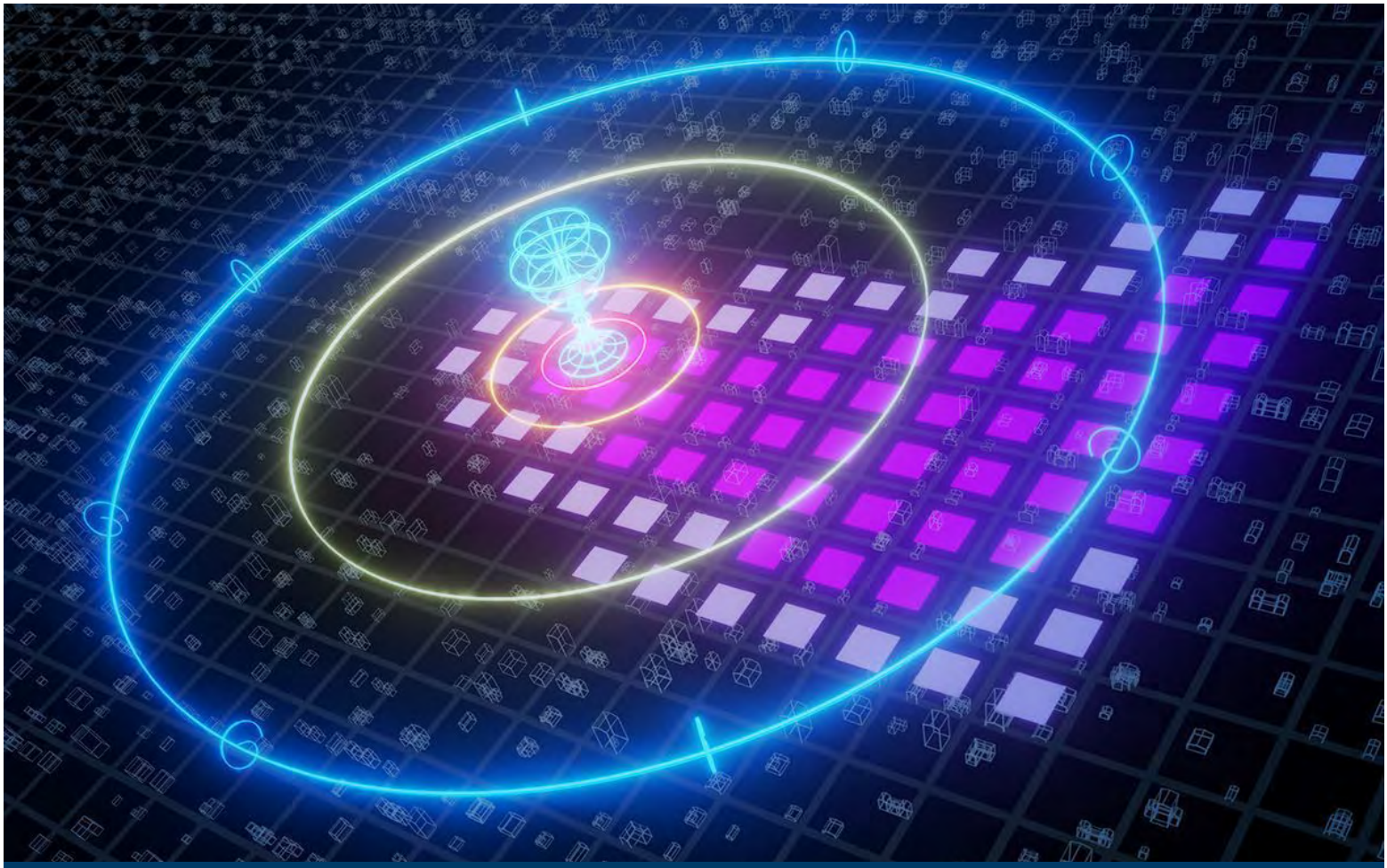

Nuclear Detonation Response Guidance

Planning for the First 72 Hours

March 2023

FEMA

Record of Change

Date	*Action Type (Review or Revision)*	*Printed Name*	*Signature*
06/12/2023	This document has been updated as of 06/12/2023 to reflect the reorganization of the Chemical, Biological, Radiological and Nuclear (CBRN) Office to the Office of Emerging Threats (OET). No other changes to the document content have occurred.		

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Introduction

Purpose

This Nuclear Detonation Response Guidance: Planning for the First 72 Hours (herein, "the 72-Hour Nuclear Response Guidance") delineates Missions and Tactics that should be executed by first responders, emergency managers, and other state, local, tribal, and territorial (SLTT) response organizations during the first minutes, hours, and days following a nuclear detonation in or near their jurisdiction. The document includes guidance on how to protect the lives of first responders and the public, develop a common operating picture, establish a coordinated multi-jurisdictional response, and prepare for the integration of support arriving from other jurisdictions, states, and federal agencies across the country. This guidance is intended to be implemented by the jurisdiction(s) where a detonation occurs, as well as those surrounding jurisdictions that are less affected and will mobilize to provide support.

How to Use this Guidance

The 72-Hour Nuclear Response Guidance should be used by SLTT planners before an incident to develop operational, prioritized nuclear detonation response plans and procedures for their jurisdiction that are flexible and include some tactical depth. To facilitate this task, the guidance provides planners with five strategic "Missions" consisting of ten operational "Tactics." In some places the guidance includes information specific enough to be incorporated directly into SLTT emergency response plans with minimal adjustments (e.g., public warning message templates in Tactic 1).

