

# Radiation Readiness & You

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*March 19, 2012*

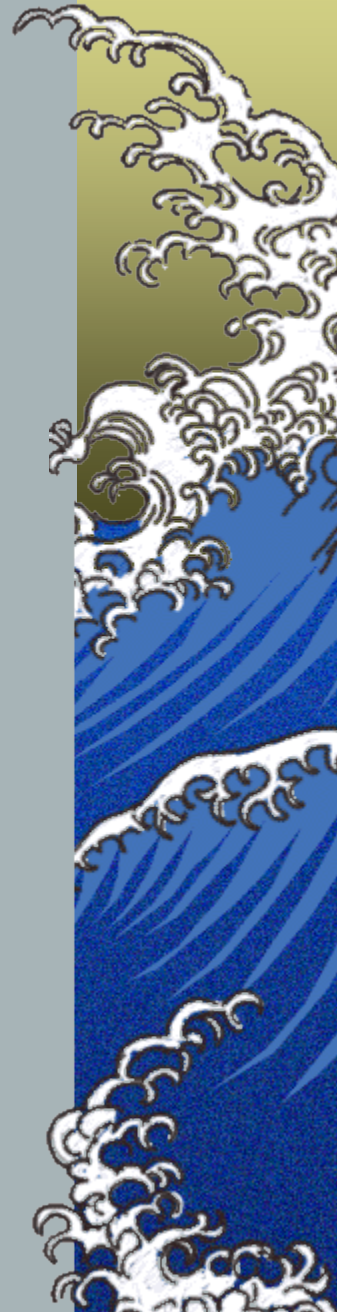


DELAWARE HEALTH AND SOCIAL SERVICES  
Division of Public Health



# Overview

- ▲ Why Radiation Matters to Everyone!
- ▲ Radiation Readiness 101
- ▲ Respond to Deliver Needed Services
  - ▲ Population Monitoring
  - ▲ Radiological Triage
  - ▲ Countermeasures
- ▲ Radiation as a Tool of Terror
- ▲ Lots of Available Resources!
- ▲ Questions?



# Why Radiation Matters to Everyone!

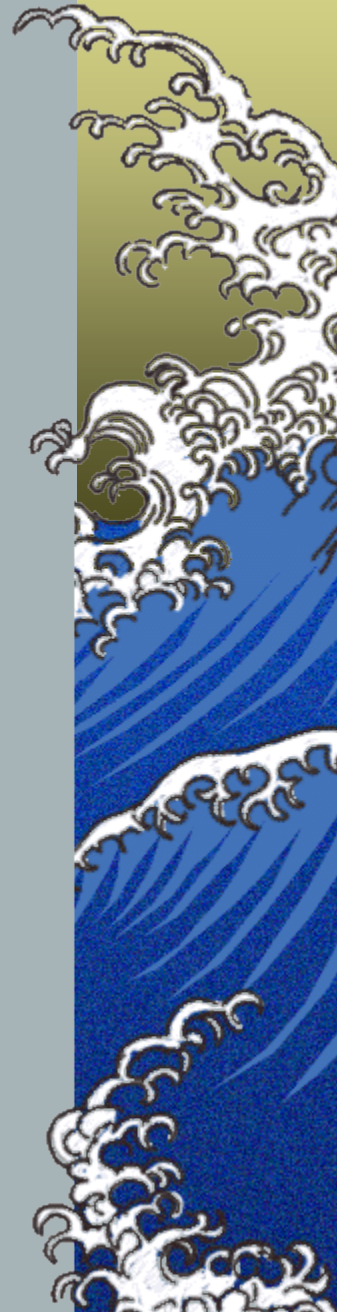
- 1. What do we mean by radiation?*
- 2. How do we encounter radiation in our daily lives?*
- 3. How much radiation is safe or advisable?*



# Why Radiation Matters to Everyone!

Radiation is used in many ways:

- ✓ Diagnosis & treatment in healthcare
- ✓ Biomedical research & development
- ✓ Homeland security & border protection
- ✓ Industrial production processes
- ✓ Sterilization of medical devices & garments
- ✓ Nuclear power generation (electricity)



# Fukushima Dai-Ichi

## March 11, 2011

Nuclear power generating station with multiple units, overwhelmed by the great Japan earthquake and tsunami in March, 2011.

Fixed worldwide attention on nuclear power safety, regulation and public policy.

