



Southern Regional Disaster Response System
HHS Region 4



EMORY
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MEDICINE

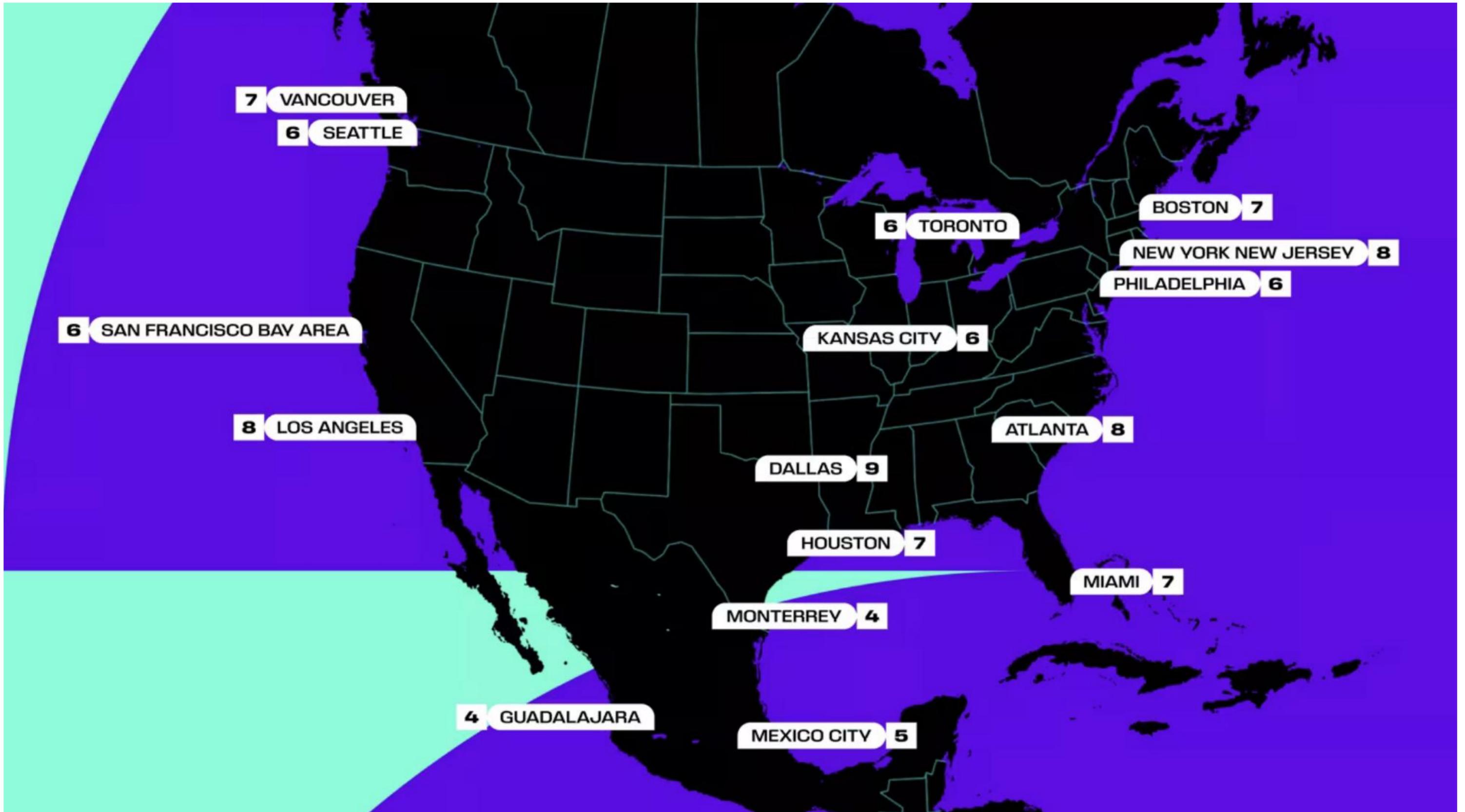
Medical Toxicology

Department of
Emergency Medicine

Thinking Ahead of the 2026 FIFA World Cup: Radiological/Nuclear Emergency Preparedness Preparedness for your Hospital

Disclosure

- We do not have any conflicts of interest to disclose



The Problem at Hand

- Radiation exposure cause non-specific and delayed clinical presentations
- Clinicians lack knowledge/experience about radiation injuries
- People fear radiation
- Laboratory testing may not be available
- Resources may not be available for testing in a mass casualty incident

Explosion at a Stadium (Source CDC)

Our Objective after this Presentation is
That You are Able to

- List the steps you need to take to prepare to receive victims of radiation incident
- Discuss the management of a critical trauma victim who is potentially contaminated with radioactive materials
- Discuss the management of radiation injuries



The Bottom Line Upfront

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- Health effects after exposure to ionizing radiation can occur “relatively shortly” after exposure to radiation or can be of delayed onset like cancer

After notification of a mass casualty incident in the Emergency Department:

- Activate the external disaster plan and the Hospital EOC. Set up Incident Command
- Alert internal stakeholders
- Secure the facility
- Maximized available treatment space
 - Expedite discharges
 - Postpone elective surgeries
 - Postpone elective radiographic procedures
- Arrange for staffing including specialized care
- Arrange for supplies including drugs and equipment
- Communicate with external stakeholders (EMS, Fire, Public Health, Emergency Management, Healthcare Coalitions, News Outlets)

Additional items to prepare in a radiological incident

- PPE
- Decontamination
- Radiation detectors
- Expert support
- Testing capabilities
- Antidotes
- Medical countermeasures



PPE Levels A and B: Typically, not needed in an ED setting

PPE Level C:
Needed in an ED
setting



Level D: Default in the ED



The Bottom Line Upfront

- Radioactive material can be localized using a handheld radiation detector like a Geiger-Muller counter.
- The material can be washed with soap and water, once the patient condition is stabilized.
- Radioactive material that has entered the body can distribute in different organs and cause subacute or long-term organ damage like cancer, or leukemia.

