



SRDRS Radiological / Nuclear Incident Response

Quick Guide for First Responders & First Receivers

(Operational Reference— EMS, Fire, Law Enforcement, Emergency Departments)

Scene Response and Initial Operations

1. Recognizing a Radiological or Nuclear Incident

Radiation injuries often have **delayed or nonspecific symptoms**, which makes early recognition difficult when the incident is covert. Possible relevant scenarios and indicators include:

- Scenarios: Nuclear detonation or improvised nuclear device (IND), Radioactive dispersal device (RDD) (“dirty bomb”), Radiological exposure device (unshielded sealed radiation source emitting Gamma Rays without contamination)
- Indicators: Large numbers of patients with (Flash thermal burns, Blast injuries), Nausea or vomiting after exposure, Radiation skin burns (burns that are unexplained by thermal, electrical, or chemical causes), Unexplained radiation detector alarms

2. Immediate Operational Priorities

Key principle: **Life-saving interventions always come first — even before radiation survey or decontamination.** Examples: airway management, control severe hemorrhage, treat tension pneumothorax, stabilize trauma

3. Radiation Protection Principles to Reduce Exposure Risk:

Time: Limit time near radioactive sources

Distance: Increase distance from the source whenever possible

Shielding: Lead aprons are not adequate shielding from Gamma Rays. Isolate materials contaminated with radioactive material in a separate space. Don PPE to prevent contamination.

4. Differentiate

Radiation Exposure (Someone receiving an X-ray)

- Exposure to radiation energy
- **No radioactive material on the person**
- Patient does **NOT contaminate others**

External Contamination

Radioactive material on: Skin, Clothing, or Hair. Contaminated patients may contaminate others or the environment. They can also expose others in their surroundings to radiation from Gamma Rays.

Internal Contamination

Radioactive material enters the body through Inhalation, Ingestion or Open wounds

5. Detection Equipment

Identify and locate your available radiation detectors. Common radiation detectors:

- **Geiger-Muller counter** (Detect contamination, Localize radioactive material)
- **Ionization chamber** (Delineate radiation exposure hazard areas)
- **Portal monitor** (Screen large number of people for contamination with radioactive material if they emit Gamma Rays)
- **Personal dosimeter** / film badge to monitor occupational exposure doses

6. Personal Protective Equipment (PPE)

In radiological incidents: **Level A and B PPE are usually NOT required.**

Level C PPE Used in field or ED settings (when the amount of contamination with radioactive material is high or when the material is at risk of being re-suspended)

Level D PPE Often sufficient in hospitals. May start with Level C and decrease to Level D in consultation with Radiation Safety Officer.

Hospital Patient Management

7. Decontamination of Patients

Emergency Decontamination

Remove clothing and Wash with **soap and water**

Removing clothing alone may eliminate up to **80–90% of contamination.**

8. Triage Considerations

Many patients may present with **combined injuries** which worsens outcomes and may **lower survivable radiation doses.** In mass casualty situations: Allocate resources to patients with the **highest chance of survival.**

9. Acute Radiation Syndrome (ARS)

Occurs when: Whole body exposure to radiation (penetrating form like from Gamma Rays), Dose ≥ 2 Gray, Exposure occurs over minutes to few hours

Four Stages of ARS

- **Prodromal stage** (Nausea, Vomiting, Diarrhea, Fatigue, or Fever)
- **Latent stage** (Temporary symptom improvement)
- **Manifest illness** (Organ system failure)
- **Recovery or death**

Severity may be estimated using:

Four ARS Subsyndromes

- Hematopoietic
- Gastrointestinal
- Cerebrovascular
- Cutaneous

Time to onset of vomiting and Serial Absolute lymphocyte count decline

10. Treatment of Radiation Injury

Treatment is largely **supportive**, like managing neutropenia after chemotherapy. Supportive care may include IV fluids, Antiemetics, Antidiarrheals, Pain control, Blood products, Nutritional support, Infection prevention, Antibiotics / antifungals / antivirals Additional Treatments: Colony-stimulating factors (Cytokines), Stem cell transplant in severe cases unlikely to respond to supportive care and cytokines

11. Medical Countermeasures for Internal Contamination

Agent	Used For	Comment
Potassium Iodide	Radioactive iodine	May only be needed in a nuclear power plant emergency
Prussian Blue	Cesium, Thallium	
DTPA (Ca-DTPA / Zn-DTPA)	Plutonium, Americium, Curium	
Sodium Bicarbonate	Uranium chemical toxicity	

12. Community Reception Centers (CRC)

CRC sites help prevent hospitals from being overwhelmed. Functions include: First aid, Contamination screening, Decontamination, and Initial Dose Assessment

13. Key Radiation Experts and Resources

Engage with:

- State Radiation Control Programs
- Health Physicists, Radiation Safety Officers
- REAC/TS
- Poison Centers, Medical Toxicologists, and Clinical Toxicologists
- Radiation Injury Treatment Network (RITN) experts
- CDC
- Online resources REMM, REAC/TS, CDC

14. Key Take-Home Messages

- Treat life-threatening injuries first
 - Radiation exposure does not always equal contamination with radioactive material
 - Remove clothing and wash with soap and water
 - Use time, distance, and PPE to reduce exposure
 - Most radiation injuries are managed with supportive care
 - Consult radiation experts early
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