Triggered an intensive study of safety and emergency preparedness to identify lessons learned for 104 nuclear power plants, by the U.S. Nuclear Regulatory Commission.



# After Fukushima: Managing the Consequences

## *Implications for the global community:*

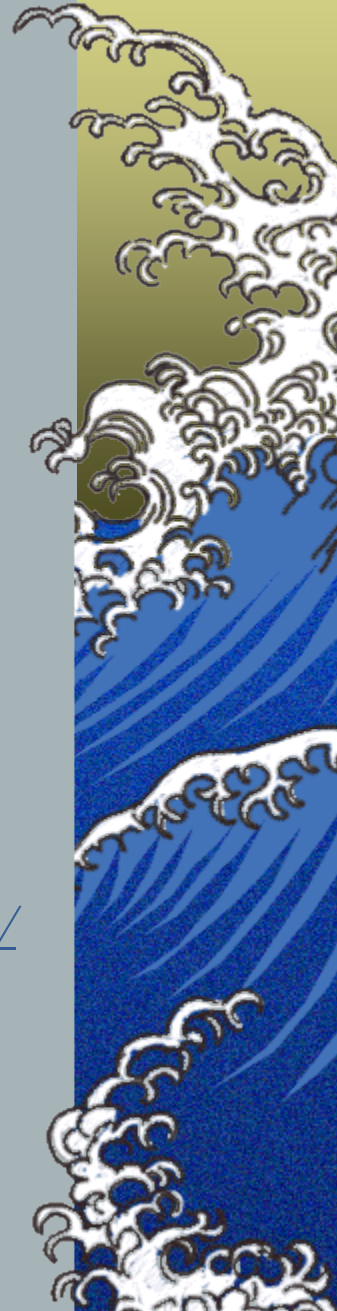
- ✓ Importance of timely communication and public health information/education
- ✓ Review safety & emergency preparedness plans for existing nuclear power plants
- ✓ Reevaluate Emergency Planning Zones
- ✓ Revisit Reentry & Recovery Policy
- ✓ Take steps to sustain professional radiological expertise in the public sector



# After Fukushima: Managing the Consequences\*

*“After Fukushima: Managing the  
Consequences of a Radiological Release,  
Final Report,” March 2012, Center for  
Biosecurity of UPMC, Baltimore, MD*

<http://www.upmcbiosecurity.org/website/resources/publications/2012/pdf/2012-03-07-after-fukishima.pdf>



# Radiation Readiness 101

- Radiation is used widely for a number of beneficial purposes. However, care must be taken to control radiation dose to As Low as Reasonably Achievable (ALARA)
- Medical radiation dose is prescribed or ordered by a physician
- Under any other circumstances, dose must be minimized to manage risk



# Be Prepared - Learn the Basics

- Time/Distance/Shielding
- Form – rays vs. particles (alpha, beta)
- Health Effects – short term vs. long term
- Exposure vs. Contamination

A few useful resources:

<http://www.bt.cdc.gov/radiation/>

<http://www.epa.gov/radiation/topics.html>



# Be Prepared – Learn the Basics

*Population Monitoring* -screening of people (and their pets) for contamination

*Radiological Triage* - screening of patients to prioritize for bioassay and countermeasures

*Countermeasures* - various protocols to reduce uptake, or speed up elimination of internal contamination



# Population Monitoring

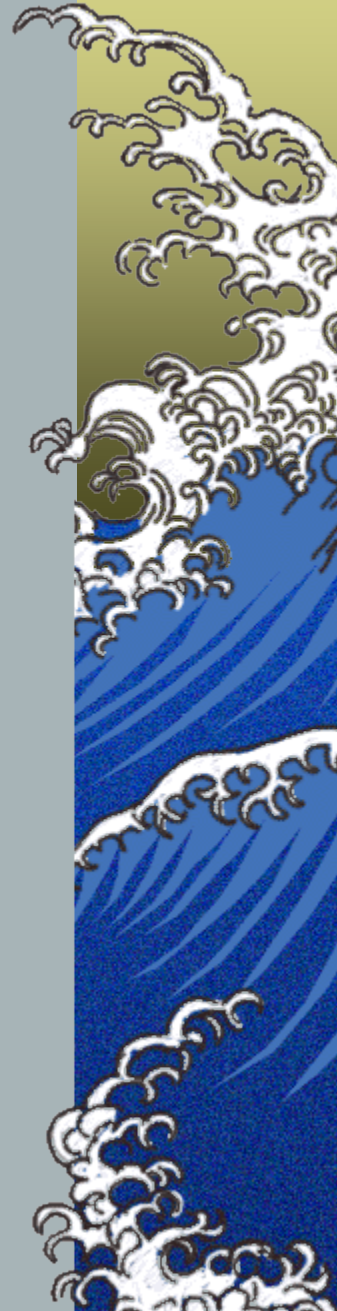
An essential element of an emergency response to any large scale radiation incident involving mass casualties:

