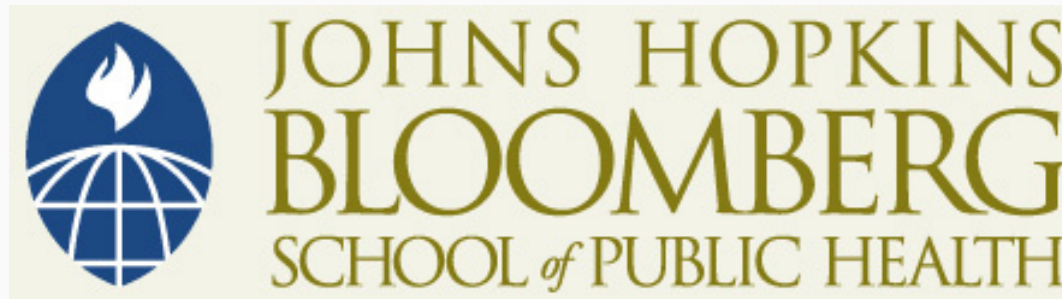


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Radiation Terror 101

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Part 3

Radiological Terror

Radiological Terror: Four Main Events

1. Nuclear device

- Stolen state-owned nuclear weapons or weapons components
- Improvised nuclear devices

2. Dirty bomb (“radiological dispersal device”)

- Conventional explosive device bundled with radioactive material
- Intended to efficiently disperse radioactivity

3. Attack on fixed nuclear facility

- Nuclear reactor
- Spent fuel storage depot
- Nuclear fuel reprocessing facility
- High-level waste site

4. Attack on radioactive material in transit

Response to Bomb-Type Attack

- **Crisis management**
 - Acute response
- **Consequence management**
 - Long-term effort

Response to Bomb-Type Attack

- **Crisis management**
 - Acute response
- **Consequence management**
 - Long-term effort
- Levels of authority
 - Federal
 - State
 - County
 - City

Acute Response

1. Determine that **radioactivity/radiation** is in the environment
 - First responders
2. Determine the **radionuclide(s)** and **amount(s)**
 - Radiation strike team
3. Estimate **doses** and **geographic dose distribution**
 - Radiation strike team + state environment dept
4. Determine need for (and implement) **evacuation**
 - Radiation strike team + health dept + fire/police

Important First Responders

- **Fire department**
 - Hazmat
 - EMS
- **Police department**
 - Bomb squad
 - Patrol officers
- **Strike team**
 - Health department
 - State Hazmat
 - Radiation experts

NCRP Alarm Levels for First Responders

■ Alarm Level 1

- 10 mrem/hour
- Lifetime cancer fatality risk (per hour)
= 5×10^{-6} = 5 in a million chance

■ Alarm Level 2

- 10 rem/hour or 10 rem total
- Lifetime cancer fatality risk per 10 rem
= 5×10^{-3} = 5 in a thousand chance

■ Population limit (for comparison)

- 100 mrem/year

■ **Acute**

- “Usual” medical problems for bomb-type attack
 - ▶ Injuries, burns
- Acute radiation syndromes
- Patient internal contamination

■ **Delayed**

- Radiation carcinogenesis
- Note: must consider both acute and delayed effects of in utero irradiation

External Contamination with Radioactivity

■ **External contamination**

- Radioactive atoms are on clothing or skin
- Irradiated by penetrating radiation (X rays and gamma rays)
- “Carry” contamination away from site on surface

Internal Contamination with Radioactivity

■ Internal contamination

- Radioactive atoms enter the body by eating or drinking, breathing gases or aerosols, absorption through skin or wound
- Irradiated by non-penetrating radiation (α and β) emitted *within* the body
- “Carry” contamination away from site within body

General Countermeasures

- **External radiation exposure**
 - Sheltering in place
 - Evacuation/relocation
 - Control of access to ground zero site
- **Internal contamination**
 - As above
 - Stable iodine (only when radioiodine present)

General Countermeasures

- **External radiation exposure**
 - Sheltering in place
 - Evacuation/relocation
 - Control of access to ground zero site
- **Internal contamination**
 - As above
 - Stable iodine (only when radioiodine present)
- **Internal contamination due to ingestion**
 - Control of food and water
 - Use of stored animal feeds

Order of Medical Management

- Treat and stabilize life-threatening injuries
- Prevent/minimize internal contamination
- Assess external contamination and decon
- Contain contamination to treatment area
- Minimize external contamination to medical personnel
- Assess internal contamination
- Assess local radiation injuries/burns

Triage

- Separate injured from non-injured
- Decontaminate both groups
 - Remove clothing and double-bag
 - Wash head and hands
- Only injured allowed in the emergency department (ED)
 - If the ED becomes a decontamination site, it is no longer an ED!

Skin Changes

- 300 rem: epilation in 2–3 weeks
- 1,000 rem: erythema in hours to weeks
- 2,000 rem: moist desquamation, ulceration
- 2,500 rem: ulceration
- 3,000 rem: blistering, necrosis at 3 weeks
- 10,000 rem: blistering, necrosis at 1 week

Lymphocyte Count

Lymphocyte Count @ 24 hrs		
Lymphocyte Count (10^3 mL^{-1})	Absorbed Dose (Gray)	Lethality w/ o Rx (%)
3	0–0.25	0
1.2–3	0.25–2	< 5
0.4–1.2	2–3.5	< 50
0.1–0.4	3.5–5	50–99
0–0.1	> 5	100

Therapy for Internal Contamination

■ **I-125 or I-131**

- Thyroid blockage
- SSKI or potassium iodide

■ **Cs-137**

- Reduction of GI absorption
- Prussian blue

■ **Unknown**

- Reduction of absorption
- Emetics, lavage, charcoal, or laxatives in cases of ingestion

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