The Nature of Radiological Terrorism

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Radioactivity is the spontaneous emission of energetic radiations from radioactive materials. The following are forms of ionizing radiation:

- **Alpha particle radiation -** Helium nucleus; Short range (tens of microns), cannot penetrate skin
- **Beta particle radiation** - Electrons/positrons; Intermediate range
- **Gamma rays** - energetic electromagnetic waves; Highly penetrating

Exposure *vs.* Contamination

- **External Exposure** of the body from external sources ; 80-90% typically removed by removing clothing
- **Internal Contamination**, inhaled or ingested is much harder to remove

Radiation dose is measured in Gray (Gy) or milli-Gray (mGy). Equivalent dose is measured in milli-Sievert (mSv)

- For our purposes, though not always, 1 mGy = 1 mSv
- Old dose units are the rad and the rem; 1 rad = 10 mGy; 1 rem = 10 mSv
- For orientation:…* Average background radiation dose from the environment is 3 mSv / year
  * A mammogram produces about 0.01 mSv; A CT scan produces about 10 mSv.

Radioactivity: The activity (strength) of a radioactive source is measured in Curies (Ci) or Becquerels (Bq)

- 1 Bq = 1 radioactive disintegration / sec; 1 Ci = 37 GBq = 37 billion disintegrations / sec

The principal medical hazards of ionizing radiation

- High radiation doses: Early effects (days / weeks) are largely damage to the blood-forming organs, and to the gastrointestinal system
- High and low radiation doses: Longer term effects: carcinogenesis, hereditary risks, effects on the developing embryo / fetus

Which are the dominant long-term risks?

- Teratogenic risks (to the embryo and fetus) are the highest (but fewer individuals typically exposed)
- Followed by the risks of radiation-induced cancer,
- Followed by the hereditary risks (to the offspring of irradiated parent(s)).

Radiation threat scenarios

- Nuclear accident – risk: fallout; outcome: long term carcinogenesis; likelihood: small; e.g.; Chernobyl
- Nuclear device – risk: γ rays, neutrons and fallout; outcome: large number of acute deaths, long-term carcinogenesis; likelihood: very small; e.g., Hiroshima and Nagasaki
- Attack on nuclear power plant – risk: release of fission products; outcome: long-term carcinogenesis; likelihood: unlikely
- Dirty bomb – risk: radioactive material release; outcome: probably few contaminated people, long-term carcinogenesis, many frightened people; likelihood: likely

A dirty bomb contains some radioactive material, some conventional explosive and a detonator

- Radioactive materials are not so hard to acquire, particularly in small amounts
- Can disperse small, intermediate or large amounts of radioactive material. Extent of contamination also depends also on the weather, location, etc.

Health care provider response to a radiological event

- Most people presenting for treatment will not require treatment, so efficient triage will be essential to prevent facilities being overwhelmed.

High throughput radiation biodosimetry after a radiological event

- High throughput biodosimetry (rapid estimation of individual's radiation doses from a sample such as blood, saliva, or urine) will be crucial after a radiological event:
  - because of the need for triage to prevent facilities being overwhelmed;
  - because people will demand reassurance

The bottom line

- The threat of radiological terror is real. Most scenarios will present major organizational challenges.
- The answer: ***BE PREPARED!***