

J06: Radionuclear Incidents

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Updated: May 27, 2021

Reviewed: March 01, 2021

Introduction

Radiological and nuclear incidents are related, but separate events.

In radiological events or accidents, individuals are exposed to radiation, or contaminated by radioactive material. This can occur as a deliberate act, as in the use of an explosive radiological dispersal device – which is any device that is designed to spread radioactive material around an area using either explosives or a compressed gas – or through exposure to radioactive material or generating devices, such as sealed sources, x-ray devices, or accelerators. Individuals exposed in these incidents may have no knowledge of their exposure until some time later.

Critical assemblies, or criticality events, occur when sub-critical masses of fissile material are brought together, inadvertently starting a chain reaction. This results in the creation of an unshielded nuclear reactor and produces significant amounts of radiation. There is no explosion, although substantial heat may be produced.

Nuclear incidents involve a chain reaction (fission) which can be accidental, or result from the intentional detonation of a nuclear weapon. Detonations are accompanied by widespread blast and heat. Exposed individuals will generally notice when this happens.

With the exception of deliberate weapons-related events (i.e., the bombings of Hiroshima and Nagasaki and national nuclear weapons tests), every radiation-related incident involving members of the public has been a radiological event. Critical assemblies have been limited to research and industrial sites.

Essentials

- [Paramedics and EMRs must contact ClinCal](#) to discuss the case, ideally prior to arrival on scene.
- Skin or wound contamination is rarely life threatening for patients or health care personnel.
- Removal of the outer layer of clothing and shoes typically reduces external contamination by 90%.
- The goal of decontamination is to remove as much contaminated material as possible without damaging the skin or creating adverse effects.
- Decontamination can be accomplished without radiological monitoring if necessary.
- Subsequent decontamination cycles may be necessary. There is no single target value for decontamination appropriateness for all circumstances. Generally, decontamination is “successful” when survey meters show less than 2 or 3 times the normal background radiation or when further efforts stop an increase in the count rate significantly.
- Internal contamination, and incorporation of radioactive materials into body tissues, may occur and require additional treatment.

General Information

Radiation Precautions

- Individuals who have been exposed to ionizing radiation, but who have not come into contact with radioactive material, are neither contaminated nor radioactive. They do not require radiation precautions.
- In patients with known or suspected external or internal contamination, paramedics and EMRs/FRs should don gown, masks, cap, boots, and gloves. The patient should be isolated to the maximal extent possible. Avoid touching surfaces or items unnecessarily.

Burns

- Both thermal and radiation burns can occur in radiological incidents. Thermal burns with radiation exposure are a “combined injury,” for which the prognosis is worse than burn or radiation exposure alone.
- Cool burns as required. Be aware of the risk of hypothermia.
- Radiation burns may occur in patients undergoing radiation therapy or who have had extensive fluoroscopy

procedures. These do not benefit from cooling and have complex wound care requirements.

Acute Radiation Syndrome

- Individuals exposed to radiation will develop Acute Radiation Syndrome (ARS) only if all of the following requirements are met:
 - The radiation dose was high
 - The radiation dose was penetrating (i.e., it was able to reach internal organs, such as x-rays or gamma rays)
 - The person's entire body, or most of it, received the dose
 - The radiation was received in a short time, usually minutes; this is most common in industrial accidents and therapeutic misadventures
- There are four subsyndromes of ARS – hematopoietic, gastrointestinal, cutaneous, and neurovascular – and their severity will vary with dose and individual factors.
- High dose whole-body radiation exposure also produces clinically detectable effects in the lungs, liver, and kidneys. Usually, injury to these organs is detected long after ARS manifests itself; individuals would need to survive the earlier injuries for these types of injuries to become life threatening.
- Immune dysfunction, as part of the injury to the hematopoietic system, is also clinically significant if the dose and exposure is severe enough.

Interventions

First Responder

- Decontaminate patient
- → [PR05: Patient Decontamination](#)
- Provide supplemental oxygen as required
 - → [A07: Oxygen Administration](#)
- Treat life and limb threatening injuries
- Place patient in position of comfort
- Cool burns
- Provide wound care

Emergency Medical Responder – All FR interventions, plus:

- **Paramedics and EMTs must contact ClinCal** to discuss the case, ideally prior to arrival on scene.
- Provide supplemental oxygen to maintain SpO₂ ≥ 94%
 - → [B01: Airway Management](#)
 - → [A07: Oxygen Administration](#)
- Manage pain
 - → [E08: Pain Management](#)

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider vascular access
 - → [D03: Vascular Access](#)
- Manage nausea
 - → [E07: Nausea and Vomiting](#)

References

1. US Department of Health & Human Services. REMM - Radiation Emergency Medical Management. 2020. [\[Link\]](#)