This guidance also contains checklists that could be used during an incident or exercise and are stylized for quick reference (e.g., most acronyms are spelled out, lifesaving priorities are succinctly summarized). These checklists are found in two places: at the top of each Tactic, which highlights key activities in that section and in Annex 2's Zone-Based Response Cards, which describes the actions first responders should initiate immediately after a nuclear detonation according to the hazards and impacts in their area. Although these are designed as just-in-time reference material, it is always best practice for any emergency planning guidance to be reviewed, adapted, and implemented according to a jurisdiction's particular needs before an incident occurs.

This guidance outlines immediate and early phase actions and priorities. It does not cover or include a glossary of fundamental concepts and terminology related to nuclear detonation scenarios, effects, impacts, or longer-term response. Prior to initiating a nuclear detonation response planning process, planners should review and become familiar with the Federal Emergency Management Agency's (FEMA) Planning Guidance for Response to a Nuclear Detonation (2022), which includes information on these fundamental concepts, including the "zone-based response" approach which is heavily featured in this document. These two documents – the Planning Guidance and 72-Hour Nuclear Response Guidance – are meant to be used together to help planners prepare for the initial and early response to a nuclear detonation.

Why Plan for the First 72 Hours?

If a nuclear detonation happened today, first responders and SLTT organizations would immediately respond to save lives. However, even with the best of plans, response assets and resources would be overwhelmed due to the scale and complexity of the incident. To maximize the efficiency and effectiveness of their emergency response, planners may need to adjust their approach towards preparing for this level of catastrophe, thereby drastically increasing lives saved, mitigating substantial human suffering, and speeding recovery.

This guidance uses the first 72 hours timeframe as a notional target to help planners focus their efforts on developing actionable strategies that would have the greatest impact on lifesaving efforts, which should be the primary focus during the first few days after a nuclear detonation. A jurisdiction's plans and protocols will need to account for several unique circumstances during this time that will define the response. During the first 72 hours, there would be:

- Maximum lifesaving opportunity: Many lives can be saved through appropriate public and responder actions during the first hours and days after the detonation. Radiation exposure from any fallout that is produced would be most dangerous in the initial hours after a nuclear detonation. The public and responders who are in areas with substantial fallout would need to take shelter in a building or underground structure while the radioactive material decays (reduces) to safer levels. Additionally, people with serious injuries from the immediate effects of a nuclear blast would benefit most from lifesaving treatment during this time.

- Minimal federal presence: The bulk of federal resources would be en route, with many arriving around and after 72 hours. SLTT jurisdictions in or near ground zero would have to respond immediately with the resources available to them, saving lives while awaiting additional support.

- Decentralized local response: The large, affected area and disruptive nature of the incident would disable some components of the impacted jurisdiction's emergency response system and break typical lines of communication. It would be critical for response elements to initially act autonomously and for jurisdictions to quickly re-establish a coordinated response network. This challenge would be most significant during the first 72 hours of the response.

Planning Tip

If operational nuclear detonation response plans are to endure first contact with an incident of this magnitude, they should adhere to the "SMART" principles by outlining response activities that are specific, measurable, achievable, realistic, and time bound.

Alignment to Incident Operational Phases

The Department of Homeland Security's Response and Recovery Federal Interagency Operational Plans (FIOP) divides incident operations into Phase 1 (Pre-incident), Phase 2 (Response), and Phase 3 (Recovery), as shown in Table 1.[1]

The actions described in this 72-Hour Nuclear Response Guidance align with Phases 1c ("Near Certainty or Credible Threat"), 2a ("Activation, Situational Assessment, and Movement"), and the transition into 2b ("Employment of Resources and Stabilization"). This guidance does not describe preventative and interdiction missions, so 1c activities are limited to emergency warning, as described in "Tactic 1: Immediately Issue Alert to Get Inside."

Table 1. Incident Operational Phases

1			2			3
Primarily Pre-Incident			**Begins when an Incident Occurs or Upon Notification**			**Sustained Operations**
1a	**1b**	**1c**	**2a**	**2b**	**2c**	**3a**
Normal Operations	Increased Likelihood or Elevated Threat	Near Certainty or Credible Threat	Activation, Situational Assessment, and Movement	Employment of Resources and Stabilization	Intermediate Operations	Long-Term Recovery Operations
		72-Hour Nuclear Response Guidance				

Key Terms and Concepts in this Guidance

Preparedness for catastrophic incidents such as a nuclear detonation requires significant flexibility on the part of the emergency planning and response community. In the post-detonation environment, responders would become overloaded with a sudden surge of incident information yet will have to rapidly make decisions amid conditions of great uncertainty. When planning for such a catastrophic incident, this ambiguity should be accepted and integrated into plans rather than fought against.

If possible, nuclear detonation response plans should be scenario-agnostic, and not limited by assumptions about yield, height of burst, target, or even the jurisdiction's location in relation to the blast. The last part is important because, although many lives can and will be saved by the jurisdiction located where the detonation occurs, that jurisdiction will require substantial, immediate, coordinated support from regional partners. Jurisdictions should develop their plans so they could

[1] (US Department of Homeland Security, August 2016)

fulfill either role during the initial response: the impacted jurisdiction or one of those immediately surrounding it.

To illustrate this point, try a short visualization exercise. Consider a nuclear detonation in a United States city that causes an explosion that destroys an area covering several square blocks, with lesser but still significant destruction spanning farther out for miles. Consider the cascading impacts and the work that needs to be done immediately and over the next few days to save lives around that detonation.