Examples of Radiation Detectors



Ionization Chamber



Geiger Muller Counter



Portal Monitor

Personal Dosimeter-
Film Badge



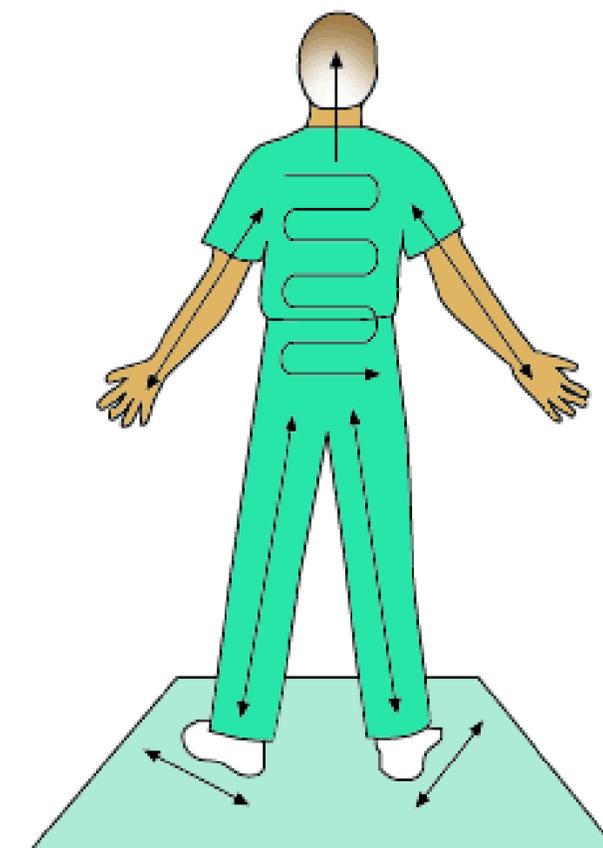
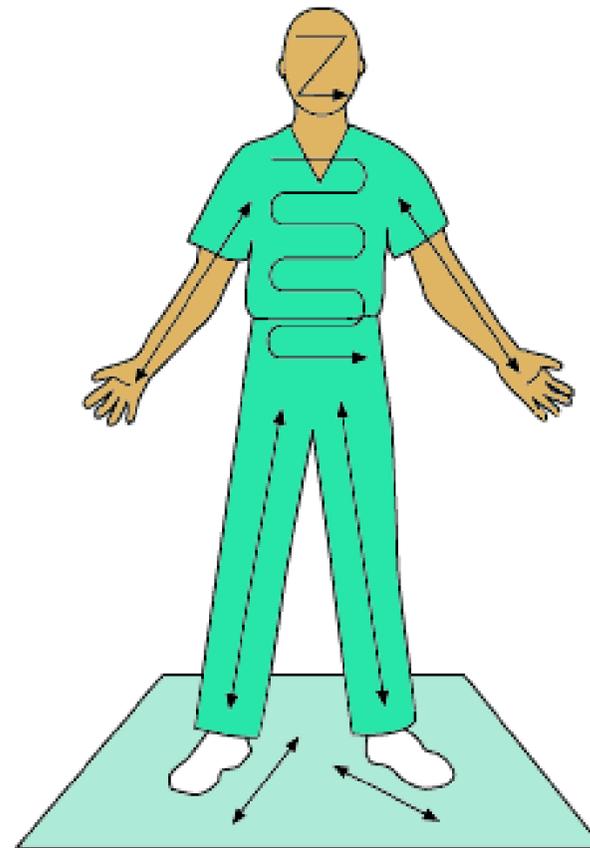
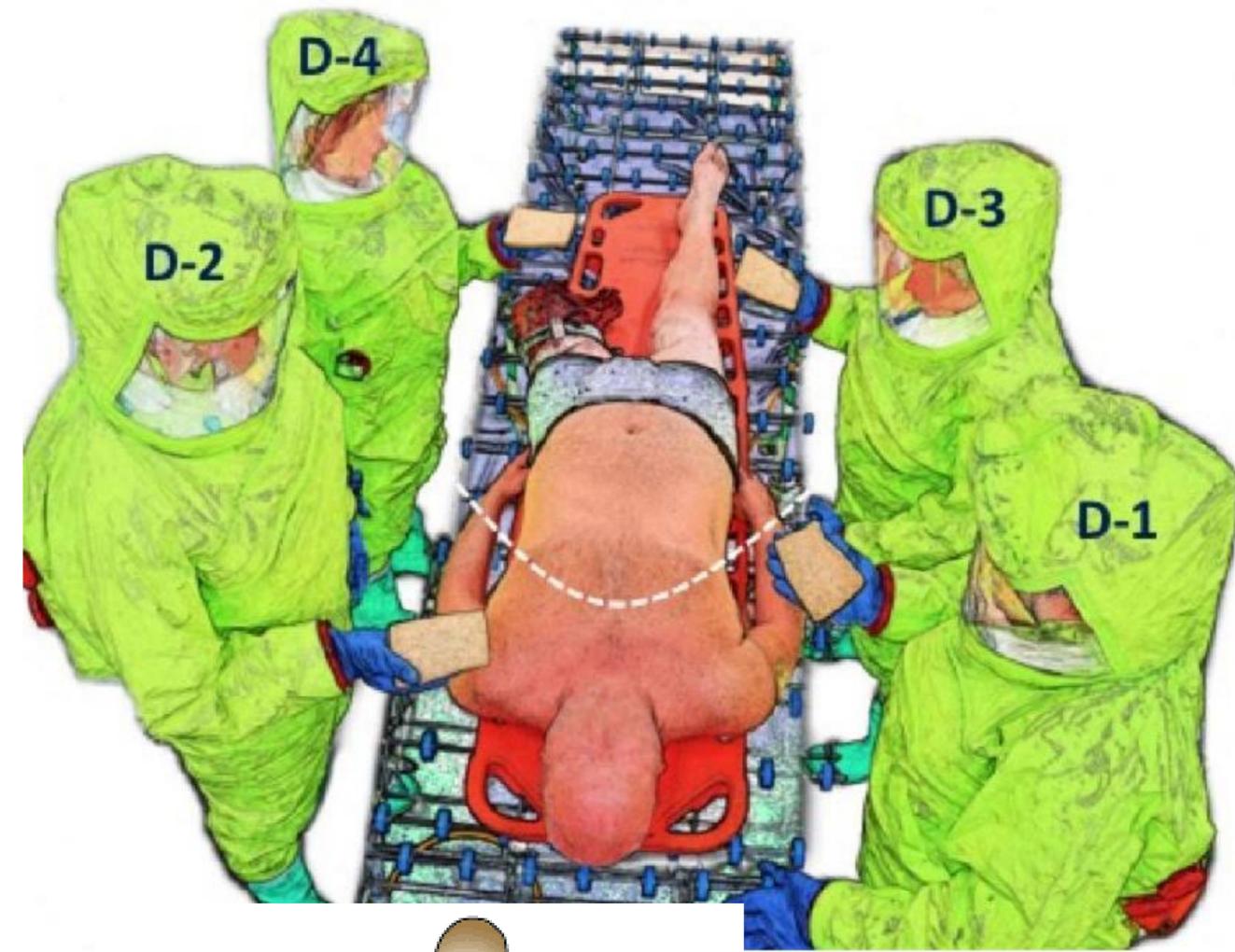
Emergency Decontamination

- Clothes removal
- Wet decontamination



**TIME IS OF
ESSENCE
IN
DECONTAMINATION**

Technical Decontamination: Ambulatory or Non-Ambulatory



The Bottom Line Upfront

Life-saving interventions like securing the airway, stopping severe bleeding, or decompressing a tension pneumothorax, should be done before a radiation survey and decontamination are completed

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WHO AND WHERE ARE THE SUBJECT MATTER EXPERTS?

Radiation Emergency Assistance Center/Training Site

[Home](#) > Radiation Emergency Assistance Center/Training Site



View Emergency Treatment Resources

In the event of a radiological emergency, medical professionals can find videos, references, and job aids to assist in the management of individuals injured by ionizing radiation.

Translated materials are also available in [Spanish](#), [Turkish](#), and [Ukrainian](#).

The Radiation Emergency Assistance Center/Training Site (REAC/TS) is a world-renowned, U.S. Department of Energy asset and a leader in emergency medical response to radiological/nuclear incidents. REAC/TS provides emergency response and subject matter expertise on the medical management of radiation incidents for the National Nuclear Security Administration's Office of Counterterrorism and Counterproliferation. REAC/TS is located at the Oak Ridge Institute for Science and Education in Oak Ridge, Tennessee, and is operated for DOE by [ORAU \[orau.org\]](https://orau.org).

REAC/TS maintains a 24/7 national and international response capability and provides continuing medical education and outreach exercises. REAC/TS courses annually reach thousands of healthcare professionals, emergency responders, and health physicists worldwide. Topics address the medical management of radiological/nuclear incidents, as well as decontamination techniques through instructional and hands-on education.

REAC/TS also operates a unique laboratory that helps DOE close a critical gap in our nation's ability to respond to a radiological or nuclear incident. The

24/7 response capability for advice and consultation on radiological emergencies



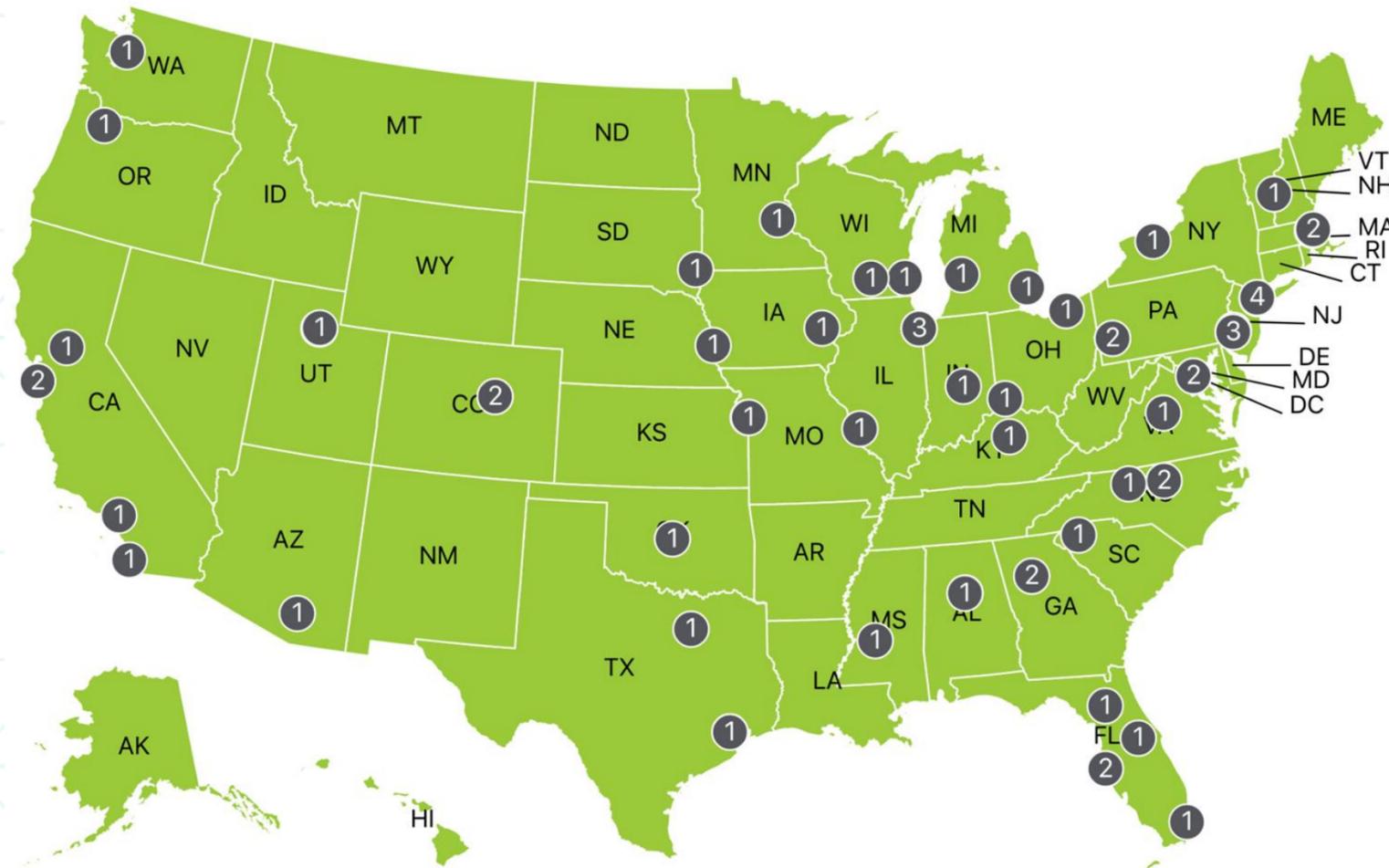
Southern Regional Disaster
Response System

