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# The Radiological Risk and Comparison with an Improvised Nuclear Device (IND)

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# Outline of Presentation

- Commercial availability of radiological sources
- Isotopes of Concern for a Radiological Dispersal Device (RDD)
- Intent and Capability of Terrorists to Deploy a RDD
- Differences between an Improvised Nuclear Device (IND) and a RDD
- Economic and Other Impacts of a RDD
- Risk mitigation/elimination measures

# Commercial Availability of Radiological Sources

- Thousands of radiological sources are found in over 150 countries
- There are **four isotopes of concern** commonly used in hospitals, medical facilities and industrial applications (e.g. cancer treatment, blood sterilization, radiography, oil exploration)

| Radionuclide and emission | Half-life | Chemical Form (typical) | Typical Use and Activity (Curies) |
|---|---|---|---|
| **Co-60** (β,γ) | 5.3 yr | Hard Metal | Teletherapy & Irradiators (10,000's Ci) |
| **Cs-137** **(β,γ)** | **30 yr** | **Salt Powder** | **Irradiators ( > 1,000's Ci)** |
| **Ir-192** (β,γ) | 74 d | Hard Metal | Radiography (~100 Ci) |
| **Am-241** (α,γ) | 433 yr | Oxide Powder | Well Logging (~ 10 Ci) |

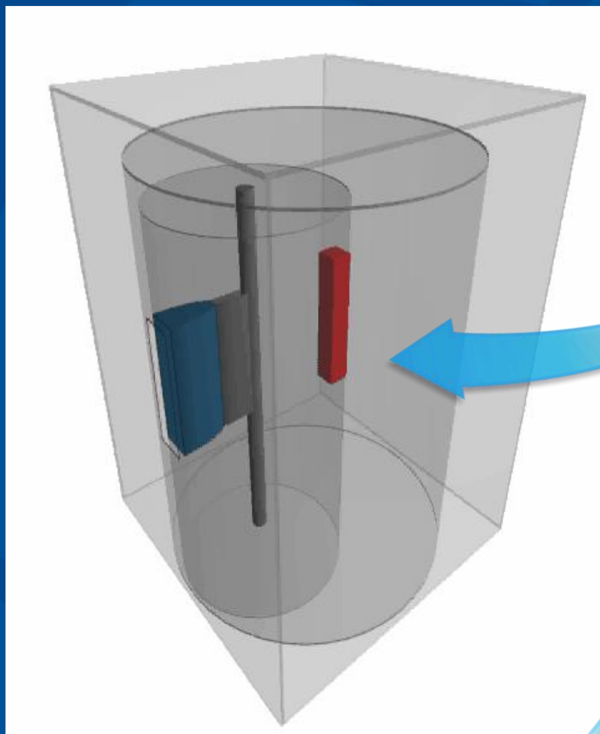
# Commercial Availability of Radiological Sources

- Biggest concern is Cesium-137 because it is a powder and much more dispersible
- Cobalt-60 and Iridium-192 are hard metals and would be dispersed as metal slugs/pellets

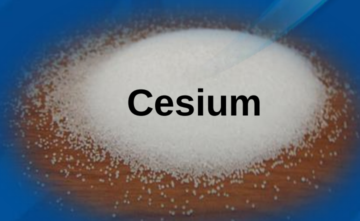

Co-60 slugs (large irradiators)

Co-60 pellets (teletherapy)

# Cesium-137 Blood Irradiator



Blood Irradiators use Cesium (Cs-137) encapsulated sources (normally 1,200 Curies to 3,000 Curies)

# 2016 Nuclear Security Summit Communiqué

*"The threat of **nuclear** and **radiological** terrorism remains one of the greatest challenges to international security, and the **threat is constantly evolving**."*

*Adopted by 52 heads of delegation*
*April 1, 2016, Washington, DC*


NUCLEAR
SECURITY
SUMMIT
WASHINGTON 2016

# Threat of Radiological Terrorism

- Terrorists groups have stated their intention to acquire and use radiological materials in a dirty bomb
- As ISIS loses territory in Iraq and Syria, it may become more desperate to carry out devastating attacks.
- The investigation into the deadly attacks in Belgium in March 2016 has prompted new worries that the Islamic State is seeking to infiltrate and attack nuclear installations or obtain radioactive materials to make a dirty bomb.
  - Terrorists in Belgium were monitoring an employee who worked at a HEU research reactor that also produces medical isotopes for a large part of Europe.
- In addition, there is increasing concern about Home Grown Violent Extremists (HVEs) that could become self-radicalized and inspired by on-line propaganda
- Terrorist use of a RDD is more likely than use of nuclear device because very little technical knowledge is required to build and deploy a RDD compared to an IND

