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National Nuclear Security Administration

Population Monitoring and Decontamination

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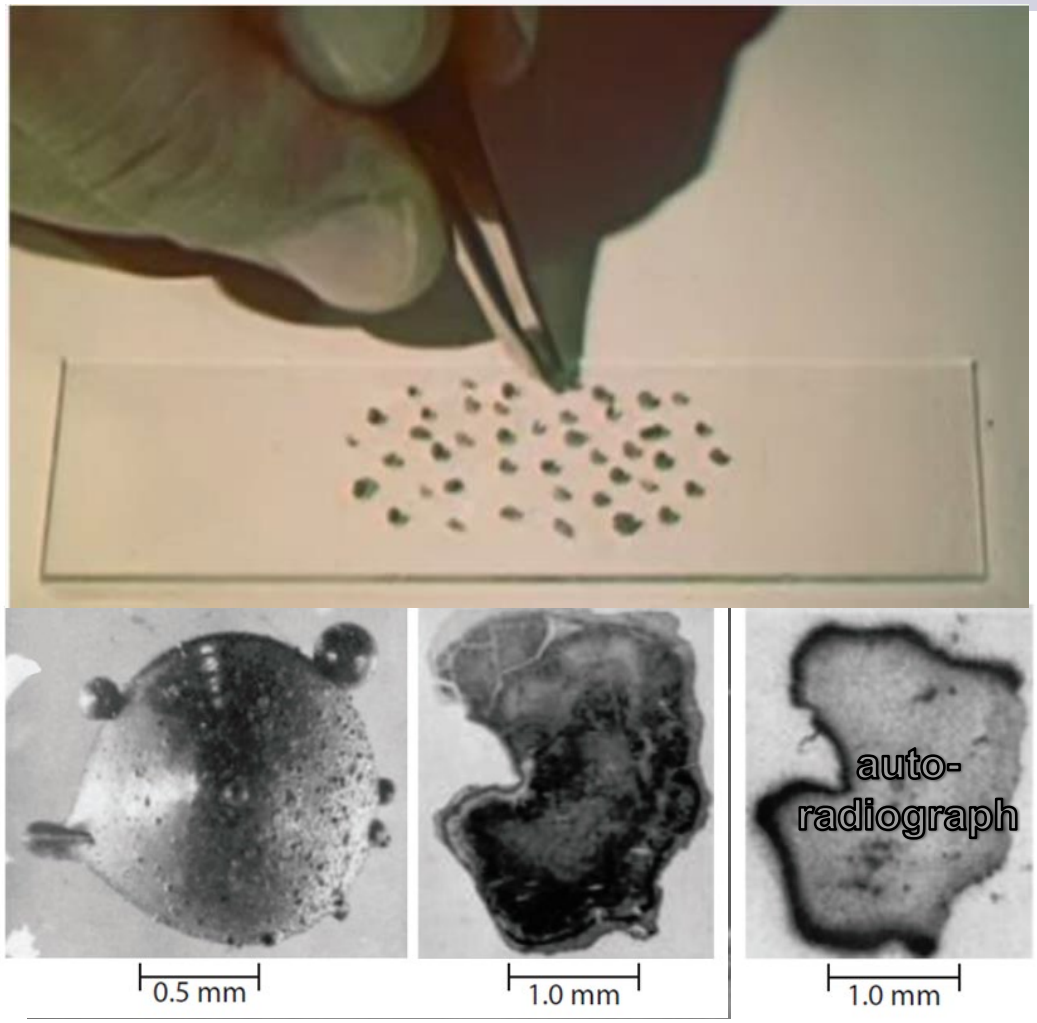
This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract DE-AC52-07NA27344. Lawrence Livermore National Security, LLC

Fallout Summary



The radioactive parts of the fallout show as dark areas on the right image.

- A fireball hotter than the sun contains all the fission products produced in the explosion.
- The fireball can interact with the ground.
- The rapid rise of the fireball (> 100s kph) creates a vacuum that pulls up thousands of tons of dirt and debris.
- If the dirt mixes into the fireball, fission products can condense onto the dirt
- As they cool, the larger particles “fall out” of the cloud.
- These images show examples of fallout particles, the right image shows how fission products coat the outside.

