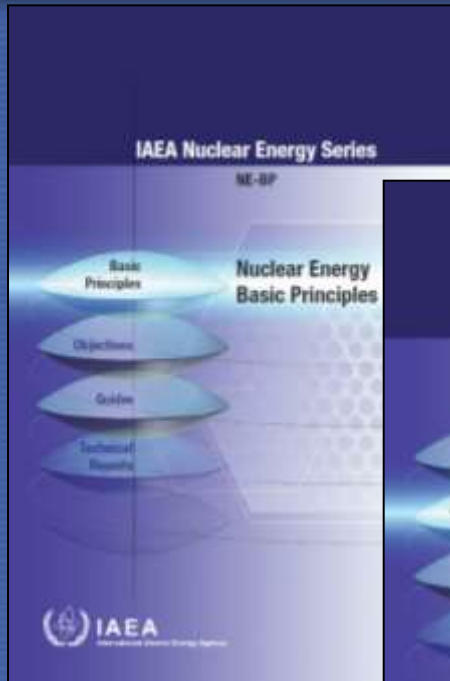
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Reasons for Loss of Source Control

Experience shows that:

- **Mobile sources are lost or stolen while in transit.**
- **Sources are abandoned, either deliberately or through lack of awareness.**
- **Sources are stolen, either for the scrap value of the source or its container**
- **Political instability and economic hardship.**

Nuclear Energy Series Documents

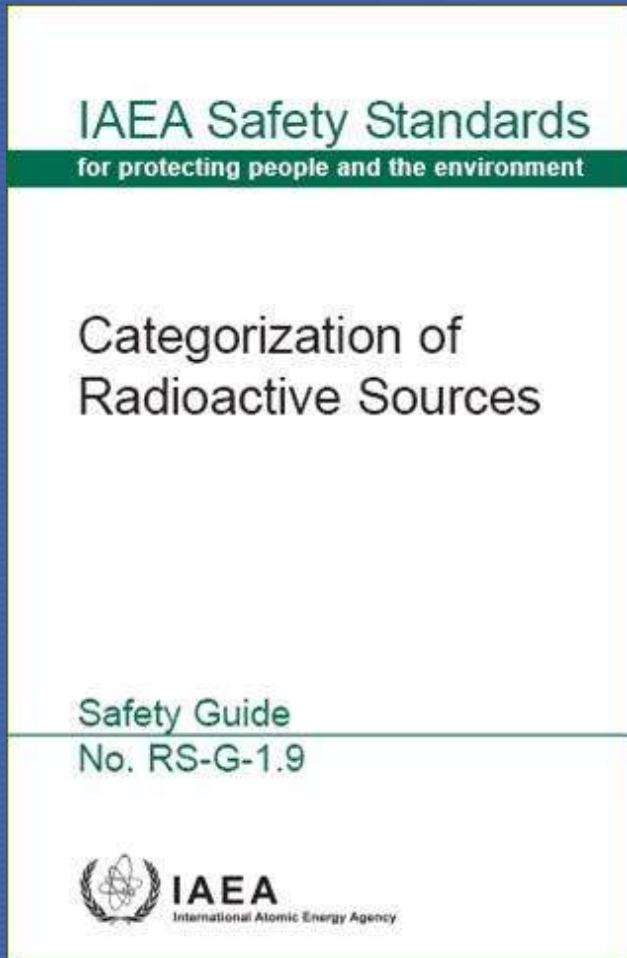


Where we (IAEA) focus our efforts

- **Higher activity sources (Cat 1, 2 & 3).**
- **Always need a request from the country.**
- **Often driven by Donor instruction.**
- **Political instability implies higher risk.**
- **Vulnerable sources.**

A radioactive source for which the control is inadequate to provide assurance of long term safety and security, such that it could relatively easily be acquired by unauthorized persons.

How we assess the threat?



- Risk based threat assessment based on the “D” value.
- Derived for emergency response.
- Now used as a basis for level of protection.
- Five categories.

Categorization of Radioactive Sources used in Common Practices



Category	Practice	Activity Ratio A/D
1	RTG's; Irradiators; Teletherapy; Gamma Knife	$A/D \geq 1000$
2	Gamma radiography Brachytherapy (HDR/MDR)	$1000 > A/D \geq 10$
3	Fixed industrial gauges (High-activity sources) Well logging	$10 > A/D \geq 1$
4	Brachytherapy (LDR except eye plaques & permanent implants) Gauges (not high activity); Static eliminators; Bone densitometers	$1 > A/D \geq 0.01$
5	Brachytherapy (eye pl. & perm implants); XRF; ECD	$0.01 > A/D \geq$ Exempt/D