HHS Region 4

Additional Experts

- Health Physicists, Radiation Safety Officers
- Radiation Oncologists
- Radiologists and Nuclear Medicine Technologists
- Medical Oncologists, Stem Cell Transplant Specialists
- State Radiation Control Program Director and Staff
- Department of Public Health WMD Coordinators

Radiation Injury Treatment Network (RITN)



74+

Network Hospitals



21,917+

Medical staff trained in radiation preparedness topics



18,000+

Medical countermeasures available for treating H-ARS patients



954+

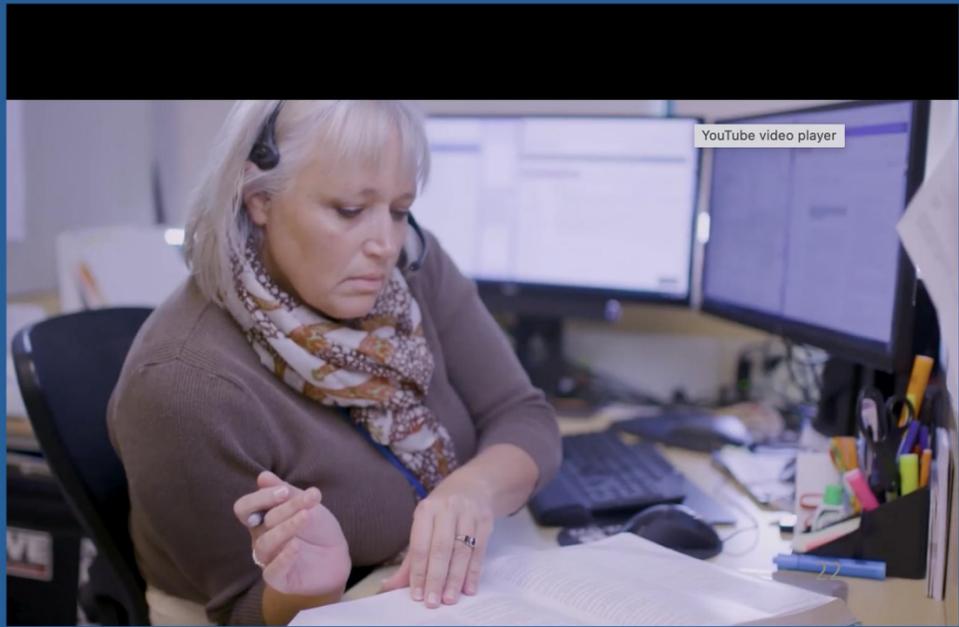
Preparedness exercises conducted by RITN hospitals

POISON EMERGENCY? CALL 1-800-222-1222 OR VISIT POISONHELP.ORG

WHO WE ARE

America's Poison Centers represents 55 poison centers across the country, and through our national [Poison Help line](http://PoisonHelp.org) (800-222-1222) and website, PoisonHelp.org, we provide all Americans expert advice available 24/7/365, at no cost. We also maintain the National Poison Data System® (NPDS), our nation's only near real-time poisoning data surveillance system, integrating the latest information from across Poison Centers.

VISIT POISONHELP.ORG



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Poison Centers: America's Poison Centers



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Virtual
Seminar in
Forensic
Toxicology

2024 Annual
Scientific
Meeting &
Symposia

DEA MATE

American Academy of Clinical Toxicology



Clinical Care, Research & Education

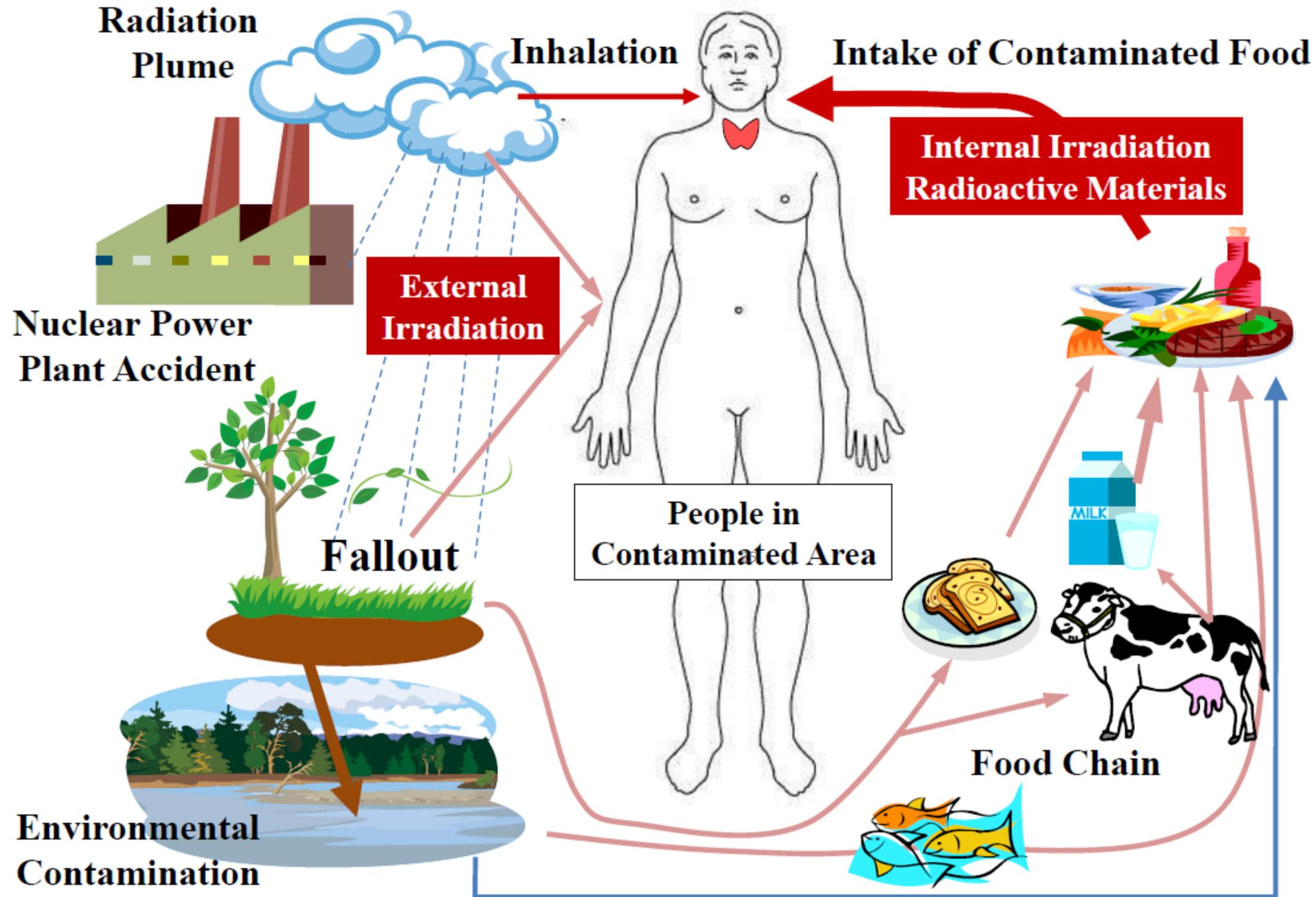
Expert clinical consultation for poisoned patients.
Local, national, and international toxicology expertise
and education.

[Learn More](#)