Pop Quiz!

What leads to a larger fallout dose, internal or external exposures?

- Inhalation difficult due to particle size

- But what if you ate a plate of food that had been outside when fallout was accumulating?

Final Results of Internal Dose Analysis and Comparison using HPAC and FIIDOS

Inhalation

Dose Type	1000 R/hr	100 R/hr	10 R/hr
External (R) (to H+48)	1900	480	100
Descending Internal CEDE (rem)*	0.14	0.15	0.09
Resuspended Internal CEDE to H+48 (rem)*	1.1	0.39	0.12
Ingested Internal CEDE (rem)	46	13	3

* Worst case fission type assumed

Answer:

- External!

Decontamination Issues

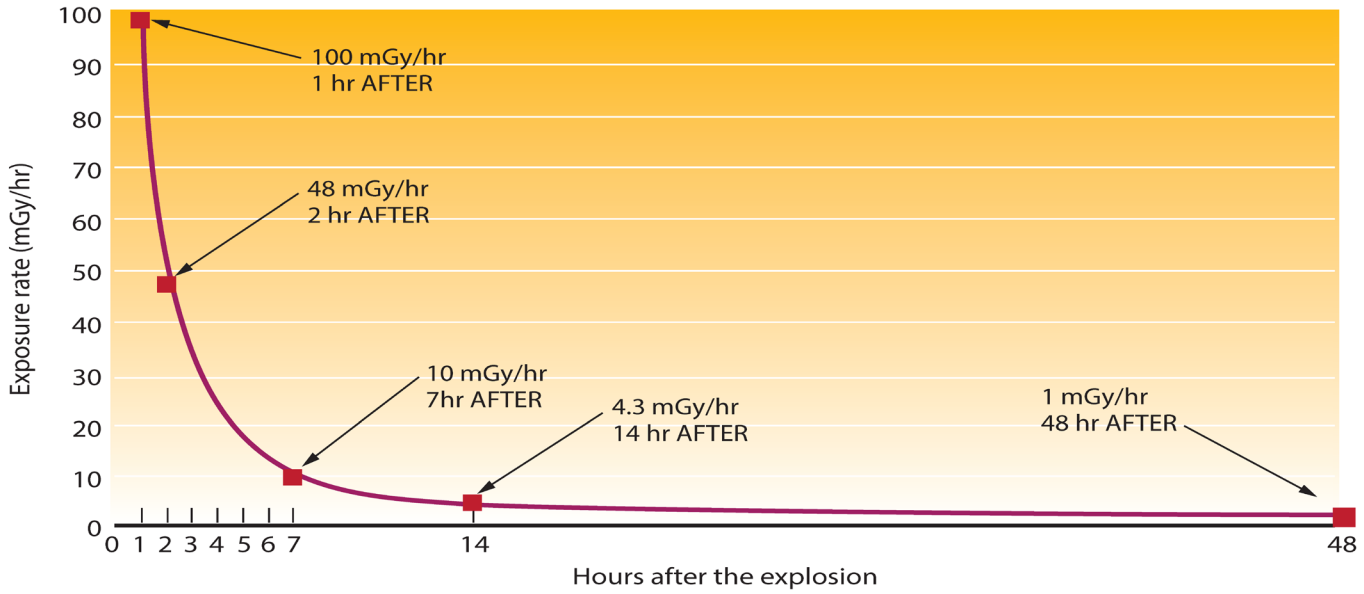
Fallout Decon

Entering Shelter

Actual Fallout Decon

- Simple self-decontamination techniques (such as removing outer clothing, showering, and brushing away fallout material) are effective.
- Techniques should be used as the impacted population leaves the high-hazard zone or enters a shelter

Decontamination Priorities for the First Day



- **Early**, even if crude, decontamination reduces your exposure better than a delayed, if more thorough, decontamination.
- Provide public messaging that instructs people to perform **self-decontamination**

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Contamination Considerations

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If you are outside when fallout is accumulating, do not remove your clothing. Cover your head and as much as your body as possible. Cover your nose and mouth and regularly brush, shake, or wipe the fallout particles off. Seek shelter.