Keep that image in focus, but slowly zoom out until the detonation is in the context of the surrounding states and region. While the damage near the detonation is extensive, there are numerous counties, cities, and possibly states nearby that are not in the most impacted area and are able to help mount a response for the survivors and receive evacuating populations. Now zoom out even farther; the image continues to show communities across the region, multiple states, and the nation with response assets or supplies that are urgently needed.

This brief exercise highlights a critical point that is the foundation of this guidance: there would be an expanding response to a nuclear detonation to save and support the lives of those impacted. Even during the first few hours and days, the "first response" would not only be executed by the jurisdiction where the detonation occurred, but also by the jurisdictions in the surrounding areas. Then, after a few days, resources would arrive from around the entire nation to support response and recovery.

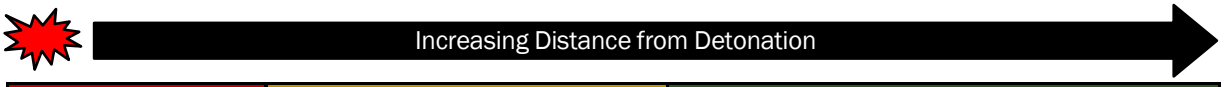
This guidance uses three terms, defined below, to refer to the role of jurisdictions in, near, and far from the detonation: The Impacted Jurisdiction, the Supporting Jurisdiction(s), and Nationwide Support (see Figure 1). Since this guidance focuses on the first 72 hours, it describes the actions of only the Impacted and Supporting Jurisdictions, that would be able to immediately execute lifesaving operations while federal agencies and SLTT jurisdictions across the country would be mobilizing to provide Nationwide Support.

As described below, the defining distinction between the Impacted and Supporting Jurisdictions is the status of their respective response infrastructure. The Impacted Jurisdiction would likely need to reconstitute their response capability while saving lives. In contrast, the Supporting Jurisdiction's response system would be generally intact, even if overwhelmed.

- Impacted Jurisdiction: This term describes the jurisdiction(s) or area(s) where the nuclear detonation occurred and encompasses the areas of significant damage and fallout radiation. In this area, response will be urgently needed to support lifesaving, shelter-in-place, and evacuation activities. However, the Impacted Jurisdiction's emergency response infrastructure may be significantly disrupted by the detonation, requiring reconstitution simultaneous to lifesaving activities. These jurisdictions should also prepare to receive outside response assets that will deploy and assist with executing operations to support lifesaving activities. During the first 72 hours, these resources will primarily arrive from the Supporting Jurisdiction(s).

- Supporting Jurisdiction(s): This term describes the regional jurisdictions, states, and areas mostly or fully outside of the blast damage and dangerous radiation zones that have largely intact and/or quickly recoverable communications, utilities, and infrastructure such that they can provide assistance to the Impacted Jurisdiction and receive evacuees over time. While these jurisdictions may still experience some effects and impacts from the detonation, a critical distinction from the Impacted Jurisdiction is that a Supporting Jurisdiction's emergency response infrastructure is fully operational.

- Nationwide Support: This term refers to the massive support that will mobilize from states outside the region and the federal government. Although the bulk of these resources will not arrive in the first 72 hours, some remote federal assistance (such as modeling, public alert and warning systems, and public messaging) will be available immediately. Impacted and Supporting Jurisdictions must be prepared to receive and integrate the resources of the national response. From the federal government, this includes specialized nuclear/radiological capabilities described in the Nuclear/Radiological Incident Annex to the Response and Recovery Federal Interagency Operational Plans (2016) in addition to general catastrophic response capabilities.



Impacted Jurisdiction	Supporting Jurisdiction(s)	Nationwide Support
• Where the detonation occurred • Responds to save lives • Reconstitutes response	• Regional SLTT jurisdiction(s) • Responds to save lives • Sends resources • Receives evacuees	• Federal government and states outside the region • Mobilizes to support • Provides remote assistance (federal)
Response assets arrive within 0 - 72 hours		Response assets arrive after 72 hours

Figure 1. Impacted Jurisdiction, Supporting Jurisdiction(s), and Nationwide Support.

How to Begin Planning

Nuclear response planning is daunting. Based on the expected catastrophic impacts from a nuclear detonation, it is unlikely that a given jurisdiction will be able to execute the operations in its all-hazards plan as it has planned and trained on for other incident types, and after the detonation there will be many competing priorities. For this reason, this guidance is intended to provide planners with an achievable starting point by narrowing down the scope to just the most critical actions that a jurisdiction must execute to mount an effective response and save the most lives. It also focuses on actions that most jurisdictions – especially ones with a radiation emergency response capability – should be able to accomplish using the resources they currently possess.

Although it is ideal for jurisdictions to plan to respond as either an Impacted or Supporting Jurisdiction, planners from small or rural jurisdictions may find that not all the actions described in this guidance are applicable to them. In this circumstance, planners should go through the document to identify the guidance that best applies. For example, a rural jurisdiction might reasonably assume that they would fill a Supporting Jurisdiction role through amplifying public messaging, sending specialized resources, preparing to receive evacuees and injured people, and integrating with the state government's response.