- ✓ Identify, screen, measure and monitor (roster) populations for exposure to, or contamination from radioactive materials
- ✓ Provide for reception, registration and decontamination of people (and pets) in a large-scale radiation incident



# Radiological Triage

1. *Priority one: save lives!*
2. *Priority two: prevent acute radiation health effects by:*
  - ✓ Survey to detect contamination on body or clothing (radiation survey meter)
  - ✓ Survey to determine intake of radioactive material into the body (meter + bioassay)
  - ✓ Removal of external or internal contamination (decontamination)



# Countermeasures

## *Prophylactic*

- ✓ Prevent uptake to target organ or system

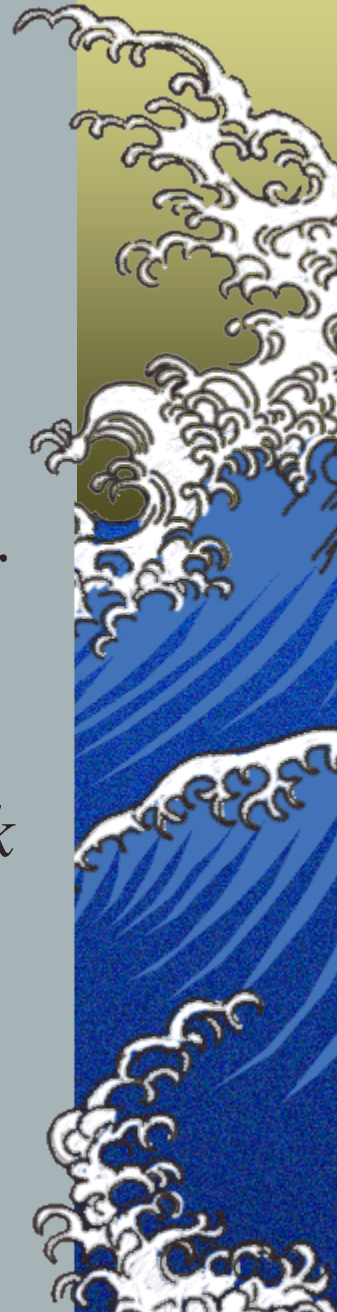
## *Treatment*

- ✓ Reduce internal contamination
- ✓ Reduce bioavailability of radio-nuclides
- ✓ Speed up elimination of radio-nuclides



# Psychodynamics of CBRNE Disasters

*Terrorism or other intentional acts utilizing chemical, biological, radiological, nuclear and/or explosive technology are referred to as “silent disasters,” with the added dimension of future orientation, such as delayed medical illnesses, risk of birth defects and other genetic impacts on the offspring of victims.*



# Response to Bomb-Type Attack

## Crisis Management:

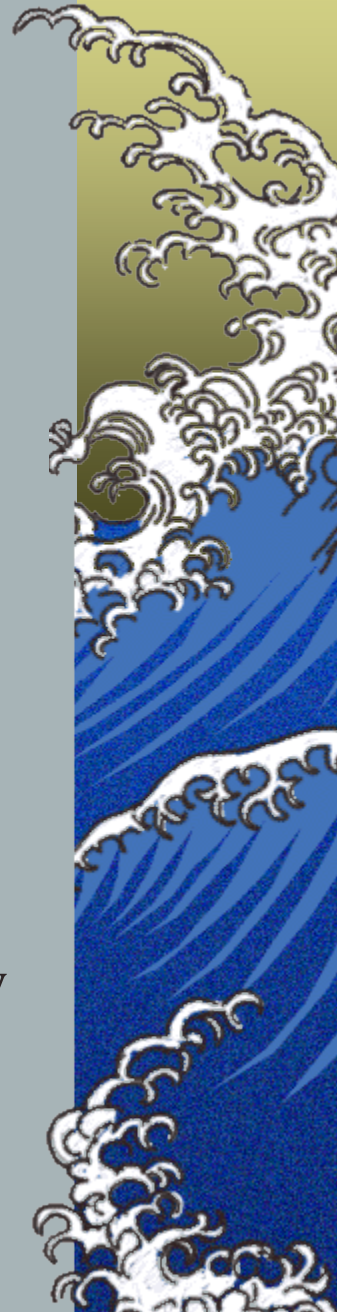
- ✓ First Responder is Incident Commander—  
Fire/Police/Hazmat Team
- ✓ FBI – Lead Federal Agency for criminal/terroristic  
acts – leads investigation/interdiction
- ✓ Mobilization of Federal Assets  
DOE, DOD, NRC OR CDC, as appropriate