If fallout is no longer accumulating, remove your outer layer of clothing (coat or improvised covering) and place it away from people.

If you do not have
mouth and brush
isolated area. Se

If the weather is s
nose and mouth a
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When you enter a shelter that has alternate clothing, act as if you are covered with mud and minimize tracking the material inside. Change clothes and footwear and place the contaminated clothing in a bag away from others.

As soon as possible, shower with soap. If no shower is available, use water to wash your hair, face and exposed parts of the body that were not covered by clothing. Wipes can be used if no water is available.

Responder Screening Priorities

The First Day:

- Radiation monitoring equipment and personnel should be prioritized for
  - responder safety,
  - hazard mapping, and
  - Rescue and MDZ evacuation support activities.
- Population contamination monitoring is a secondary priority.
- Population decontamination should focus on self-decontamination as they leave the area.
- If population contamination screening is used it should focus on rapid assessment of life safety contamination concerns.

After the First Day:

- ***As more resources become available*** and deliberate evacuations from fallout areas are initiated;
  - monitoring and decontamination sites can be established, preferably close to the outer boundary of the Hot Zone.
  - Consider locations with replacement clothing and shoes.
- More detailed screening can be conducted at reception centers to help reduce any residual contamination.

The First Day:

Contamination Screening should focus on immediate hazard levels

If trying to identify significantly contaminated individuals who may be a decontamination priority, use the IAEA group screening method of 0.1 mSv/h (10 mR/hr) at 1 m.

After more resources arrive:

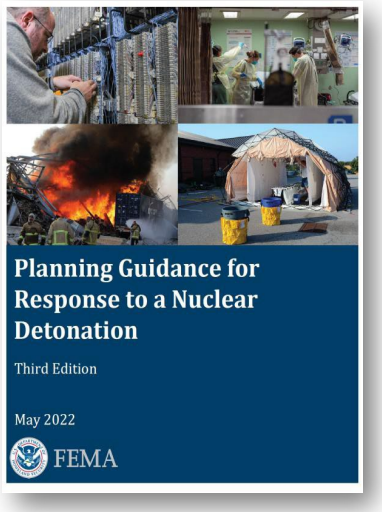
Common Misperceptions of Decontamination

- Anticipate misperceptions about decontamination, these include:
  - Reluctance to helping others due to irrational fear of exposure or contamination
  - Thinking that radiation exposure and contamination is like a contagious disease
  - Internal contamination concerns from eating or breathing fallout is not a significant hazard compared to external exposure
  - Simple brushing & wiping may suffice. Avoid emphasizing wet-decontamination until resources are available
- Medical treatment should never be delayed due to contamination concerns. Contamination should be considered the lowest medical priority.
- Shelter should never be denied due to contamination concerns.

Chapter 5: Population Monitoring

- Population monitoring in the planning guidance includes both:
  - Monitoring with radiation detection equipment for external contamination
  - Identifying those that many need long term health surveillance monitoring

Chapter 5



Population (Public Health) Monitoring

- A more structured population monitoring should begin within days after a nuclear detonation
- The primary purpose of population monitoring, following a nuclear detonation, is screening to assess for radiation exposure
  - Primarily through interviews and an understanding of impacted areas identified by responders and models when available
  - Contamination monitoring when resources are available
- Public health monitoring will help determine if further medical care is needed
- Establishing a registry to help monitor for potential long-term health effects and follow up activities

https://www.cdc.gov/nceh/radiation/emergencies/pdf/population-monitoring-guide.pdf
Planning Guidance for Response to a Nuclear Detonation (May 2022) (fema.gov)