When launching a nuclear response planning initiative, planners may find it helpful to host a workshop or brainstorming session during which planners pose the following questions:

- With the resources and training available today, what would our organization's actions be for the first 72 hours if a nuclear detonation occurred in our jurisdiction?
- With the resources and training available today, what would our organization's actions be for the first 72 hours if a nuclear detonation occurs in a neighboring jurisdiction?
- How would our organization rapidly establish a connected and coordinated multi-jurisdictional response with cities, counties, and states in our region?
- What planning assumptions would impact the availability and effectiveness of responding resources (e.g., social unrest, availability of responders, threats of follow-on attack, other environmental hazards, infrastructure outages)?

Planners should also make sure that there is someone knowledgeable about nuclear detonation effects, impacts, and response concepts present in the room for any of these sessions. This can be anyone from an experienced subject matter expert to an all-hazards planner who has taken the time to make an in-depth review of FEMA's Planning Guidance for Response to a Nuclear Detonation and similar resources. Planning organizations that don't have someone with this knowledge in-house, or would like additional support, can request assistance from:

- State agencies, which have core capabilities in emergency response and radiological protection. They also may have a state plan to plug into or learn from or may know of another local jurisdiction that has conducted similar planning.
- FEMA Regional Offices have a Regional Emerging Threat (ET) Coordinator.
- Federal subject matter experts, particularly those at the Department of Energy, Department of Health and Human Services, and/or Environmental Protection Agency.
- Regional partners, as emphasized in this guidance will be key to coordinating and executing a number of these Missions and Tactics. Like state agencies, they may also have existing plans to plug into or learn from.
- Non-government organizations, such as academic institutions and associations with expertise in radiological emergency response.
- Radiological Operations Support Specialist (ROSS), A ROSS is a state and local radiological subject matter expert who can support local planning and response efforts. Planners should reach out to their FEMA liaison for more information.

Missions and Tactics Overview

Guidance Structure

The 72-Hour Nuclear Response Guidance is organized into five Missions and ten Tactics. Each Mission focuses on a high priority objective during the first 72 hours of the response. The Tactics and accompanying annexes provide specific information to achieve the overall Mission and response objectives.

Below is a summary of the Missions and their corresponding Tactics (Figure 2). Although the Tactics are listed numerically, they are not sequential: emergency planners should consider each of these Missions and Tactics to be essential to mounting an effective lifesaving response and should be initiated as soon as possible. Although, it is also likely that some actions, while ideally beginning within the first few hours after the detonation, may take longer to initiate depending on the impacts to the responding jurisdictions (e.g., establishing area command in Tactic 5).

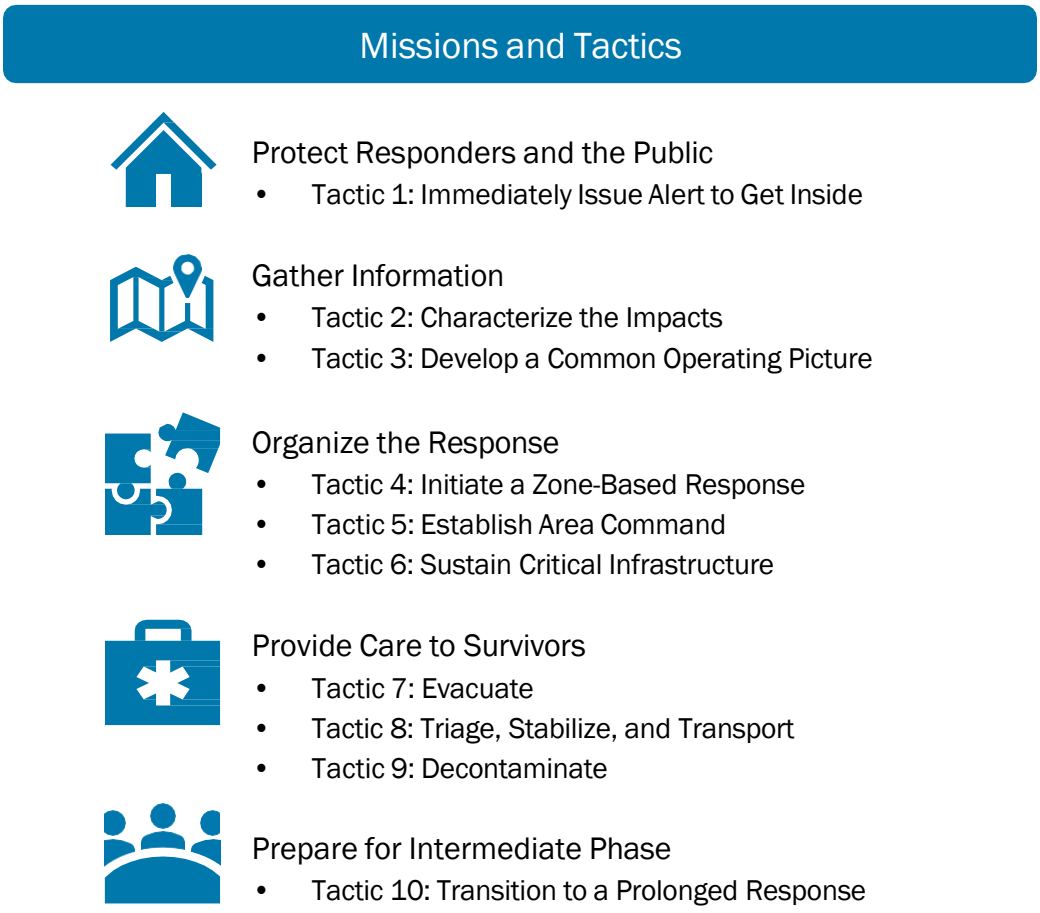


Figure 2. Summary of Missions and Corresponding Tactics.