# Differences between an IND versus RDD


**Improvised Nuclear Device**
Very high consequence, very low probability

**Radiological 'dirty bomb'**
Lower consequence, but higher probability

# Impacts of an RDD

- The effects of an RDD can vary depending on what type of radioactive material is used and how effectively it is dispersed
- While few people would be killed by the initial blast, a single dirty bomb using Cesium-137 could render several city blocks unusable and <u>cause tens of billions of damage in economic losses</u>
- Buildings would likely have to be demolished and access to the contaminated area could be denied for years

***New York City***

# Risk Mitigation Measures

- **Secure:**
  - Upgrade the physical security of sites with high activity devices.
- **Remove:**
  - Remove and dispose of excess and unwanted radiological sources as rapidly as possible
- **Replace:**
  - Replace high-activity devices with alternative technologies (such as x-rays) that cannot be used to make a dirty bomb
  - Replacement of Cesium-137 blood and research irradiators should be a top priority given the greater risk reduction (permanent threat reduction)

# Case Study: Risk Elimination Measures

- Several other countries are working on risk **elimination** measures by replacing cesium irradiators with x-ray technologies:
  - France has replaced all of its cesium blood irradiators with x-ray devices.
  - Norway – in response to the 2011 Andres Breivik terrorist incident and his manifesto – has replaced all of its cesium irradiators with x-ray devices.
  - Japan – due to extensive and costly regulations and the fear of radiation in the aftermath of Fukushima – has replaced more than 70% of its cesium blood irradiators with x-ray devices.

# Case Study:  Norway

- Andres Breivik carried out terrorist attacks in Norway in July 2011 in which 77 people were killed.
- These attacks represent the deadliest incident on Norwegian soil since World War II.
- His manifesto mentioned acquiring and using radiological material for a dirty bomb.
- In response, officials decided to replace all of their cesium devices with x-ray equipment.

NORWEGIAN 2011 TERRORIST MADE REFERENCES
ABOUT ACQUIRING RADIOLOGICAL MATERIAL
TO MAKE A DIRTY BOMB

The terrorist attacks in Norway on July 2011, in which 77 people were killed, represented the deadliest incident on Norwegian soil since World War II. Breivik, the 32-year-old Norwegian accused of executing the two attacks, was active on neo-Nazi and anti-Islamic Web sites. As unprecedented as the attacks themselves were, Breivik's 1,500-page manifesto, which he wrote in English under the pseudonym "Andrew Berwick", predicted that greater acts of violence are forthcoming with the use of chemical, biological, radiological, and nuclear materials.

His treatise noted that Russia, other former Soviet republics, and the United States all possess large quantities of radiological material, "unsecured… in the strangest of places." Breivik considers it:

"… relatively easy to acquire at least one [high-risk radioisotope] if you have a minimum of information in regards to appropriate sources. It is therefore likely that any Justiciar Knight cell attempting to acquire radiological material will be successful. We, the PCCTS, Knights Templar or any allied liberation organization is likely to obtain radioactive material through the "black market" or by going directly to the sources ourselves. Due to the nature of our hierarchical structure it is unlikely that we can afford purchasing it from criminal organization as the prize would simply be too steep. In any case, the black market remains as one viable option for acquirement."


More significantly, Breivik demonstrated an appreciation for the typical radioactivity levels of individual radioisotopes and the utility in deploying radiological weapons in Western European capitals and other vital locations and their effective means for "ideological, psychological and economical damage."

Reference: Breivik, A. B. (2012). 2083: A European Declaration of Independence 2011. Retrieved online at:
https://fas.org/programs/tap/_docs/2083_-_A_European_Declaration_of_Independence.pdf

# Progress to Date

- Significant progress has already made by numerous countries
- Concrete next steps:
  - Continue/accelerate global efforts to <u>secure</u> the most vulnerable highest-activity radioactive sources
  - Accelerate efforts to <u>replace Cs-137 blood and research irradiators</u> with x-ray devices that cannot be used to make a dirty bomb (risk elimination)