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Community Reception Centers

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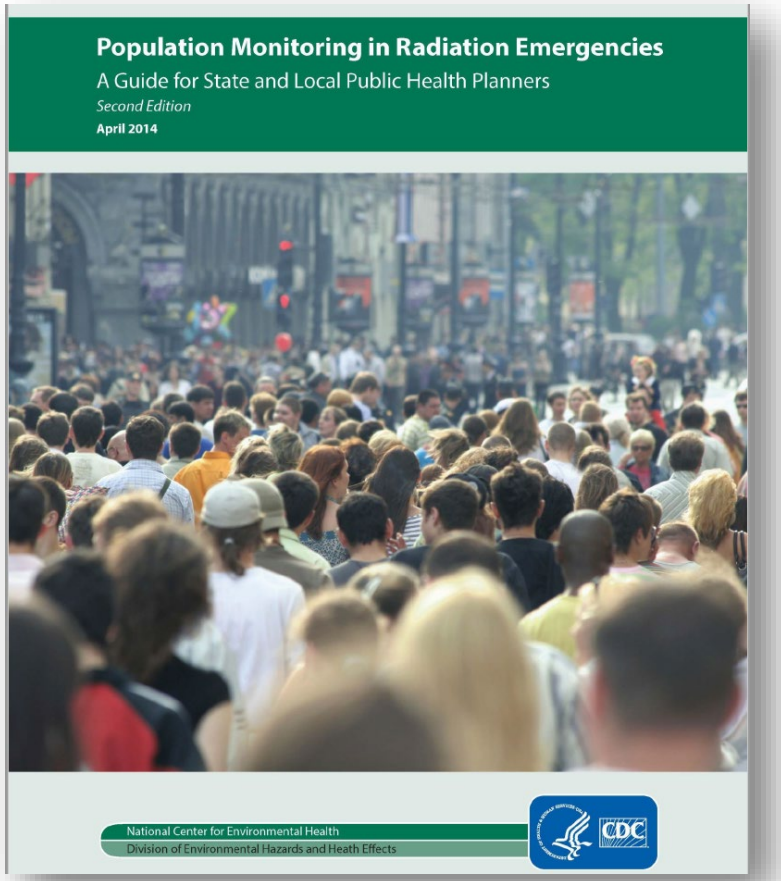