Radium Safely & Securely Stored



Thailand



Sudan

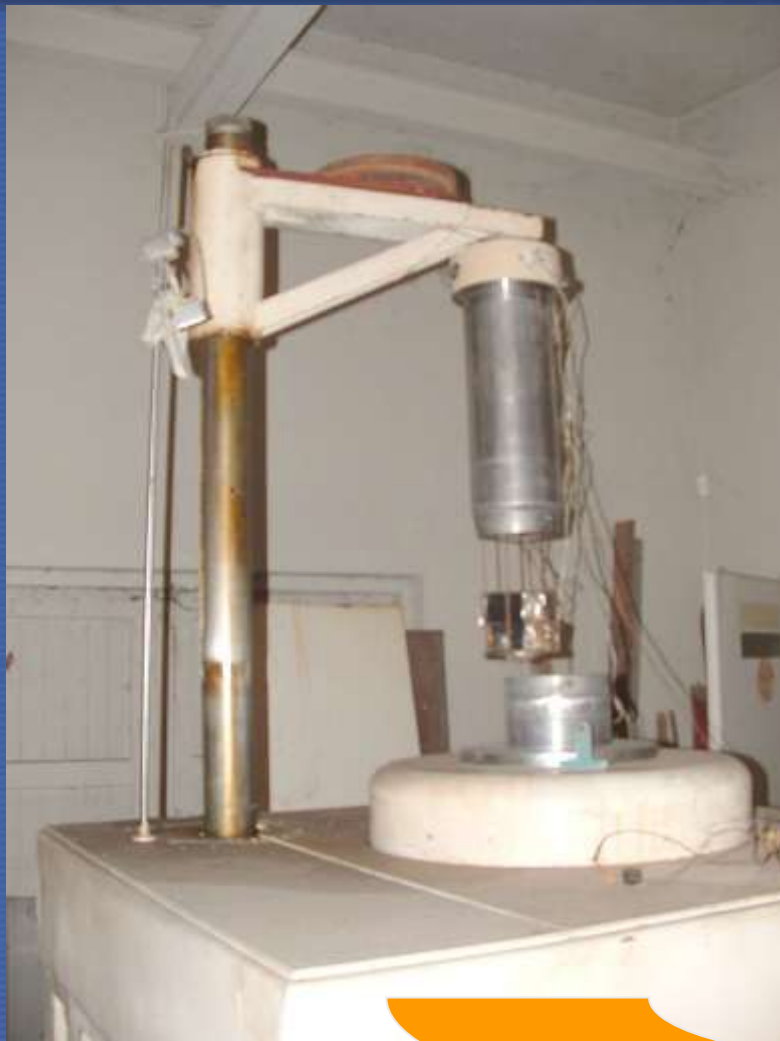


Tanzania

Research Irradiator Body being moved



Dismantling, Transport and Storage



Apartments nearby



Near the centre of a major Capital City

Work done in Belarus “STAVRIDA”



Before dismantling



Transportation



Storage

Better DSRS management.

- **NEFW started working on improving the management of sources in 1995.**
- **9/11 brought security into the picture.**
- **Tripartite secured approx 60 000 Ci in 6 FSU countries.**
- **EU operations successful in many countries.**
- **Other operations in Nigeria, Tanzania, Balarus and Cuba.**
- **A total of 5082 individual sources dealt with in the last three years including 202 repatriated.**

Sustainable Source Recovery

- Physical Protection of vulnerable sources **very important** but!!
- Holistic approach vital.
- A source that starts leaking will create not only unsafe conditions but additional financial burdens.
- End points must be kept in mind (Storage and Disposal).
- Must take a longer term view.

Best Options for Disused Sources?

- **Return to supplier**
- **Long term storage (50 y, 100 y, ???)**
- **Disposal**



Return to Supplier (problematic!!)

- **How secure is the supplier?**
- **Does the liability pass with the source?**
- **Expensive – from US\$ 100 000 upwards!!**
- **Externalities not built into the purchase.**
- **New source to replace old.**
- **New contract must include return to supplier.**

Long Term Storage

- **Suitable conditioning keeping the end-point in mind**
- **Qualified staff**
- **Retrievability**
- **Inspection**
- **Knowledge management**
- **Funding**
 - **Liability calculation**

Long Term Storage

- **Comprehensive radiation protection;**
- **Access control (radiation/contamination controlled areas);**
- **Quality control;**
- **Physical security;**
- **Handling equipment (hoists, fork-lift trucks, etc.);**
- **Maintenance services;**
- **Regulatory Authority controls.**

Terrorist Threat

- **New paradigm must be built into your safety case for operating and disused sources.**
- **How long will we be concerned about this threat? – Forever!!**
- **Concerns many players in the national system of protection.**
- **Ultimate responsibility with the Operator.**
- **Our safety and security systems must evolve.**
- **Is it real?**

Where do we obtain our funding?

- **Limited amount of TC funds.**
 - Replacement of teletherapy.
 - Supported radium operations in the past.
- **Nuclear Security Fund (NSF)**
 - Donations from mainly “Western” nations.
 - Donor often directs where to work.
 - Coordinated by Office of Nuclear Security.
 - Short term focus going for the “quick fix”

Discussion

- Once the “threat” has changed, who will ensure the worldwide safe & secure management of sources.
- Is the work we are doing today sustainable?
- For DSRS to be both **safe** and **secure** they need to be moved into a **viable** radioactive waste management system.
- The entire management system needs to be addressed not just the back-end.

Conclusion

- **The IAEA has been working holistically to improve the management of DSRS.**
- **Source recovery operations conducted in many countries.**
- **Much more needs to be done.**
- **Need a sustainable source of funding.**