MISSION: PROTECT RESPONDERS AND THE PUBLIC

This Mission provides planners with the resources and direction to develop procedures for disseminating emergency alerts and warnings. This is the single most impactful Mission in this document, since the most lives can be saved during the initial 60 minutes after the detonation if the public reduces their exposure to potential fallout by sheltering inside of the basement or central room of any nearby building.[2]

Many of the activities described in later Missions and Tactics could occur to some extent without a plan in place, albeit less effectively; however, prompt messaging will not. Tactic 1: Immediately Issue Alert to Get Inside directs planners towards pre-scripted messages that can be incorporated directly into SLTT's nuclear detonation response plans and communication materials. The messages can be quickly disseminated via emergency alert systems, social media, or other communication channels either to warn the public and responders of an impending nuclear attack before detonation or to notify them that a nuclear detonation has occurred. In either case, the message is essentially the same: get inside, stay inside, and stay tuned.

MISSION: GATHER INFORMATION

For SLTT jurisdictions to mount a coordinated response, they will need to attain a common understanding of the geographic impacts and hazards. This Mission focuses on early-phase data collection, incident characterization, and developing a common operating picture (COP). Unlike most other emergencies, a nuclear detonation would likely result in immediate catastrophic destruction of communication and emergency response infrastructure, particularly in the Impacted Jurisdiction, which will inhibit the flow of information from responders on the ground to virtual or physical emergency operations centers (EOC), making information gathering more difficult.

The Tactics in this Mission highlight the importance of information collection by first responders early in the response. Tactic 2: Characterize the Impacts begins by describing the initial actions first responders should take after a nuclear detonation. Then, it provides responders with instructions on what impact information to prioritize and how to collect it safely to help the EOC construct a COP. Tactic 3: Develop a Common Operating Picture instructs EOCs to receive, map, share and use this information as the basis for the "Zone-based Response" introduced in the next Mission.

Finally, this Mission introduces the "pixel-picture" metaphor that is referenced elsewhere in this guidance. This comparison illustrates how isolated pieces of information from first responders or first responder facilities (the "pixels"), when aggregated, allow EOCs to build a common operating picture (the "picture") of the incident to inform response decision-making.

[2] (Federal Emergency Management Agency (FEMA), 2022)

MISSION: ORGANIZE THE REPONSE

Using information being gathered through Tactics 2 and 3, EOCs, incident commanders, and other response leadership can simultaneously begin organizing the response. This Mission is essentially where the response begins to transition from an initial reaction to a deliberate, planned, and coordinated response. Using the zone-based response concept described in Chapter 2 of FEMA's Planning Guidance for Response to a Nuclear Detonation, responders should prioritize incoming resources and response activities for the Moderate Damage Zone (MDZ) (but outside of the Dangerous Radiation Zone (DRZ)) since that area is likely where the greatest lifesaving potential will be due to the number of injuries that will need urgent care and the possibility of fires and building collapses that could threaten those sheltering in place.

Like other Missions in this guidance, many of the Tactics will take place simultaneously. Tactic 4: Initiate a Zone-Based Response and the response cards in Annex 2 outline the lifesaving activities that can begin immediately depending on the blast damage, radiation hazards, and conditions in each area. With a zone-based response, actions can be pre-defined and agreed upon so that they can be initiated by responders immediately (without needing to wait for direction); thus, zone-based planning maximizes time for lifesaving activities. Also, per Tactic 4, emergency dosimetry and radiation exposure decision points should be communicated to first responders, and dose control procedures should be put in place to ensure exposures are as low as reasonably achievable (ALARA) while balancing lifesaving activities.

Tactic 5: Establish Area Command instructs EOCs and incident commanders to establish an Area Command or Unified Area Command that can coordinate a catastrophic incident, leveraging best practices in the National Incident Management System (NIMS). Tactic 6: Sustain Critical Infrastructure focuses on early-phase infrastructure restoration to enable lifesaving activities and coordination including supplying water, bringing in generators and other power restoration activities, restoring communications capabilities, and clearing debris and major roadways for evacuation operations.

This Mission will begin laying the foundation for Impacted and Supporting Jurisdictions to coordinate and manage the scale and severity of the emergency, to facilitate strategic decision-making, and to allocate critical resources to support lifesaving activities.

MISSION: PROVIDE CARE TO SURVIVORS

The detonation will cause large portions of the surrounding population to spontaneously evacuate, despite recommendations to shelter in place. It will also result in tens or hundreds of thousands of injuries if the detonation occurs in an urban area. Many of these injuries, particularly those resulting from flying debris and thermal burns, will require prompt medical triage and stabilization by first responders and healthcare providers. Furthermore, if fallout is produced, a considerable number of people – injured and uninjured – will traverse through contaminated areas.

This Mission focuses on providing care to survivors and includes three Tactics that planners can use to prepare first responders and frontline healthcare providers to be able to provide the best care

possible to evacuees and survivors, given the resources available. Tactic 7: Evacuate outlines a process for facilitating spontaneous evacuations, planning phased evacuations, and preparing to receive evacuees. Tactic 8: Triage, Stabilize, and Transport outlines the potential ad hoc healthcare landscape in the impacted areas. Planners should expect medical triage sites to be stood up in a spontaneous fashion for initial triage and patient stabilization, with limited resources and transportation capabilities. This Tactic also points planners to Annex 3, which provides steps that responders and healthcare providers (HCPs) can implement for triage during the initial response in a resource-austere environment. Tactic 9: Decontaminate highlights the importance of promoting rapid, dry self-decontamination methods, such as changing or shaking outer layers of clothes and wiping exposed surfaces, as the primary method for emergency self-decontamination.