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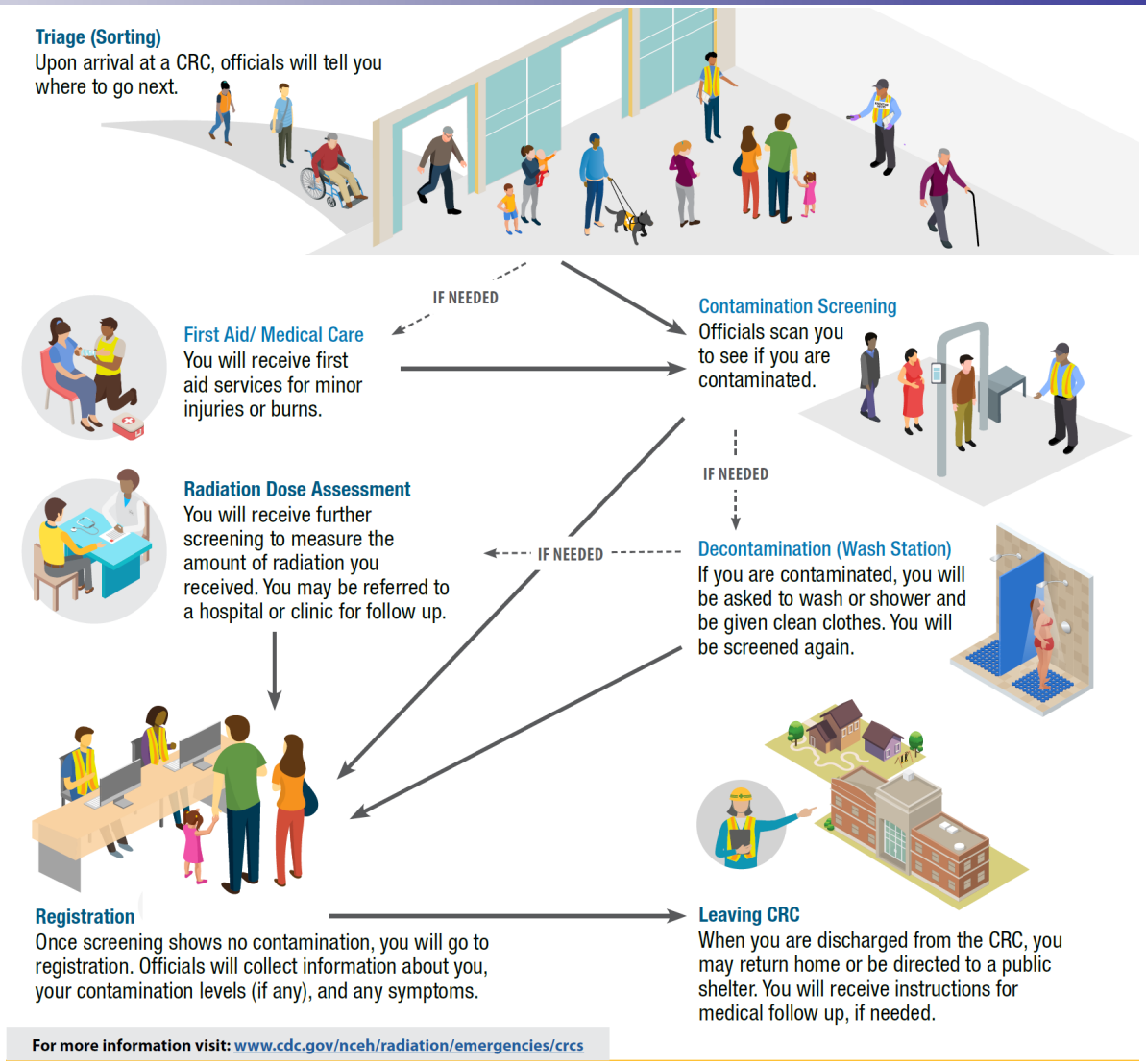