# Response to Bomb-Type Attack

## Consequence Management:

- ✓ Federal assets shift from assessment of radiation dose, to recovery activities
- ✓ Delaware Emergency Management (DEMA) is the lead agency, administers governing plans
- ✓ Delaware Division of Public Health advises on radiation dose to the public and to response/recovery workers



# Radio-nuclides as a Tool of Terror:

*Are always ON & can be portable*

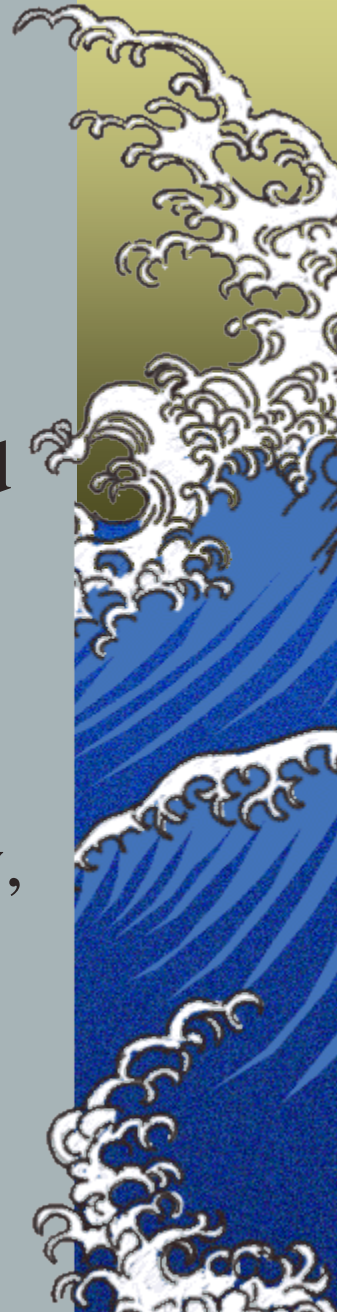
- Radio-nuclides with **higher energy**, more penetrating characteristics – can result in higher radiation dose to people
- Radio-nuclides with **longer half-lives** can increase impact on property & the environment



# Radiation Protection Units

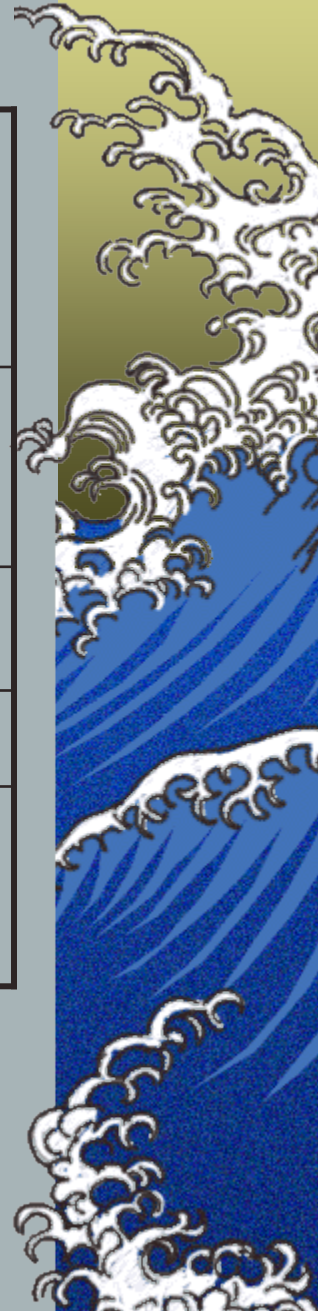
**Curie (Ci)** – unit describing quantity of radioactive material, in terms of radiation emitted in process of radioactive decay

**Half-Life** – unit describing length of time for a given radionuclide to lose half of its radioactivity, and is specific to each radionuclide