MISSION: PREPARE FOR INTERMEDIATE PHASE

The focus of the response during the first few days will be to establish a common operating picture while saving lives. This last Mission consists of a single Tactic, Tactic 10: Transition to a Prolonged Response. This Tactic highlights activities that EOCs in the Impacted and Supporting Jurisdictions should execute during the first 72 hours to queue up operations that will be critical to enabling further lifesaving activities and planning for intermediate and later phase response objectives in the days, weeks, and months ahead. These actions include establishing public communication strategies, collecting public health data early on, setting up logistics support structures, and managing fatalities.

Mission: Protect Responders and the Public

Tactic 1: Immediately Issue Alert to Get Inside

GUIDANCE SUMMARY:

Following a nuclear attack warning or a nuclear detonation, issue immediate shelter-in-place notifications using all available alerts, warnings, and notifications (AWN) systems. After a detonation, the message should instruct everyone (including responders) within 50 miles of the detonation to get inside the nearest building that is not threatened by fire or collapse, stay there, and tune in for more information. This single action may save hundreds of thousands of lives in a large city.

Tactic 1 Checklist

After a nuclear attack warning from FEMA, delivered over the National Alert and Warning System (NAWAS):

- ☐ Immediately issue an attack warning message to the public. See Table 2 for templates.

After a nuclear detonation occurs:

- ☐ Immediately issue nuclear detonation protective action messages to the public. See Table 2 for templates.
- ☐ Assist Impacted Jurisdiction(s) with distributing/amplifying protective action messages.
- ☐ Deconflict public alert and warning messages across neighboring jurisdictions.

KEY ACTIVITIES:

In the case of a nuclear attack warning or a suspected or confirmed nuclear detonation, all potentially impacted jurisdictions should provide immediate lifesaving nuclear-detonation related AWN through all available channels. To be most effective – and save the most lives – these messages must:

- Advise responders and the public to shelter in place and "Get inside, stay inside, and stay tuned."
- Be pre-scripted, pre-approved, and ready to send via all available AWN channels prior to an incident. This is true for both an attack warning scenario and following a nuclear detonation, as there will be insufficient time to compose messages ad hoc. See Table 2.
- Inform the public to go inside the basement or central room of any nearby building and, if there was a detonation, stay there for up to 24 hours or until informed it is safe to change locations. Responders should also immediately take this action to protect themselves, and follow the additional steps described in Tactic 2.

- If done before the detonation (in an attack-warning scenario), seeking shelter can significantly mitigate blast, thermal, and radiation effects. After the detonation, sheltering-in-place can provide protection from exposure to radioactive fallout. This simple protective measure could save hundreds of thousands of lives in a major city.

- When possible, emergency messaging and pre-incident awareness campaigns should emphasize that the best shelter location is in the center of a large building of heavy construction (e.g., concrete, reinforced brick, cement), away from windows and doors, or in basements and other underground areas (e.g., parking garages, subways). Sheltering in a subterranean basement or the center of a large building provides better protection. In Figure 3, the numbers in the various rooms represent a "dose reduction factor." For example, a dose reduction factor of 200 indicates that a person in that area would receive 1/200th of the dose of a person out in the open.[3]

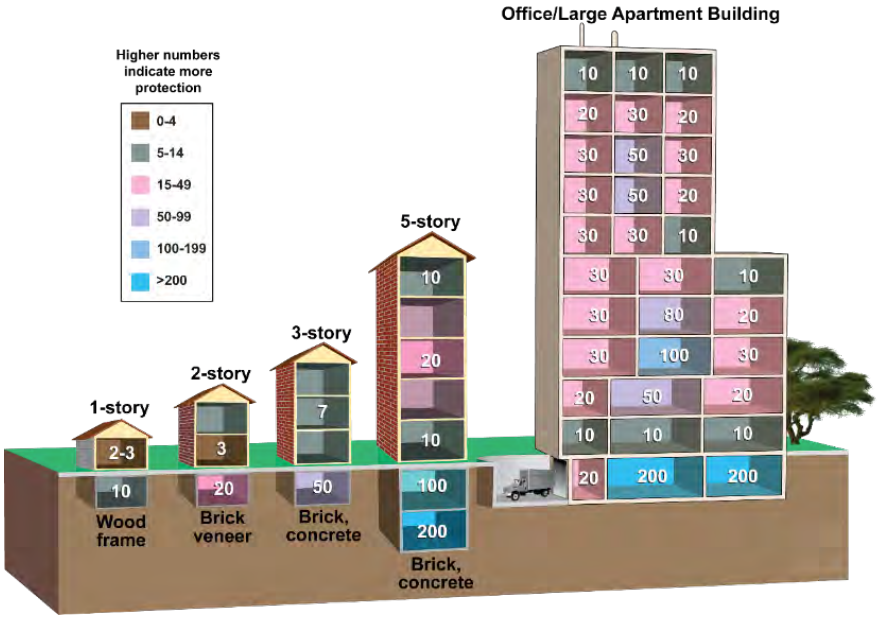


Figure 3. Example protection factors for a variety of building types. (Credit: LLNL)

What is a Nuclear Detonation Attack Warning?

FEMA may issue warning of a nuclear attack to SLTT jurisdictions. If the warning is due to a nuclear-armed ballistic missile, SLTT jurisdictions may only have 15–30 minutes between the warning and the detonation.