https://www.cdc.gov/nceh/radiation/emergencies/crcs.htm

Radiation Fears Will Lead to Psychological Trauma

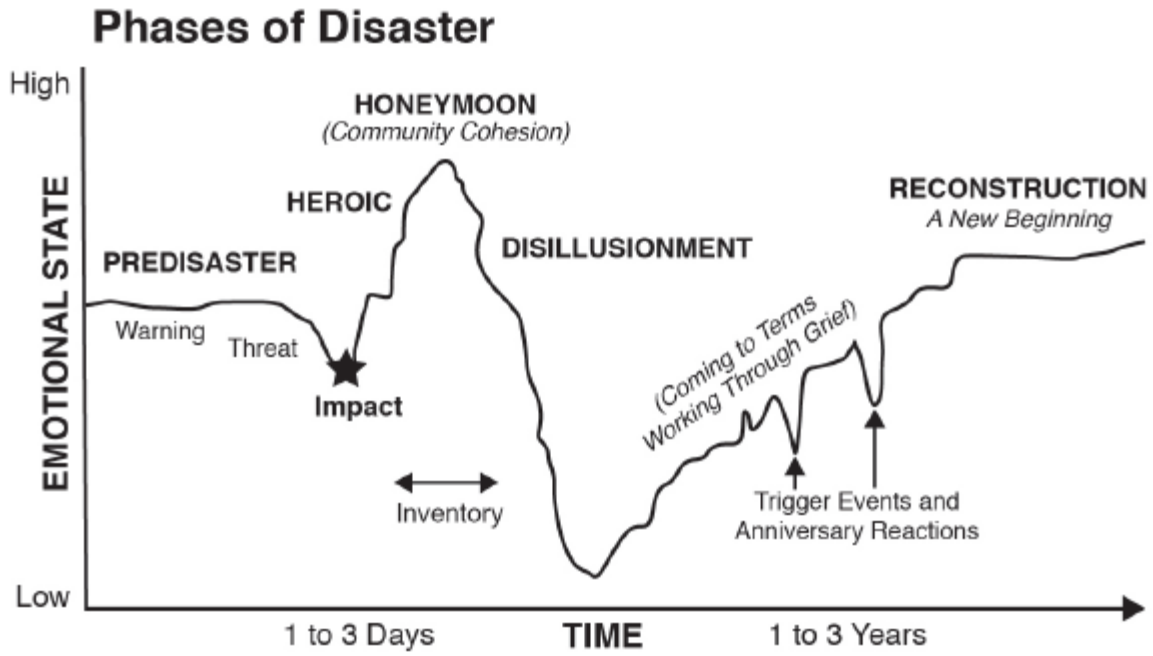

FIGURE 2.1 Psychological reactions to disaster with time.
NOTES: Reactions of members of the public to a disaster including a nuclear or radiological incident vary according to the phase of the disaster and with time during recovery. Dr. Robert Ursano (Uniformed Services University F. Edward Hébert School of Medicine) used the plot to demonstrate that public reactions and acceptance of a radiation registry will likely depend on when it is introduced and how it is communicated by the planners.
SOURCES: Adapted from Zunin and Myers as cited in DeWolfe, 2000.

Long-Term Health Monitoring of Populations Following a Nuclear or Radiological Incident in the United States: Proceedings of a Workshop (2019)

Psychological First Aid

- **Psychological first aid is…**
  - comforting someone in distress and helping them feel safe and calm
  - assessing needs and concerns
  - protecting people from further harm
  - providing emotional support
  - helping to address immediate basic needs, such as food and water, a blanket or a temporary place to stay
  - helping people access information, services and social supports

Psychological first aid - Global First Aid platform (globalfirstaidcentre.org)

New WHO online training course on Mental Health and Psychosocial Support in Emergencies

https://openwho.org/courses/mental-health-and-psychosocial-support-in-emergencies/

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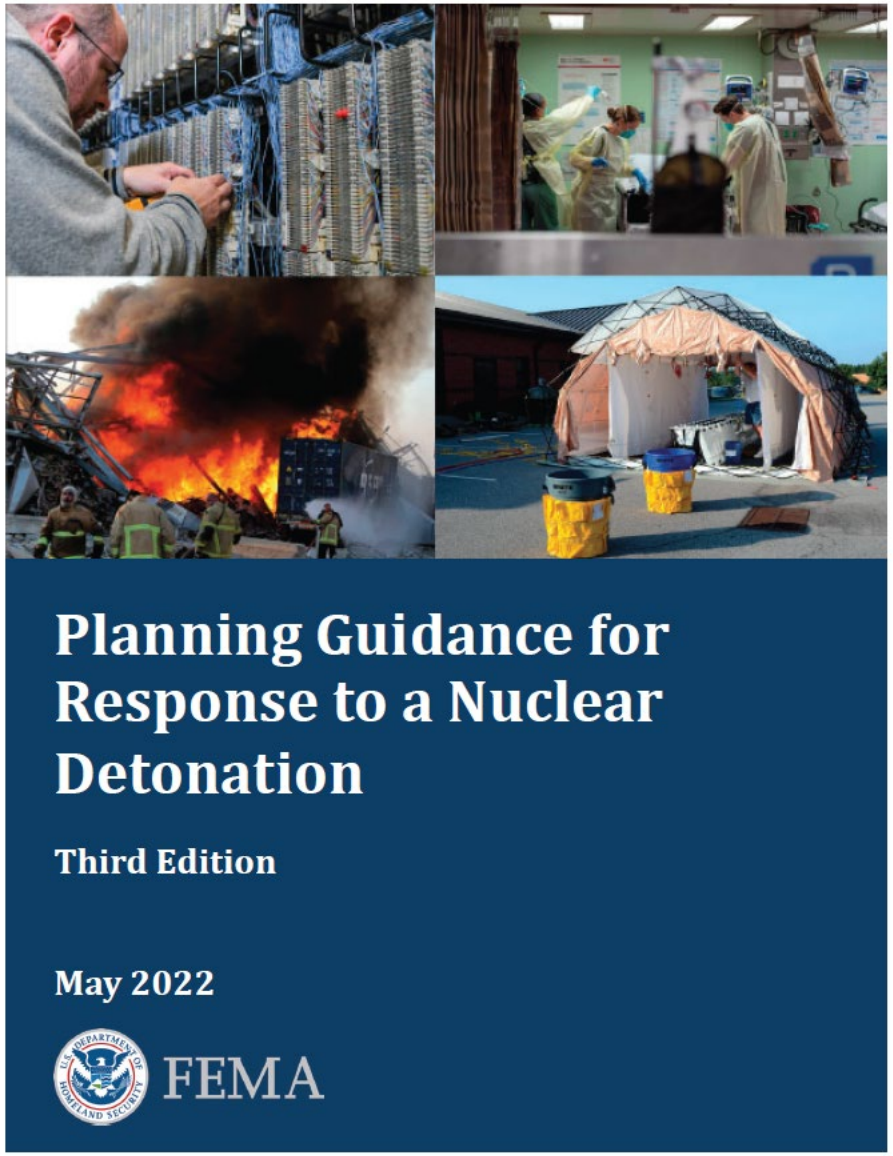
Planning Guidance for Response to a Nuclear Detonation