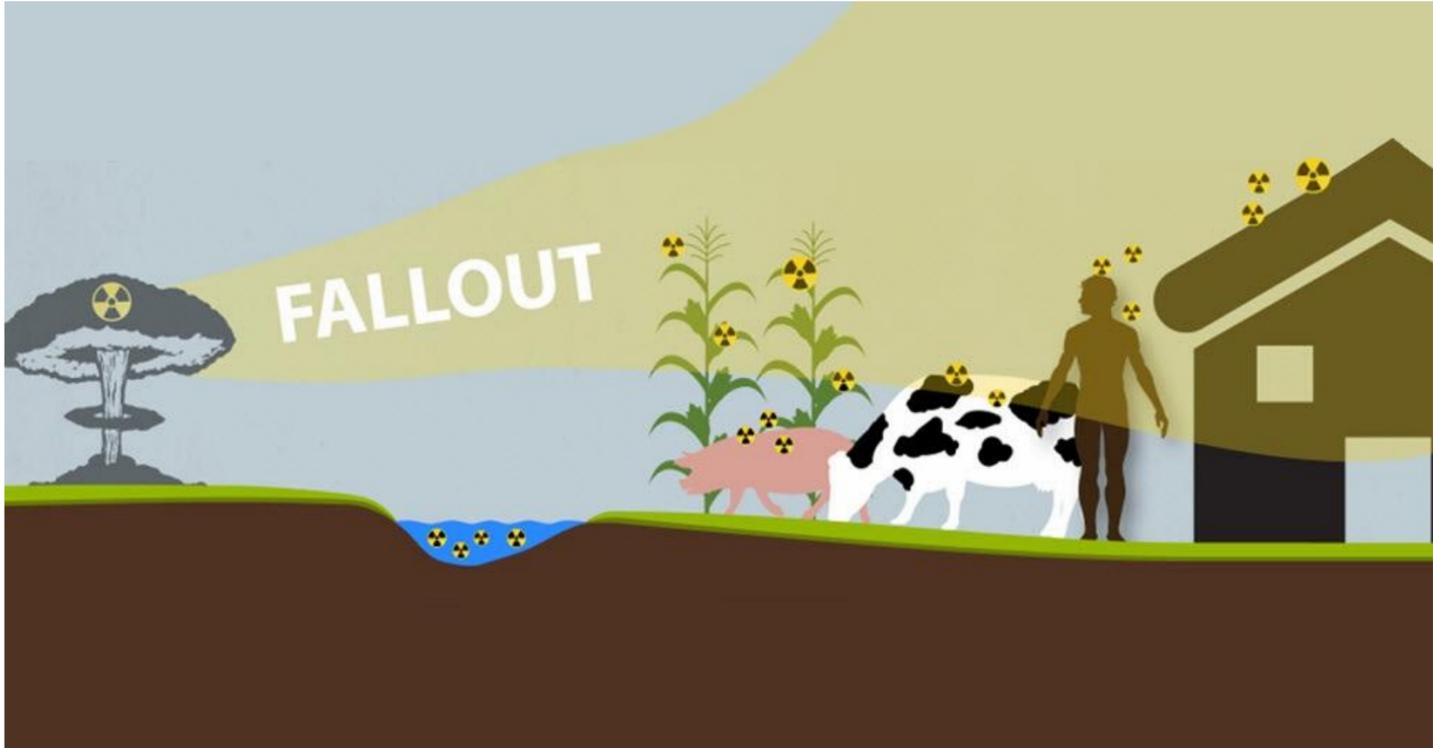
American College of Medical Toxicology

How does one recognize a radiological or nuclear incident?

Nuclear Power Plant Emergency



IND Detonation Scenario



Nuclear Weapon Detonation

What is a nuclear weapon?

A nuclear weapon is a device that uses a nuclear reaction to create an explosion. This explosion is much more powerful than that of conventional explosives (like TNT). When a nuclear weapon explodes, it gives off four types of energy: a blast wave, intense light, heat, and radiation. Nuclear weapons can be in the form of bombs or missiles.



When a nuclear weapon explodes, a large fireball is created. Everything inside of this fireball vaporizes and is carried upward. This creates a mushroom-shaped cloud. The material in the cloud cools into dust-like particles and drops back to the earth as **fallout**. Fallout can be carried by the wind and can end up miles from the site of the explosion. Fallout is radioactive and can contaminate anything it lands on.



What are the main dangers of a nuclear weapon?

A nuclear weapon would cause great destruction, death, and injury and have a wide area of impact. People close to the blast site could experience:

Thermal Burns and Instant Radiation Exposures

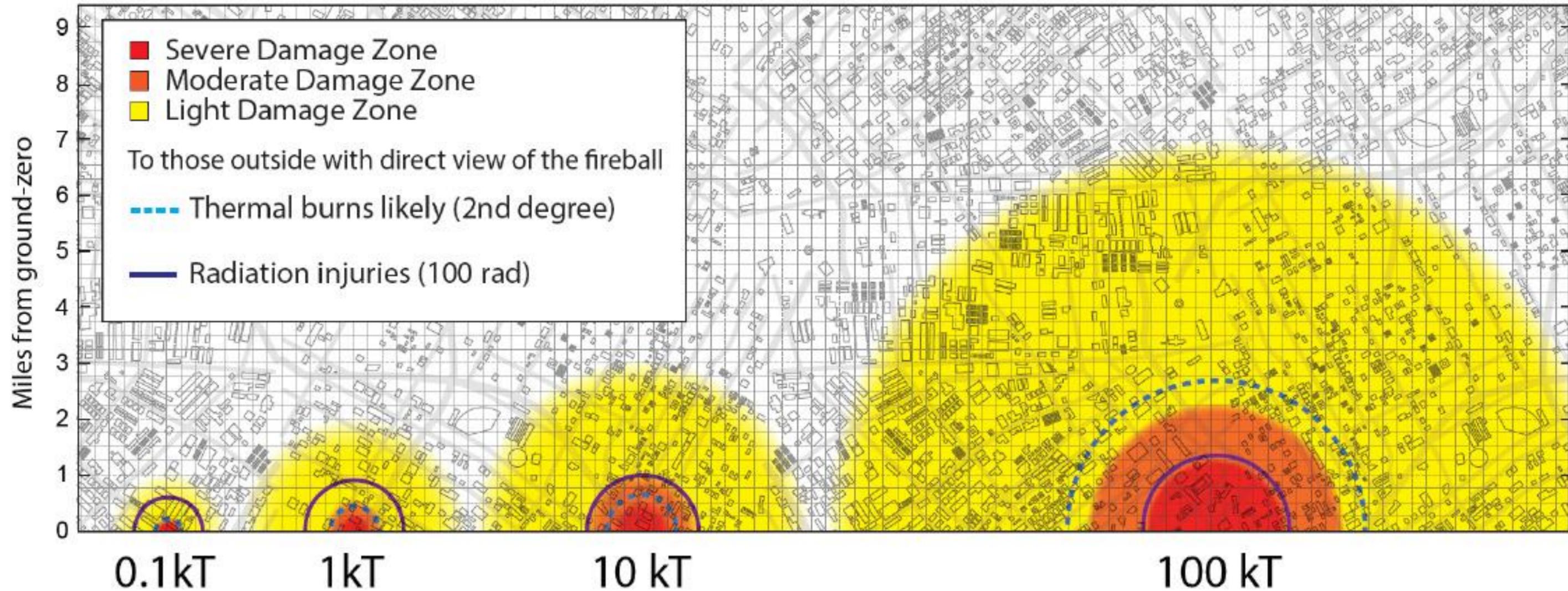


Figure 7: Radiation and burn injury ranges overlaid on damage zones demonstrating the extent of outdoor 1 Gy (100 rad) initial radiation and second-degree thermal burns for unobstructed 0.1, 1, 10, and 100 kT surface detonations.

Flash burns accounted for the overwhelming majority of burns sustained among survivors of Hiroshima

% were flame

Planning Guidance for Response to a Nuclear Detonation, Third Edition

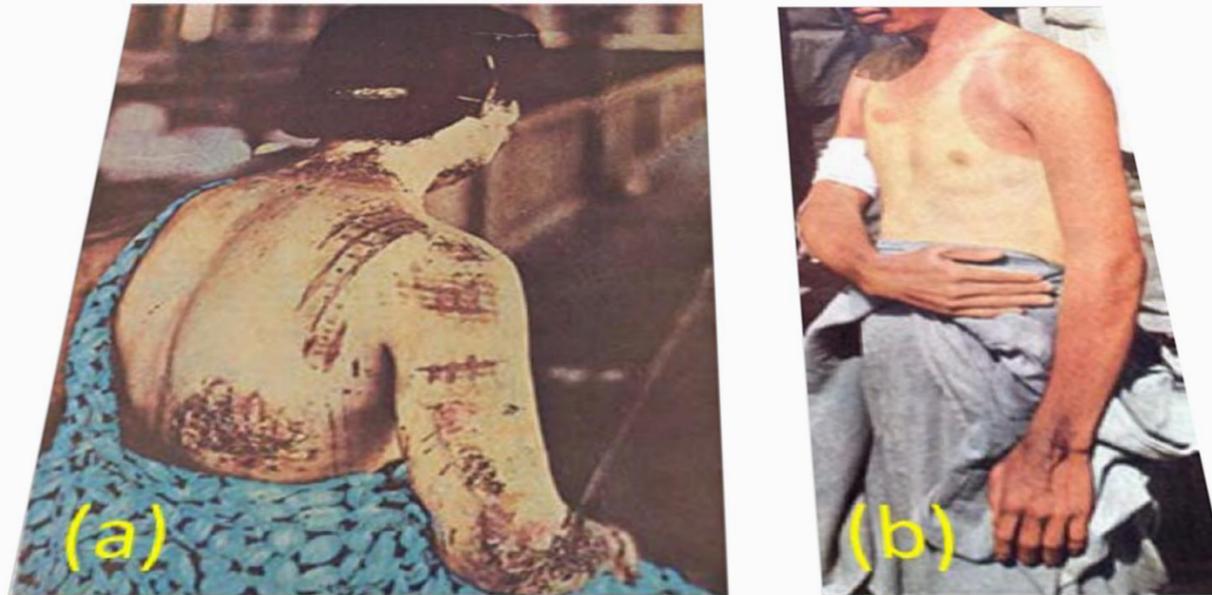


Figure 25: Flash burn victims from (a) Hiroshima showing pattern burns due to clothing patterns and (b) Nagasaki showing profile burns from clothing coverage (War Department, 1945).

