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Overview of Nuclear and Radiological Security

Exceptional service in the national interest

Sandia National Laboratories

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U.S. DEPARTMENT OF ENERGY

NNSA

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Nuclear Security of Radiological Sources in Egypt: April 13-14, 2013

Why do we care about Radiological Security?

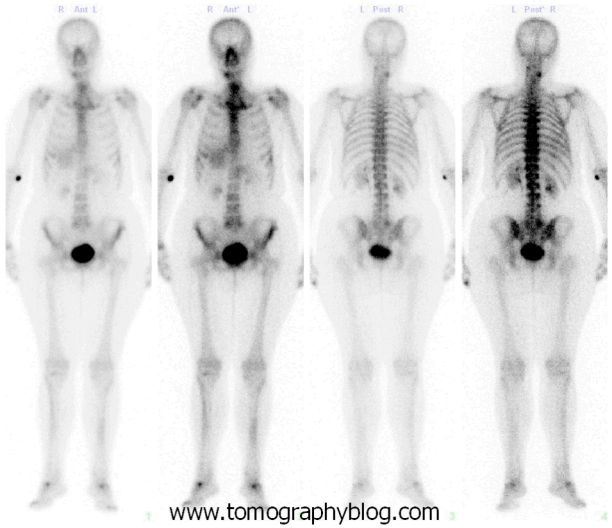
http://www.youtube.com/watch?v=fh-VqehmgCQ

- Consequences
  - Exposure
  - Contamination

- If it can happen by "accident", it can happen by deliberate malicious intent

Materials in Medical Use

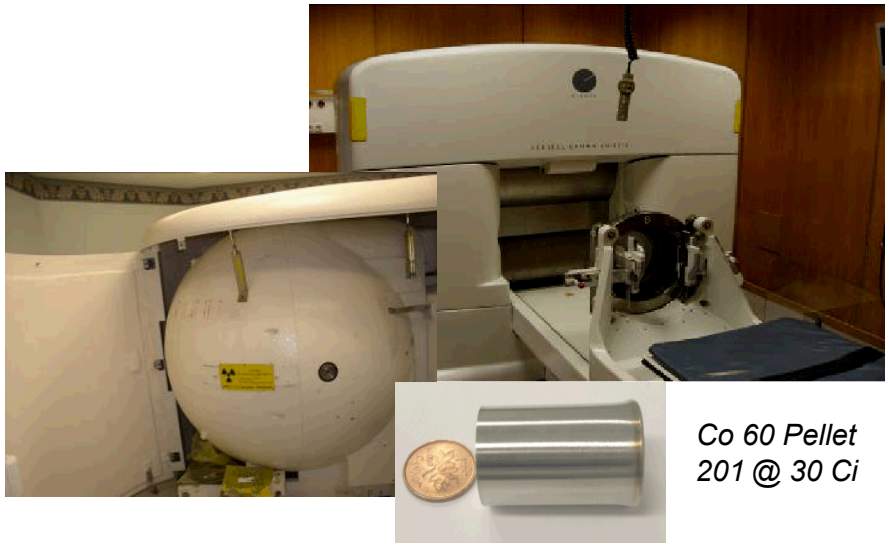
- Cancer Treatments
- Blood Sterilization
- Radiography



Radiotherapy

- **Gamma Knife**
  - Cobalt (Co 60) source pellets stored in shielded sphere within cabinet
  - Loading is about 6000 Ci

Co has 5.5 year half-life, field resourcing



Co 60 Pellet
201 @ 30 Ci

- **High Dose Rate (HDR)**
  - Used in brachytherapy treatment (“short” time)
  - Iridium (Ir 192) seeds in shielded lower cylinder
  - Contains approximately 12 Ci

Ir has 74 day half life, field resourcing

Irradiators

Gammacell 3000 in Blood Laboratory

- **Blood Irradiators**
  - Cesium (Cs 137) encapsulated sources normally 1200 Ci to 3000 Ci (can be higher)

