



RADIOLOGICAL EMERGENCIES

Emergency Management Pocket Guide For Clinicians

Emergency Management Pocket Guide

This pocket guide is designed for clinicians, including physicians, nurses, and other health care professionals, who will provide emergency care following a radiological event. It should be used as a supplement to training and practice drills.

ADDITIONAL RESOURCES

Centers for Disease Control and Prevention (CDC)

Phone: 1 (800) 311-3435

Web: emergency.cdc.gov/radiation

Radiation Emergency Assistance Center/Training Site (REAC/TS)

Phone: (865) 576-1005

Web: www.orau.gov/reacts

Armed Forces Radiobiology Research Institute, Medical Radiobiology Team

Phone: (301) 295-0530

Web: www.usuhs.edu/afrrri

American Association of Poison Control

Phone: 1 (800) 222-1222

Web: www.aapcc.org

State and Local Public Health Departments (record below):

Local Public Health Department:

State Public Health Department:

RADIATION PRINCIPLES

Radiation cannot be seen, felt, smelled, or tasted. A radiological survey with specialized equipment is the only way to confirm the presence of radioactive materials. If a terrorist event involves the use of radioactive material, both patient exposure and contamination must be assessed.

Exposure occurs when a person is near a radiation source. People exposed to a source of radiation can suffer radiation illness if their dose is high enough, but they do not become radioactive. For example, an x-ray machine is a source of radiation exposure, but a person does not become radioactive following a chest x-ray.

Contamination occurs externally when loose particles of radioactive material are deposited on surfaces, skin, or clothing. Internal contamination can occur if radioactive particles are inhaled, ingested, or lodged in an open wound.

Contaminated people should be decontaminated as soon as possible. People who have been exposed to radiation but are not contaminated with radioactive material do not need to be decontaminated.

MEDICAL MANAGEMENT PRINCIPLES

- It is highly unlikely that radioactivity associated with a contaminated patient would pose a significant health risk to care providers.
- In certain rare instances, the presence of imbedded radioactive fragments or large amounts of external contamination might require decontamination to be expedited.
- However, *addressing contamination issues should not delay treatment of life-threatening injuries.*
- Contaminated patients with life-threatening injuries can be wrapped in sheets for transport to treatment areas.

STAFF PROTECTION GUIDELINES

Establish an ad hoc triage area.

- Base the location on the pre-established disaster plan and the anticipated number of casualties.
- Establish a contaminated area and clean area separated by a buffer zone.
- Survey your body with a radiation meter when entering and exiting a clean area.
- Remove your contaminated outer garments when leaving the contaminated area.

Use universal precautions to protect staff.

- Follow standard guidelines for protection from microbiological contamination.
- Surgical or N95 masks should be adequate in most situations. In the triage pre-decontamination area, an air-purifying respirator may be necessary when the risk of external contamination with radioactive material is high
- Survey hands and clothing at frequent intervals with a radiation meter.
- Due to fetal sensitivity to radiation, assign pregnant staff to other duties.

DECONTAMINATION GUIDELINES

Survey the patient with a radiation meter.

- Perform survey using consistent technique and trained personnel. Include radiation safety officers on the response team.
- Note exceptionally large amounts of surface or imbedded radioactive material.
- Handle radioactive objects with forceps and seal in lead containers.
- Record location and level of any contamination found.

Remove patient clothing carefully to avoid spread of contamination.

- This might remove up to 90% of radioactive particles.
- Double-bag clothing following radioactive hazardous waste guidelines, label, and save as evidence.
- Repeat patient survey and record levels.

Cleanse contaminated areas.

- Wash wounds first with saline.
- If facial contamination is present, flush eyes, nose, and ears with saline and rinse mouth.
- Cleanse skin with soap and water beginning with areas of highest contamination.
- Do not irritate the skin.
- Resurvey and note levels.
- Repeat washing until survey indicates radiation level is no more than twice background or the level remains unchanged.
- Cover wounds with water-proof dressing.
- Dispose of waste water through normal channels.
- Consider establishing separate shower area.

RADIATION-RELATED ILLNESS/INJURY

Acute radiation syndrome (ARS)

ARS occurs when high doses of radiation are delivered rapidly to large portions of the body. The most probable terrorist events, such as the use of a dirty bomb, will likely generate low levels of radiation exposure. If ARS cases are seen, small casualty numbers are likely.

- Time of exposure, distance from radioactive source, and duration of exposure should be noted.
- Patients can present individually if exposed to radioactive sources hidden in the community.
- Symptoms can be immediate or delayed, mild or severe, based on radiation dose.
- Nausea, vomiting may occur minutes to days after exposure. Time of onset and duration is a major factor in diagnosis and dose estimation.
- Early onset of vomiting followed by symptoms of bone marrow suppression, gastrointestinal destruction, and/or cardiovascular/central nervous system effects is indicative of acute illness.
- During the latent stage a patient could look healthy.