Radiation Zones: Dangerous Radiation Zone & Hot Zone

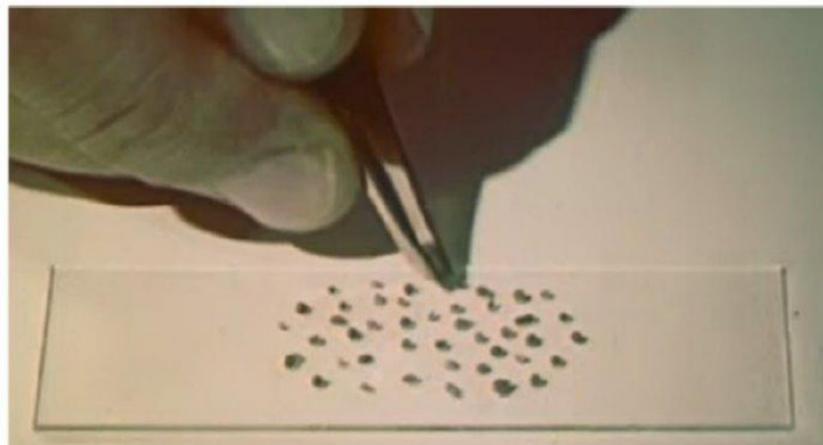


Figure 10: Fallout Particles from Near-Surface Nuclear Tests

After a nuclear detonation near the surface, immediately dangerous fallout will descend back to earth within the first few minutes to hours and can be readily visible as it comes down.

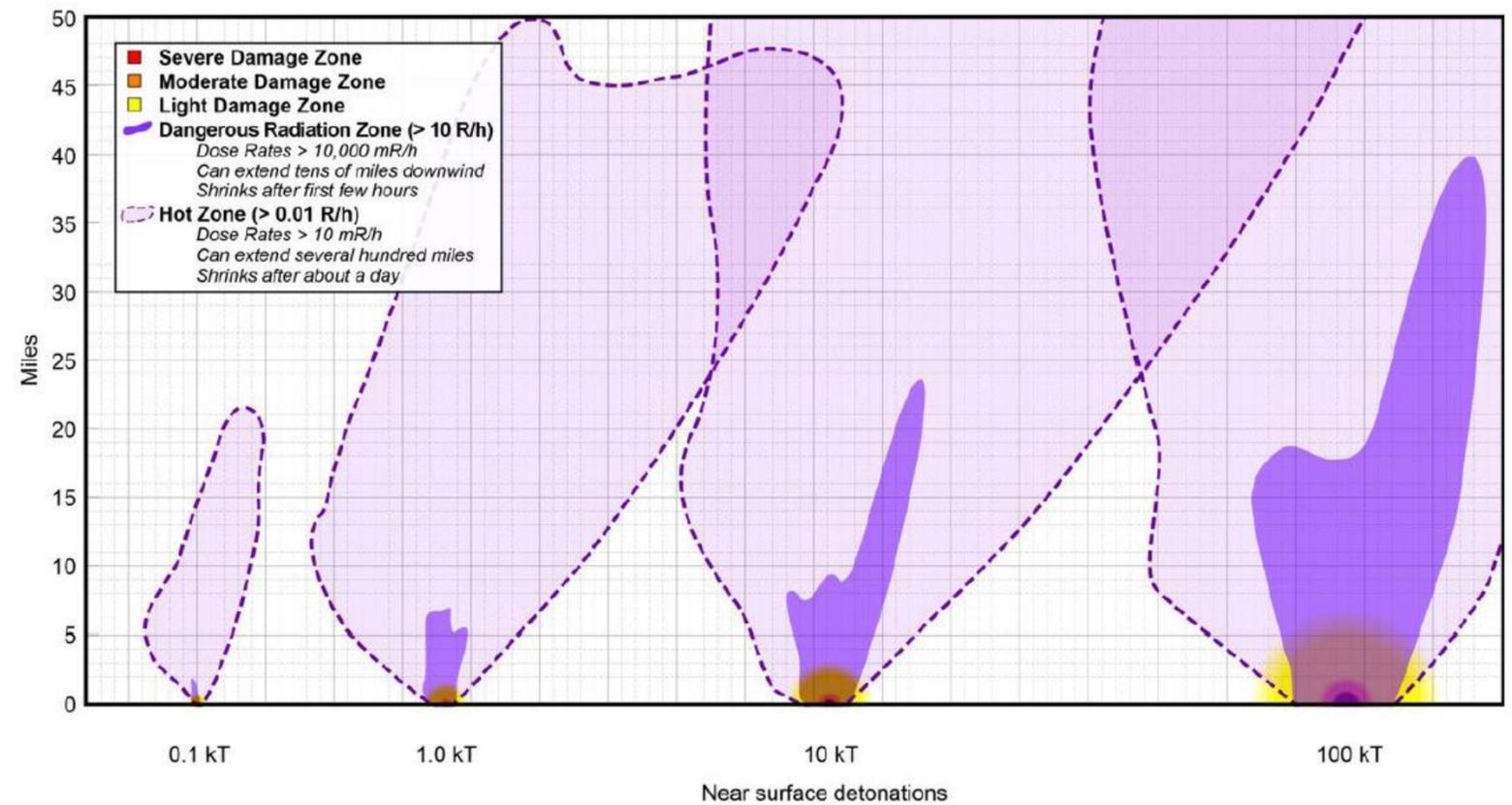
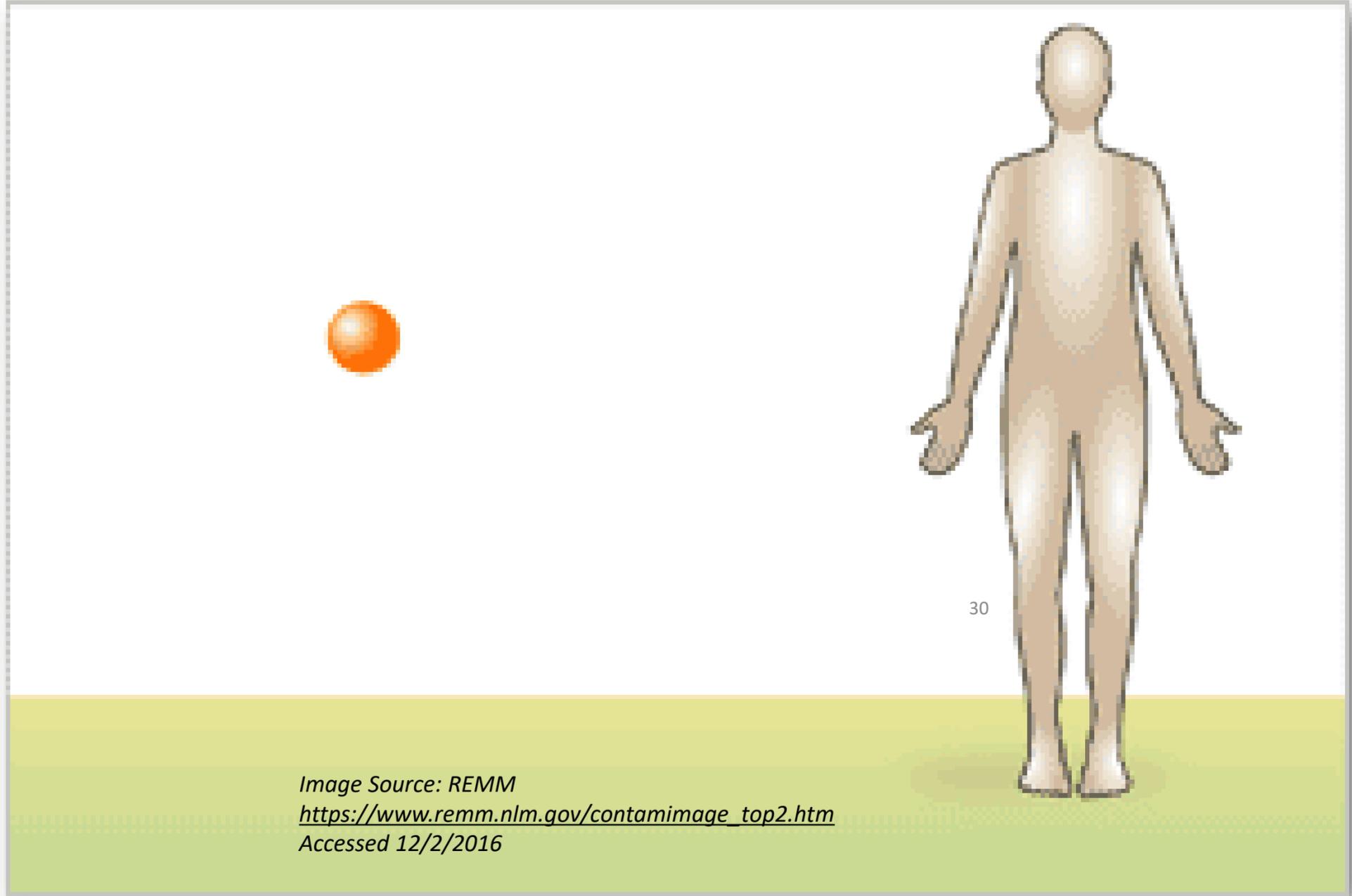