[3] (Buddemeier & M. B. Dillon, Key Response Planning Factors for the Aftermath of Nuclear Terrorism, 2009)

For an attack-warning scenario:

- If the federal government determines there is a ballistic missile threat to the United States, the following notifications will be made to SLTT audiences:
    - FEMA will transmit an alert to locations equipped with National Alert and Warning System (NAWAS) telephone network access. These are primarily state government watch centers. This alert will inform state watch centers of an impending threat.
    - A "National Alert" to the public may be sent by the President of the United States or FEMA using FEMA's Integrated Public Alert and Warning System (IPAWS) and/or National Public Warning System (NPWS).
- State, tribal, and territorial jurisdictions should immediately amplify the NAWAS alert to local jurisdiction counterparts, such as county or city emergency operations centers (EOC) and watch centers.
- Upon receiving the NAWAS alert, SLTT jurisdictions should immediately issue a nuclear attack warning message in Table 2, regardless of whether the separate "National Alert" to the public has been issued by the President or FEMA.
- There will not be enough time for significant resource movement following an alert, but with planning, jurisdictions could execute a limited roll call of response assets to confirm they are sheltered and to assess their level of response capability.

After a suspected or confirmed nuclear detonation:

- The Impacted Jurisdiction (if possible) and Supporting Jurisdictions, including state authorities, should all immediately issue a shelter-in-place message to areas within 50 miles of the detonation to ensure anyone capable of receiving the message can take protective action.
    - Alerts that are sent to overlapping jurisdictions via the IPAWS will result in the public receiving multiple alerts. While this will improve coverage and increase the chances that someone will receive lifesaving warnings, it could result in conflicting messages. During the nuclear detonation response planning process, leverage the template language referenced in Table 2 and work with neighboring jurisdictions to ensure the same pre-scripted instructions will be disseminated to avoid conflicting information.
    - Consider developing multi-jurisdictional agreements and memoranda of understanding to enable distribution of warning messages to other jurisdictions.
- Continue to amplify and repeat the shelter-in-place message through all available methods, adjusting as necessary to account for areas where evacuation is a priority. Although some responders will be able to operate outdoors (see Tactic 2), the public should remain sheltered for

at least the first 24 hours, unless there are immediate life-safety concerns with the location they are sheltering in (e.g., fire, building collapse).

The message templates in Table 2 have been prepared by federal technical experts and are designed for all AWN systems. Planners and public warning specialists should also review the current editions of DHS's Emergency Support Function (ESF) #15 External Affairs Annex N and FEMA's Communicating in the Immediate Aftermath. These resources contain additional templates for immediate warning messages and guidance for communicating with the public on other topics, including decontamination, evacuation, and water and food safety.[4] Please remember:

- Some dissemination methods, such as Wireless Emergency Alerts (WEA) and SMS-text based systems, have strict content and character limits. The messages below include a buffer to provide flexibility for customization, but planners should ensure their message templates account for any platform-specific limitations.
- For alerting platforms that do not specify the sender, always include agency signature.
- Consider including the Centers for Disease Control and Prevention's "Where-To-Go" infographic, as appropriate.[5]

Table 2. Nuclear Attack Warning and Detonation: Template Public Warning Messages[6]

Message for a Nuclear Attack Warning
▪ WEA 360-character compatible (approx. 320 characters): [SOURCExxxxxxxxxx] warns (nuclear) attack is imminent in [LOCATIONxxxxxxxxxx]. Get inside a basement or central room of a sturdy building NOW and stay away from windows and doors. Stay inside. Listen for more info. Do not leave unless officials provide other instructions or your shelter is threatened by fire or collapse.
▪ WEA 90-character compatible (approx. 88 characters): [SOURCExxxxxxxxxx] warns (nuclear) attack in [LOCATIONxxxxxxxxx]. Get inside, stay inside NOW
Message for a Nuclear Detonation
▪ WEA 360-character compatible (approx. 349 characters): [SOURCExxxxxxxxxx] warns a nuclear detonation has occurred. People in [LOCATIONxxxxxxxxx] - get inside, stay inside, stay tuned for more information. Prepare to stay inside for at least 24 hours unless officials provide other instructions, or your building is threatened by fire or collapse. Follow instructions from officials – this can save your life.
▪ WEA 90-character compatible (approx. 88 characters): [SOURCExxxxxxxxxx] warns nuclear attack in [LOCATIONxxxxxxxxx]. Get inside, stay inside NOW

[4] (US Department of Homeland Security (DHS), 2019), (Federal Emergency Management Agency (FEMA), 2013)

[5] (Centers for Disease Control and Prevention (CDC), 2021)

[6] These messages have been adapted from DHS's Emergency Support Function #15 External Affairs, Annex N (2019). Planners are strongly encouraged to review the current editions of the Annex N and Communicating in the Immediate Aftermath which include additional messaging content and other critical context for public warning experts.

Refer To

FEMA's Planning Guidance for Response to a Nuclear Detonation, Third Edition

- "Chapter 3: Shelter & Evacuation" for information about sheltering and evacuating various populations.
- "Chapter 6: Communications and Public Preparedness" for information about developing message dissemination plans.
- "Chapter 7: Alerts, Warnings, Notifications, and FEMA's Integrated Public Alert and Warning System (IPAWS)" for information about IPAWS and WEA messaging.