Treatment

- Perform sequential CBCs with differential to assess progressive declines in lymphocyte levels.
- Monitor for fluid and electrolyte balance and evidence of hemodynamic instability.
- Treat symptomatically with focus on prevention of infection, including antibiotics.

- Consider Cytokines such as Neupogen, Neulasta or Leukine.
- Perform surgical interventions within the first 48 hours or delay until after hematopoietic recovery.
- Download biodosimetry dose assessment software from www.afrii.usuhs.mil.

Cutaneous radiation injury (CRI)

CRI is acute radiation injury to the skin.

- Skin damage can manifest within hours, days, or weeks after radiation exposure.
- Transient itching, tingling, erythema, or edema could be seen within hours or days of exposure, and is usually followed by a latent period.
- Lesions are not seen for weeks to months post-exposure, but then can be debilitating or even life-threatening.
- Delayed occurrence of lesions is a differentiating factor from thermal burns.
- Note time of occurrence of signs and symptoms and progressive changes in appearance.
- Treat localized injuries symptomatically, focusing on pain and infection control.

Internal contamination

Internal contamination should be considered if persistently high survey readings are noted following decontamination. Internal contamination generally does not cause early symptoms.

- Nose, or mouth contamination can indicate inhalation or ingestion.

- Assessment could include analysis of urine, blood, and fecal samples or whole body counts. Consult with radiation experts.
- Radiation experts could recommend early administration of radionuclide-specific decorporation agents such as Prussian Blue, or DTPA.

Psychosocial issues

- In urban areas hundreds to thousands may seek care. Many could require radiation screening and decontamination while a minority could have significant exposure.
- Psychogenic illness symptoms such as nausea or vomiting may manifest.
- Vomiting due to radiation exposure is usually recurrent rather than episodic.
- Include mental health professionals on team.
- Have radiation exposure fact sheets available for patients and families.
- Pregnant patients require special counseling.
- Separate areas for radiation screening and decontamination could be needed for mass casualties.

MANAGEMENT OF DECEASED

- A patient exposed to a lethal dose of radiation without contamination is not radioactive and no special precautions are needed.
- Special precautions are necessary for contaminated deceased.
- For information regarding handling decedents: <https://emergency.cdc.gov/radiation/examiners-coroners.asp>



U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

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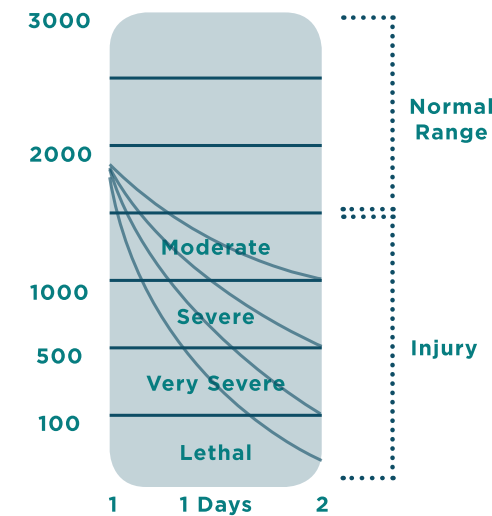
Table 1. Estimation of External Radiation Dose Related to Onset of Vomiting*

Vomiting Post Incident	Estimated Dose	Degree of ARS
Less than 10 minutes	> 8 Gy	Lethal
10-30 minutes	6-8 Gy	Very Severe
Less than 1 hour	4-6 Gy	Severe
1-2 Hours	2-4 Gy	Moderate
More than 2 hours after	Less than 2 Gy	Mild

* For acute external exposures only. Gray (Gy) is the SI unit of measurement for radiation absorbed dose.

Adapted from: Berger Me, Leonard RB, Ricks RC, Wiley AL, Lowry Pc. *Hospital Triage in the First 24 Hours After a Nuclear or Radiological Disaster*. REAC/TS (Radiation Emergency Assistance Center/Training Site); <https://www.orau.gov/reacts>; 2004.

Andrews Lymphocyte Nomogram



From Andrews GA, Auxier JA, Lushbaugh CC. *The Importance of Dosimetry to the Medical Management of Persons Exposed to High Levels of Radiation. In Personal Dosimetry for Radiation Accidents*. Vienna: International Atomic Energy Agency; 1965.

Pocket Guide Web Access:
<http://emergency.cdc.gov/radiation>

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