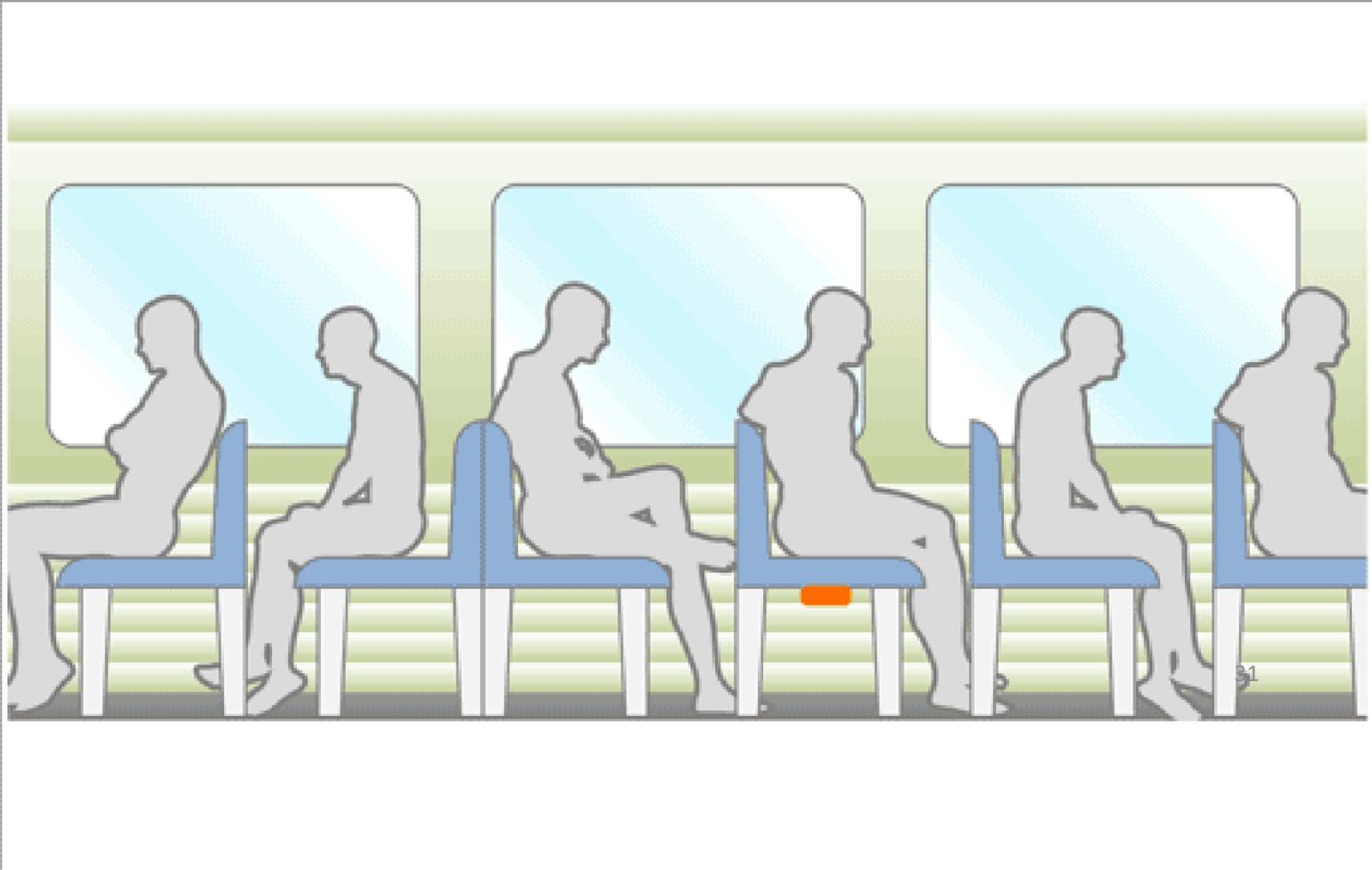
Figure 15: Illustrations of Response Zones for a Variety of Yields

The HZ, like the DRZ, should be established by measured radiation levels. The HZ is bound by 0.01 R/h and higher exposure rates within the 10 R/h boundary. The SDZ is expected to have HZ radiation levels or higher, even for low air bursts. The HZ will overlap with parts of the MDZ and LDZ for near-surface detonations. Figure 15 illustrates the relationship between the HZ, damage zones, and the DRZ for surface detonations of various yields.