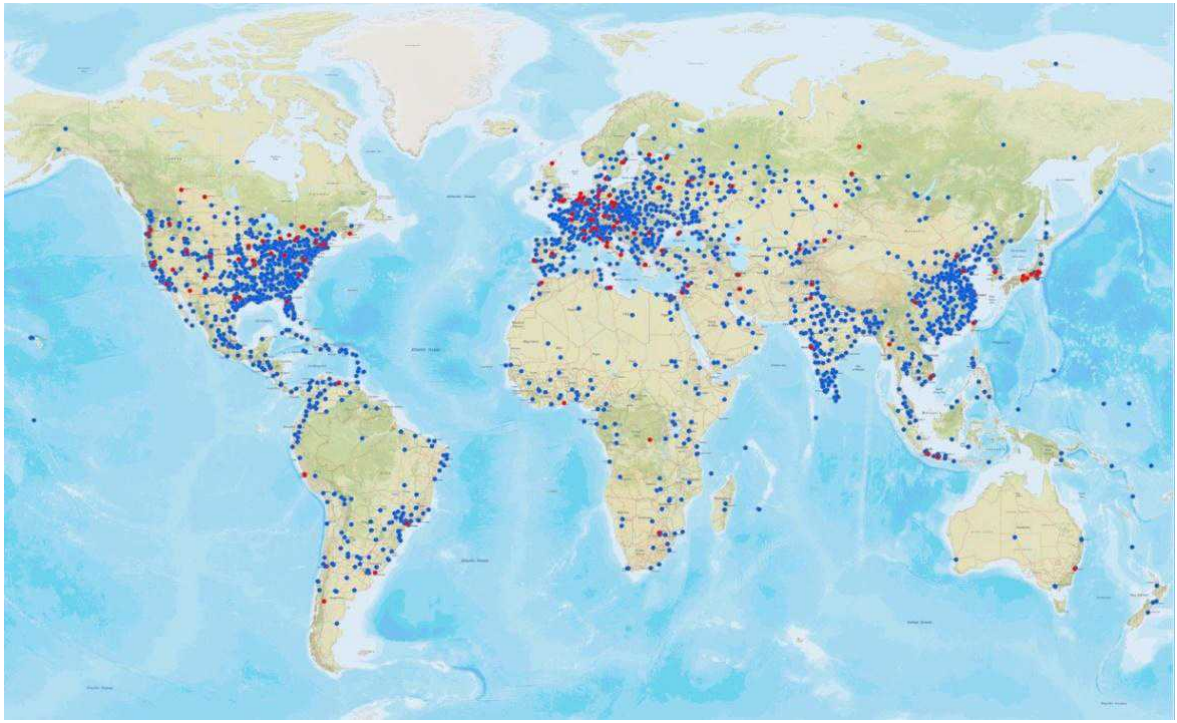
Cs 137 has 30 yr half-life, normally not field resourced

Gammacell 40 in Research Laboratory

- **Research Irradiators**
  - Used in gene and cell research
  - Cesium encapsulated sources normally 4000 Ci (some up to 20,000 Ci)

Propagation of Radiological Material

- Nuclear and radiological materials are located at thousands of civilian sites and are used for legitimate and beneficial commercial, medical, and research purposes



- It is estimated that over 5,000 facilities world-wide contain sources of 10 curies or greater.

Attractiveness of Radiological Material for Malicious Intent

- Readily available and does not take large quantities
- Relatively unsophisticated technology
- Minimal security in many instances
- Public perception of radiation

Risks - Likelihood

- **Stolen Cs-137 (North Carolina, 1998)** - 19 vials of Cesium-137 were stolen from a locked safe at a Greensboro, NC hospital during the NCAA basketball tournament hosted in Greensboro. The vials were never recovered and insider involvement was likely.
- **•Coworker Attack with Ir-192 Injures 75 People (China, 2003)** - Chinese nuclear medicine expert, was given a suspended death sentence after being convicted of placing radioactive Ir-192 pellets in a colleague's office. Perpetrator worked at a Chinese hospital in Guangzhou and used forged official papers to buy the Ir-192**.**
- **•Unauthorized Access to GammaKnife Room (Pittsburgh, 2006)** - Egyptian national, on a student visa and possessing a large industrial screwdriver, was found after hours in a hospital room housing a large gamma knife machine containing hundreds of Co-60 sources. Scratch marks were left on the back of the machine.
- **•Dhiren Barot (UK, 2006)** - Arrested in the U.K. and admitted to performing reconnaissance of American targets for Al-Qaeda. Plotted to blow up the NY Stock Exchange with a "dirty bomb".
- **•Cs-137 Source Stolen for Extortion Purposes (Argentina, 2009)** - Two armed men entered the Baker Atlas drilling equipment storage facility in Neuquen, Argentina. They handcuffed the guard and took the keys to a radiological source storage bunker containing Cs-137 sources used for oil well logging. The company began receiving extortion calls, demanding $500,000 and threatening "to make this city glow" if the thieves were not paid.

Risks - Threats

- Whether by theft or sabotage, radiological sources can be used for malicious purposes
  - Exposure
  - Contamination – direct and indirect
- Deliberately exposing people and the environment to radiation exposure via
  - dispersal of radioactive material in a Radiological Dispersion Device (RDD or dirty bomb), or
  - external radiation exposure in a Radiological Exposure Device (RED)

Risks - Consequences

- Acute radiation sickness or fatality
- Radiation dose to the public and emergency workers with subsequent increase in latent cancer likelihood
- Contamination
- Loss of function of an area including city, residential or facilities
- Economic disruption
- Social disruption
- Psychological effects

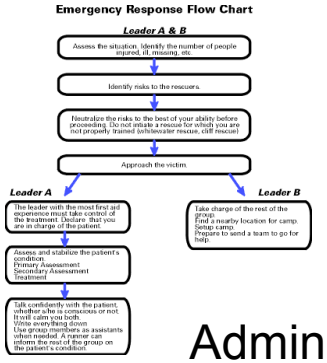
Radiological Security

- Preventative
  - Administrative Controls and Record-keeping
  - Access Controls
  - Radiological Security Culture
  - Recognizing radiation exposure

- Protective - Security Systems to Detect Unauthorized Activity
  - Detection of unauthorized activity
  - Delay until response can arrive and interrupt
  - Response to prevent successful removal of radiological material

Radiological Security

People
Supported by



Administrative Controls
and Procedures

Security Technologies
and Systems