# A Few Key Radio-nuclides

Radionuclide	Half-Life	Typical Max. Quant.	Main Emissions
Cobalt-60	5.3 yr	13,000 Ci	Beta, Gamma
Cesium-137	30 yr	200 Ci	Gamma
Iridium-192	74 day	25 Ci	Beta
Americium- 241	432 yr	1 Ci	Alpha, Gamma



# Radiation Exposure

## ➤ External:

- Radiation source is **outside** the body
- Most risk from x or gamma rays
- ✓ (able to penetrate into body)

## ➤ Internal:

- Radiation source is **inside** the body
- Most risk from alpha and beta particles
- ✓ (deposit energy over short distance)



# Acute Radiation Syndrome

**People exposed to radiation will get Acute Radiation Syndrome ONLY if:**

1. Radiation dose is sufficiently high\* **AND**
2. Type of radiation is penetrating **AND**
3. Person's entire body or most of it, received dose, **AND**
4. Radiation was received in a short time, usually within minutes.

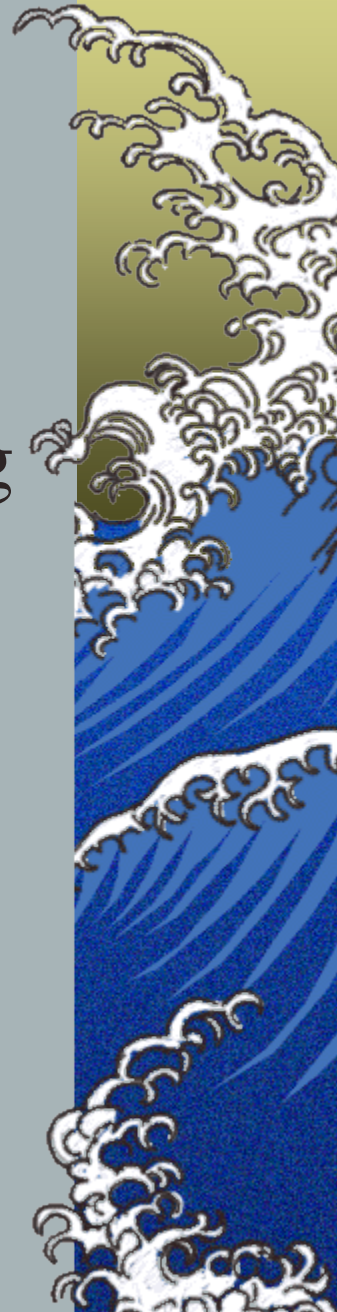
*\*Severity is a function of dose, has threshold\**



# Acute Radiation Syndrome

## Symptoms:

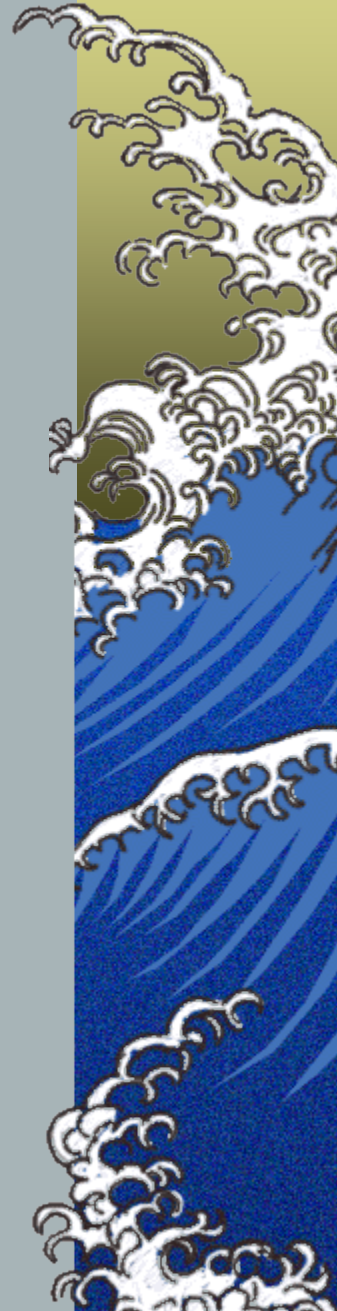
- ✓ Initial: skin reddening, nausea, vomiting and diarrhea (NVD)
- ✓ Hr-Day-Mo: NVD, fatigue, fever, seizures, coma, death
- ✓ Duration: seriously ill stage can last days-wks-mos