Radioactive Dispersal Device: External with Radioactive Material



Radiological Exposure Device: Exposure to Radiation Without Contamination



Source unshielded

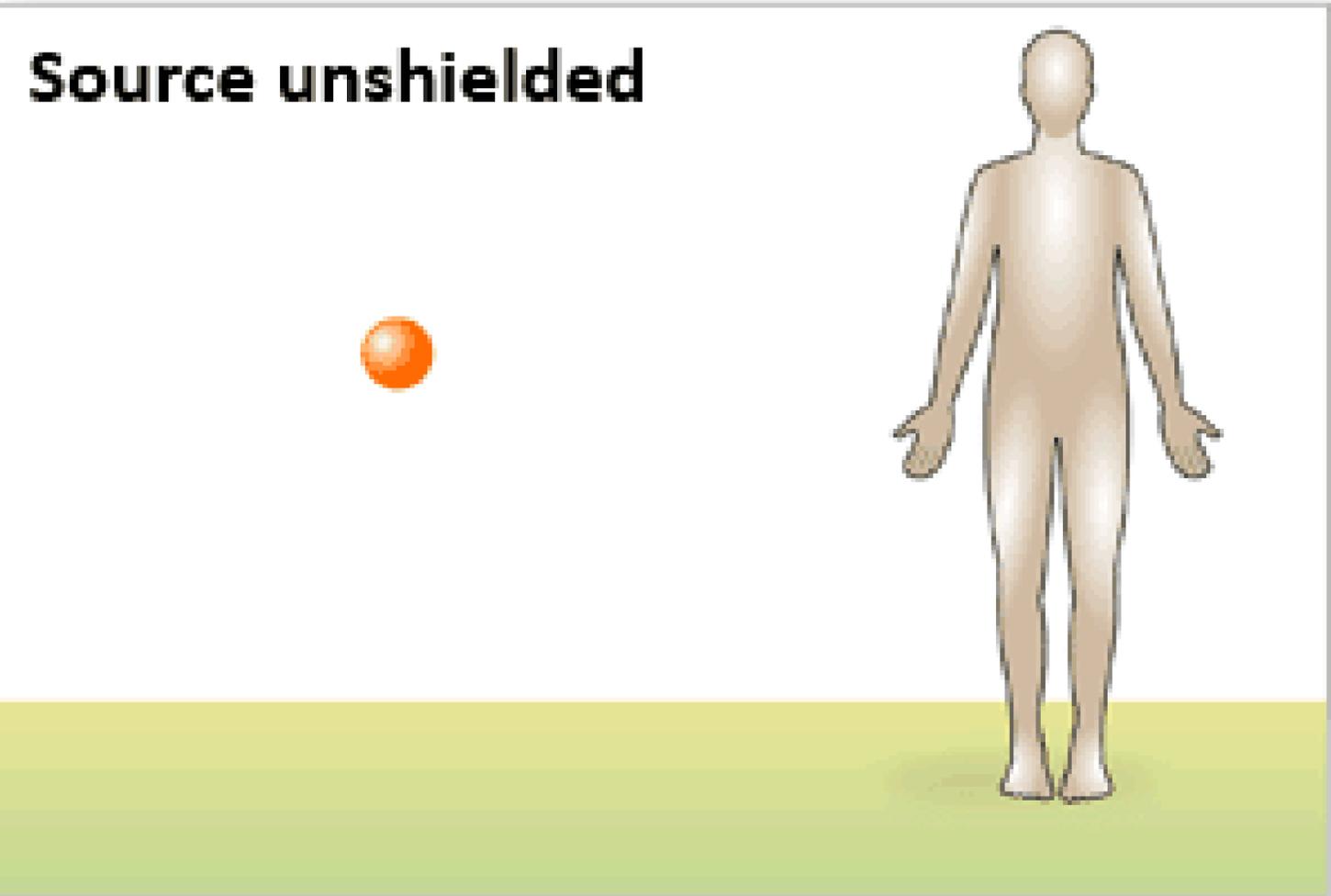


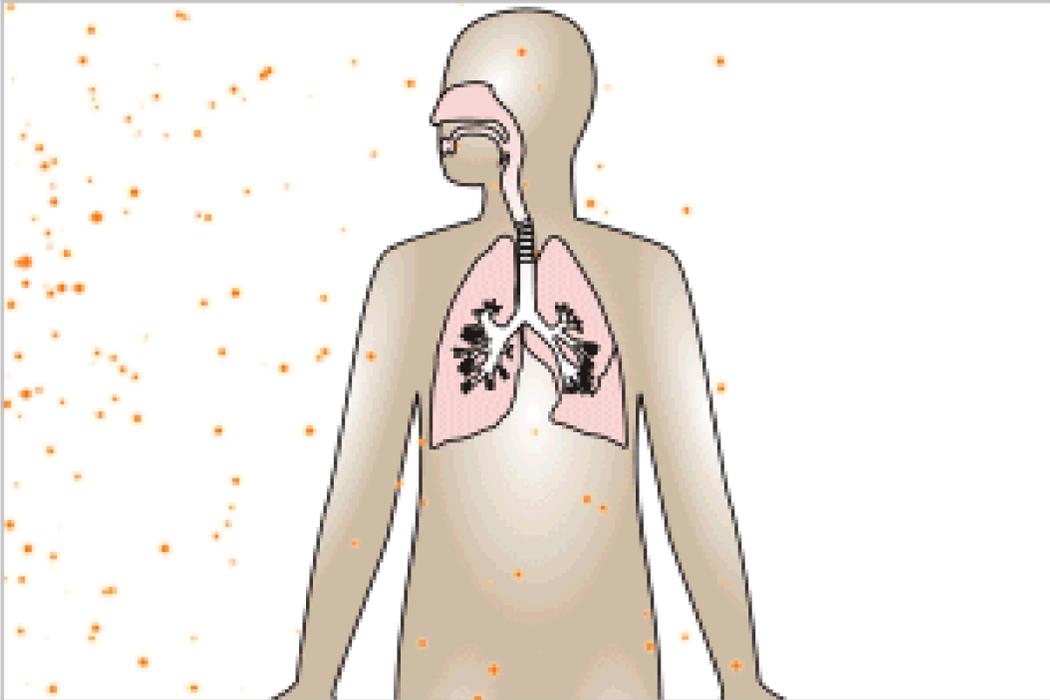
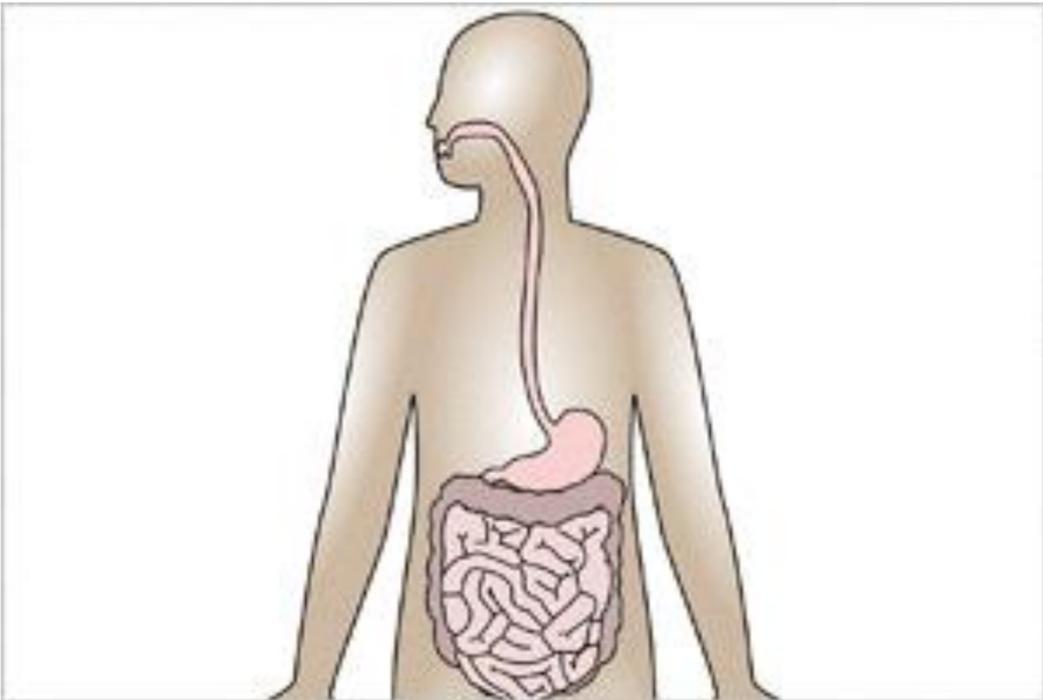
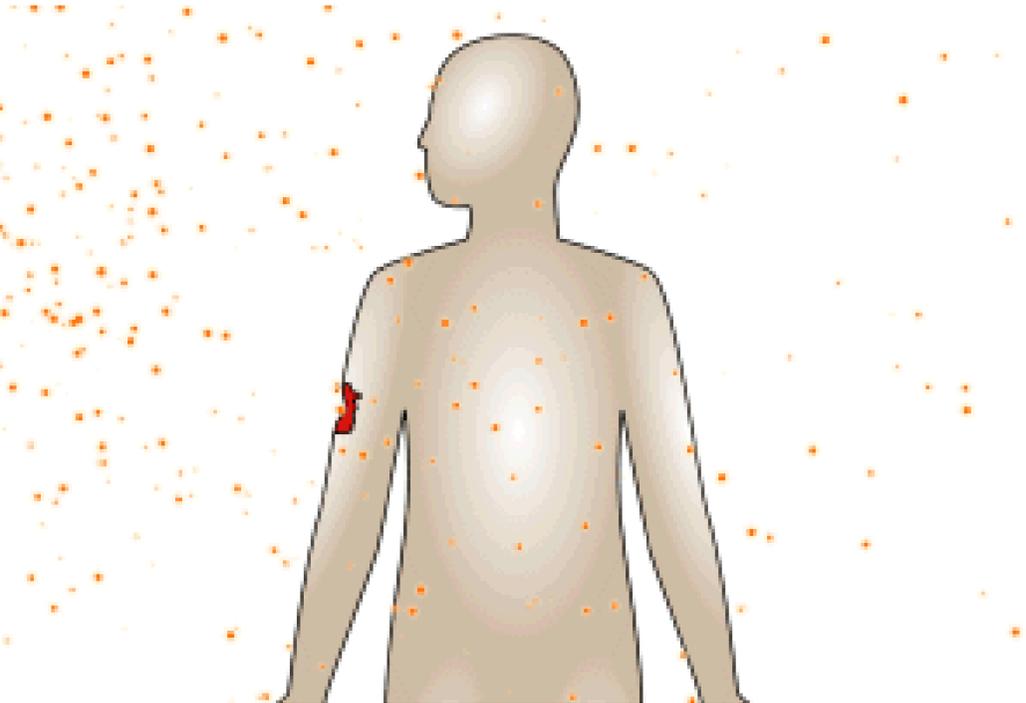
Image Source: REMM <https://www.remm.nlm.gov/exposureimage.htm>
accessed 12/2/2016

The Bottom Line Upfront

- Radiation protection principles
 - Time and Distance
 - Decontamination of patients contaminated with radioactive materials
- Patients can have their body externally contaminated with radioactive material.
 - They can also take up this material by inhaling it or ingesting it. If they have an open wound, the material could enter the body that way, as well.



Source REMM



Medical Countermeasures that can potentially decrease risk of health effects after internal contamination

Prussian Blue



Calcium or Zinc DTPA



Potassium Iodide

Sodium Bicarbonate

Cesium
Thallium

Plutonium
Americium
Curium

Iodine (within
4-6 hours)

Uranium to
prevent
chemical
toxicity

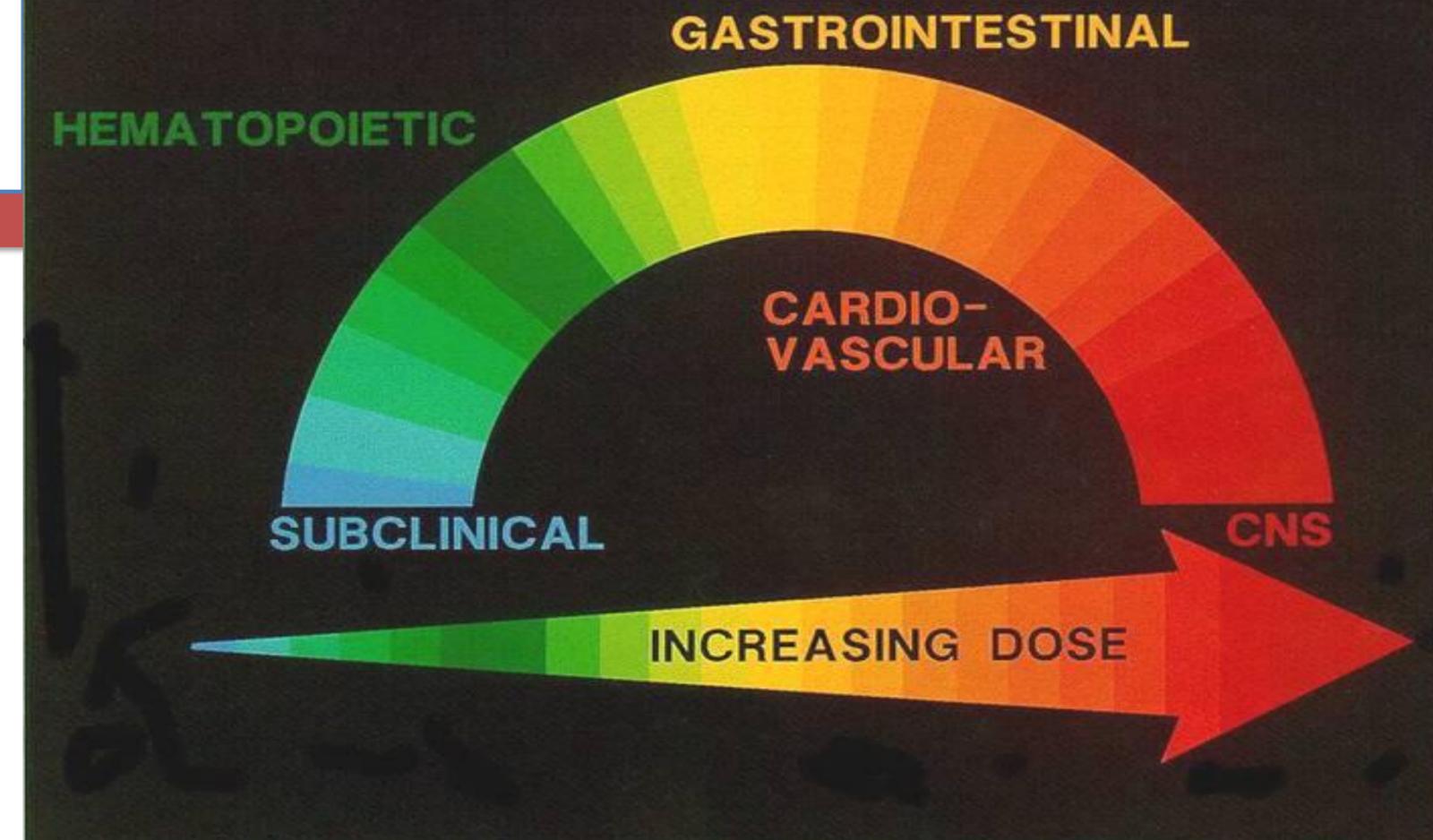
The Rule of 4s:

4 stages

- Prodrome
- Latent
- Manifest
- Recovery or death

4 Conditions

- Exposure to penetrating radiation like gamma rays
- Whole body exposure or near whole body
- Dose ≥ 2 Gray
- Dose received over a short period of time (minutes to few hours)



4 Potential Subsyndromes

- Hematopoietic subsyndrome
- Gastrointestinal subsyndrome
- Cerebrovascular subsyndrome
- Cutaneous subsyndrome

The Bottom Line Upfront

- Patients with ARS develop prodromal symptoms like nausea, vomiting, diarrhea, fever, and fatigue.
- The time to onset and severity of these prodromal signs and symptoms like time to onset of vomiting and diarrhea, can help a clinician estimate the severity of the patient condition.
- The rate of drop of the absolute lymphocyte counts can also be used by the clinician to assess severity and prognosis.
- Newer technologies are being developed to predict the severity of a patient disease.

The Bottom Line Upfront

- Care of ARS is primarily supportive and like the care of a patient who is neutropenic after chemotherapy for cancer.
- Cytokines like filgrastim, pegfilgrastim, sargramostim, and romiplostim can be used to help the bone marrow recover faster, shorten the duration of neutropenia, and decrease the severity of thrombocytopenia, and risk of death.
- Victims with combined injuries or comorbid conditions will have a more severe illness and worse prognosis for survival.

Care for ARS

IVF	Neutropenic Precautions	Blood Products
Nutrition	Antiemetics	Antidiarrheals
Analgesics	Antibacterials	Antivirals Antifungals
Colony Stimulating Factors	³⁸ Psychological Support	Stem Cell Transplant

**MEDICAL
COUNTERMEASURES**



Medical Countermeasures

Filgrastim

Sargramostim

Peg-Filgrastim

Romiplostim

Online Resources

- [Radiation Emergency Medical Management](#)
- [Centers for Disease Control and Prevention](#)



DIAGNOSIS & TREATMENT	
	Management Algorithms
	Dose Estimator
	Scarce Resources Triage Tool
	Isotopes of Interest
	Radiation Countermeasures
	Videos
TRIAGE	
	START Triage (Adults)
	JumpSTART Triage (Children)
	SALT Triage
REFERENCES	
	Radiation Units
	Emergency Contacts
ABOUT	
	About Mobile REMM
	REMM Disclaimers

Online Resources

- [Radiation Emergency Assistance Center/Training Site \(REAC/TS\)](#)
- [Radiation Injury Treatment Network](#)
- [Federal Emergency Management Agency \(example guidance\)](#)
- [World Health Organization](#)

The screenshot shows the top section of the RITN website. On the left is the RITN logo, which consists of a stylized atom symbol and the text "RITN" in large green letters, with "RADIATION INJURY TREATMENT NETWORK" in smaller black letters below it. To the right of the logo is the tagline: "Preparing to treat acute radiation syndrome from a distant radiological mass casualty disaster". Further right is a link for "RITN Portal" with an external link icon. Below this is a dark blue navigation bar with white text for the following categories: "About" (with a dropdown arrow), "Treatment", "Triage", "Training" (with a dropdown arrow), "Exercises", "Resources" (with a dropdown arrow), "Events", and "Contact".

The screenshot shows the navigation menu for the REAC/TS website. At the top left is the REAC/TS logo, which includes a radiation symbol and the text "REAC/TS" in bold, with "Radiation Emergency Assistance Center/Training Site" in smaller text below it. The menu items, each with an icon, are: "REAC/TS News" (document icon), "Eguides to Radiation Medical Management/ Pocket Guides" (book icon), "Contacting REAC/TS and Radiation Countermeasures" (phone icon), "Federal, State, and International Resources" (globe icon), "Radiation Incident Resources" (document icon), "REAC/TS Radiation Videos/ JIT Training" (video icon), "Radiation Injury Treatment Network" (atom icon and external link icon), "Self-Assessments" (question mark icon), "Checklists" (document icon), "Cytogenetic Biodosimetry Laboratory" (microscope icon), and "Calendar" (calendar icon).

ASPR TRACIE-Radiation Resources

The screenshot displays the ASPR TRACIE website interface. At the top, the HHS.gov logo and 'U.S. Department of Health & Human Services' are visible. The main header features the TRACIE logo and navigation links: HOME, TECHNICAL RESOURCES, ASSISTANCE CENTER, INFORMATION EXCHANGE, REGISTER, and LOGIN. The search results page shows a search bar with 'radiation' entered. Below the search bar, there is a list of search results. The first result is 'Management of the Deceased in Radiation Emergencies' by Radiation Emergency Medical Management, published in 2022. The second result is 'Step-by-Step Guide to Implementing the Coalition Radiation Surge TTX Template (PDF)' by ASPR TRACIE, published in 2021. The third result is 'Step-by-Step Guide to Implementing the Coalition Radiation Surge TTX Template (Word)' by ASPR TRACIE, published in 2021. The fourth result is 'Prototype / Template for Adult Hospital Orders During a Radiation Emergency' by Radiation Injury Treatment Network, published in 2017. A 'Refine Your Results' sidebar on the right shows a filter for 'Publication Year' with options for 2024 (2), 2023 (5), and 2022 (5). A 'Back to top' button is located at the bottom right of the search results area.

Search Results

If you need assistance locating a resource, contact ASPR TRACIE.

Search

radiation

Management of the Deceased in Radiation Emergencies
Author: Radiation Emergency Medical Management.
Source: U.S. Department of Health and Human Services.
Date Published: 2022
Annotation: This webpage includes information on how to handle human remains that have been exposed to radiation.
URL: <https://remm.hhs.gov/deceased.htm>
Keywords: radiation, remains, contamination, contaminated remains
ID: 11320

Refine Your Results

Publication Year

- 2024 (2)
- 2023 (5)
- 2022 (5)

Step-by-Step Guide to Implementing the Coalition Radiation Surge TTX Template (PDF)
Author: ASPR TRACIE.
Date Published: 2021
Annotation: This document can help exercise designers set up a healthcare coalition radiation surge tabletop exercise.
URL: <https://files.asprtracie.hhs.gov/documents/aspr-tracie-step-by-step-guide-to-implementing-coalition-rad-surge-ttx-template-final.pdf>
Keywords: radiation, radiological, nuclear, ttx, tabletop, HCC, coalition
ID: 10147
Rate: ★★★★★ Favorite: ♥
Login to rate, favorite, and comment on the article
Comments 0

Step-by-Step Guide to Implementing the Coalition Radiation Surge TTX Template (Word)
Author: ASPR TRACIE.
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Keywords: radiation, radiological, nuclear, ttx, tabletop, HCC, coalition
ID: 10148
Rate: ★★★★★ Favorite: ♥
Login to rate, favorite, and comment on the article
Comments 0

Prototype / Template for Adult Hospital Orders During a Radiation Emergency
Author: Radiation Injury Treatment Network.
Date Published: 2017
Annotation: Healthcare providers can customize this set of orders—created by REMM and RITN physicians—for adult patients who have been exposed to radiation. It includes links to additional tool... [Read More]

Back to top ↑

Online Resources

- [Southern Regional Disaster Response System](#)

The screenshot shows the website for the Southern Regional Disaster Response System (HHS Region 4). The header includes navigation links: ABOUT, EVENTS, RESOURCES, MEDICAL OPERATIONS COORDINATION CENTER, TELEMEDICINE, and SPECIALTY COLLABORATIONS. A search bar is located in the top right corner. The main content area features the title "Radiological/Nuclear Emergency Webinar Series" with a decorative line below it. To the right is a "RESOURCES" sidebar with links to CHEMICAL EMERGENCY WEBINAR SERIES, RADIOLOGICAL/NUCLEAR EMERGENCY WEBINAR SERIES (highlighted), CLINICAL, PEDIATRIC, and EDUCATION & TRAINING. Below the title is the section "SRDRS RADIATION WEBINAR SERIES" with another decorative line. A promotional graphic for the webinar series is displayed, including a QR code and a list of six webinars. To the right of the graphic, text states: "We are pleased to announce that our 6-part webinar series titled Healthcare & Public Health Planning for a Radiological/Nuclear Emergency is now live on Canvas, an online Learning Management System. As a reminder, each webinar provides EMS CEU, CNE, and CME!" A "REGISTER NOW >>" button is located at the bottom right of the graphic area.



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