- The 2022 Planning Guidance
- Provides a description of the Key Zones
- Identifies appropriate zone priorities and protective measures
- Demonstrates that a little bit of knowledge could *prevent* 100,000s of casualties
- This includes actions taken *after* the detonation occurs

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Thank you

Decontamination options

- Dry versus wet (water).
- Potable drinking water could be rationed.

The availability of running water will impact decontamination procedures.

If running water is available:

- People should decontaminate by carefully removing their outer layer of clothing and showering or washing exposed skin at a sink. Individuals who are unable to perform these tasks by themselves will require personal assistance.

If running water is NOT available:

- People should carefully remove their outer layer of clothing and decontaminate exposed skin with moist wipes or damp towels, or use other dry decontamination techniques. Individuals who are unable to perform these tasks by themselves will require personal assistance.
- Dry decontamination techniques may also include using tape or lint rollers to remove visible dust from clothing or skin.

The following pages provide two examples of decontamination operation flow diagrams for a shelter. Figure 8 shows what decontamination operations might look like at a shelter with radiation detection equipment. Figure 9 illustrates what decontamination operations might look like at a shelter without radiation detection equipment.

Long-Term Registry of Patients and Communicating Risk

Key Considerations for Registration and Public Health Follow-up

- Recording relevant information about shelter residents in a public health registry will help public health officials provide follow-up services and conduct epidemiological investigations.
- Ideally, shelter registration will be conducted using an electronic database that interfaces with CRC databases and existing tracking systems.
- Using existing systems, such as electronic databases that can be used for mass dispensing operations or large-scale evacuations, can help CRCs, hospitals, and shelters maintain consistent, accessible records for displaced people.
- If a suitable electronic database is not available, shelter operators need to keep written records to capture important information when people check into the shelter and when they check out.
- If contamination screening is offered at the shelter, a contamination assessment form should be completed by screening staff and included with each person's shelter registration.
- When a person leaves a shelter, documenting the intended destination and collecting accurate contact information can facilitate long-term follow-up and disaster assistance efforts.
- Registration and tracking processes will need to be put in place to keep track of personal possessions, animals, and vehicles.

Basic	• Staff know where to direct technical questions and media inquiries. • Resources are available for shelter residents who request additional information on radiation risks.
Intermediate	In addition to the capabilities above: • Staff are trained in basic psychological first aid. • Behavioral health specialists are available for counseling. • Healthcare staff are trained to discuss radiation risk.
Advanced	In addition to the capabilities above: • Radiation experts (e.g., health physicist, radiation technologist, medical physicist) trained in risk communication and psychological first aid are available to answer questions or offer daily briefings.

https://www.cdc.gov/nceh/radiation/emergencies/pdf/operating-public-shelters.pdf