# Delayed Radiation Effects

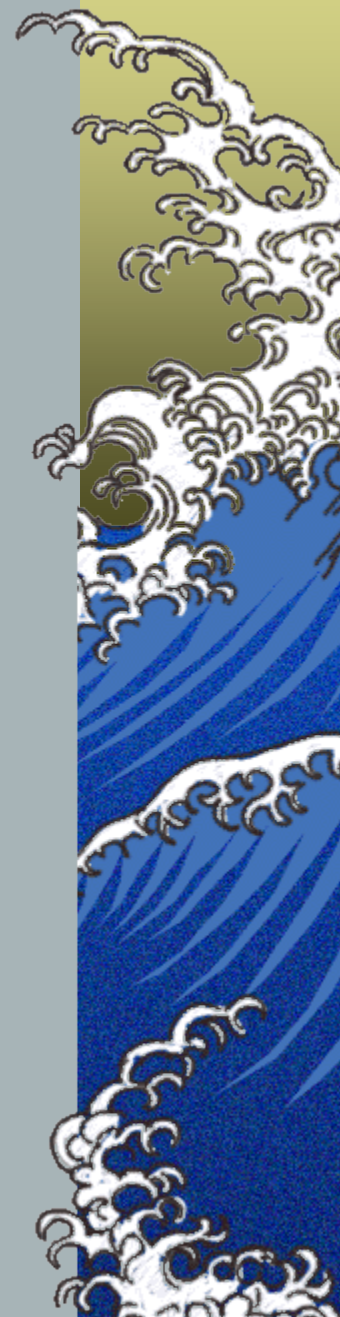
- ✓ Cancer, genetic changes
- ✓ Burns, cataract formation
- ✓ Growth & mental retardation (offspring)

*\*Risk is a function of dose, no threshold\**



# Recovery

- ✓ Establish “patient roster” for health surveillance (clinician, epidemiologist)
- ✓ Perform “dose reconstruction” to estimate magnitude of original radiation exposure levels at ground zero and extrapolate to determine dose estimates (health physics, radiation safety)



# Resources for Risk Communication

Communicating Radiation Risks:  
*Crisis Communications for Emergency  
Responders, Office of Radiation and Indoor  
Air, EPA-402-F-07-008, July 2007*

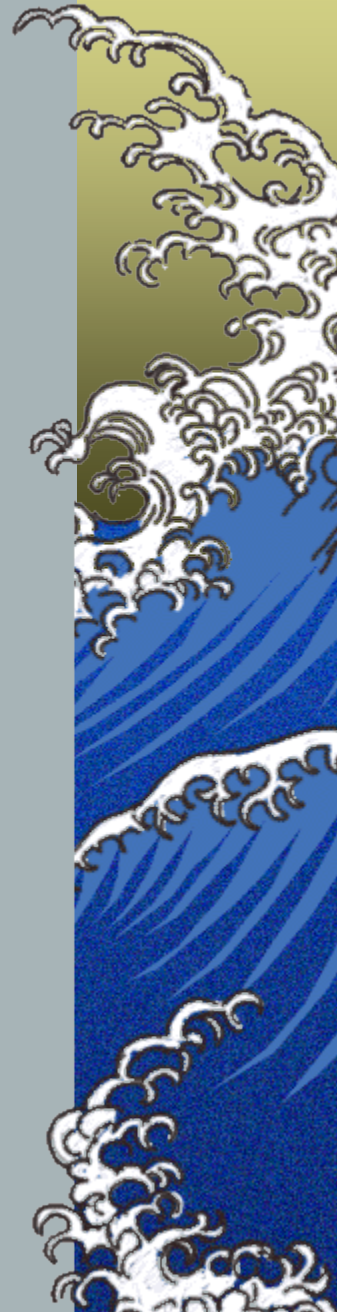
[www.epa.gov](http://www.epa.gov)



# Resources for First Receivers and Responders

*National Alliance for Radiation Readiness  
(NARR) Website:*

<http://www.radiationready.org>



# Resources for Clinicians

- ✓ Radiological Emergency Medical Management, [www.remm.org](http://www.remm.org)
- ✓ Radiological Terrorism Toolkit for Public Health Officials, [www.cdc.gov](http://www.cdc.gov)
- ✓ Radiological Terrorism Toolkit for Emergency Services Clinicians, [www.cdc.gov](http://www.cdc.gov)



# Questions ?

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