See also the following additional communication resources:

- Annex N of the DHS Emergency Support Function #15 - External Affairs; Standard Operating Procedures (July 2019).
- FEMA's forthcoming Nuclear Detonation Preparedness: Communicating in the Immediate Aftermath and FEMA's Improvised Nuclear Device Response and Recovery: Communicating in the Immediate Aftermath
- RadResponder.net Public Information Officer library
- CDC's "Radiation Emergencies" website, Sheltering in Place During a Radiation Emergency

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Mission: Gather Information

Tactic 2: Characterize the Impacts

GUIDANCE SUMMARY:

First responders should initially take shelter indoors and, if they have radiation detection equipment, begin tracking their radiation dose. Then, they must use their available resources to assess radiation exposure rates, blast damage, critical infrastructure impacts, injuries, and fires in the immediate vicinity of their location. They should share this information with other responders and a central data collection point, such as an emergency operations center (EOC) (Tactic 3).

Tactic 2 Checklist

- ☐ Initially, responders shelter indoors. Conduct lifesaving activities inside:
  - o If/while exposure rate outside is above Dangerous Radiation Zone (DRZ) levels (greater than 10 R/hour (h)), operate indoors or underground and only conduct quick, critical, lifesaving activities outside.
  - o If/when exposure rate outside is below 10 R/h, conduct outdoor lifesaving activities.
  - o Do not enter areas greater than 100 R/h exposure rate without permission from the incident commander or a careful assessment of the risks and benefits.
  - o If possible, track total exposure (dose) and keep exposure as low as reasonably achievable (ALARA) while conducting life-saving activities.
- ☐ Assess immediate impacts in vicinity:
  - o Priority: Radiation levels and blast damage severity.
  - o Additional: Critical infrastructure impacts, road access, injuries, and fires.
- ☐ Communicate impacts (e.g., radiation exposure rate, blast damage) to a central location, such as an EOC.
- ☐ Establish communications with other first response facilities (e.g., firehouses, police stations, hospitals).

KEY ACTIVITIES:

Responders without radiation detection instruments: Initially follow the same guidance as the public and take shelter in the center or basement of a sturdy building until informed that it is safe to respond. Conduct lifesaving activities inside to the greatest extent possible.

Responders with radiation detection instruments: Take shelter in the center or basement of a sturdy building.

- Do not exit shelter or enter areas if radiation exposures exceed 10 R/h (the Dangerous Radiation Zone (DRZ), see Table 4) outside unless there is a time critical, life-safety issue (e.g., avoiding fire, building collapse) or to conduct quick, critical, lifesaving activities. While sheltered inside, use detection equipment to monitor indoor exposure rates.[7]
    - Be aware that some radiation detectors overload at exposure rates lower than 10 R/h. If an overload occurs, relocate to an area that does not overload the detector.
- If outdoor radiation exposures are below 10 R/h, perform hazard assessment of the immediate area and begin activities described in Tactic 4 and Annex 2.
- Radiation exposure rates will fluctuate across areas. When traveling outside, stay near buildings that offer adequate shelter, closely monitor radiation levels, and immediately backtrack using the previous path should the level of radiation exceed 10 R/h until in safer conditions (<10 R/h). Then, seek guidance from command or technical experts before continuing into areas >10 R/hr. If command or technical experts are not available, evaluate whether to continue into the area to conduct quick, critical, lifesaving activities. See Annex 1 for information on dose management.
    - Do not enter areas greater than 100 R/h exposure rate without permission from the incident commander or after a careful assessment of the risks and benefits for the lifesaving activities to be conducted.[8]
- Begin monitoring and recording total dose of personnel. Keep exposures as low as reasonably achievable (ALARA) while conducting lifesaving activities. If there is not enough detection equipment available to equip each responder, use one piece of equipment to approximate dose for a small group of responders if they will deploy, work, and return together.[9] See Tactic 4 and Annex 1 for information regarding responder safety.

Radiation is not the only hazard responders should be concerned about. It may not be the most dangerous/life-threatening hazard, nor a reason to not conduct lifesaving activities. Structurally damaged buildings, large-scale fires, or other hazards may be the real threat to shelter integrity or the lives of the public and responders. The totality of hazards must be taken into account before conducting a response activity.

[7] This document uses units familiar to U.S. audiences and emergency responders. In some places, SI (international) units are used when the audience leans more towards the medical community. See page 5 of FEMA's Planning Guidance for Response to a Nuclear Detonation for an overview of US and SI units and their conversions.
[8] First responders saving lives in areas above DRZ levels (10 R/h) may encounter areas with extremely high exposure rates. 100 R/h (International Atomic Energy Agency (IAEA), 2006), is proposed here as a potential decision point at which point a responder conducting lifesaving operations should seek permission or advice from an Incident Commander, safety officer, or other technical expert or be capable of making an informed decision themselves before continuing. Since there is no universally agreed-upon turn-back limit for lifesaving activities, planners are strongly encouraged to work with radiation health experts and first responders to identify decision points that are appropriate for their operational protocols.
[9] (National Council on Radiation Protection and Measurements, 2019, p. 9)

Critical Concept

"Pixels" Build a Detailed Picture – A Metaphor for Early-phase Impact Characterization

Tactic 2 asks responders to gather and confirm information on impacts and conditions in their immediate location, which will contribute to overall situational awareness in Tactic 3. Consider a picture that is comprised of many small "pixels" or dots that, when combined, form a picture. For an incident as large and complex as a nuclear detonation, planning for how responders assess and report conditions in their area (their "pixels") is critically important. Tactic 3 will describe aggregating the individual responder "pixels" into a "picture" via a centralized, coordinated effort.

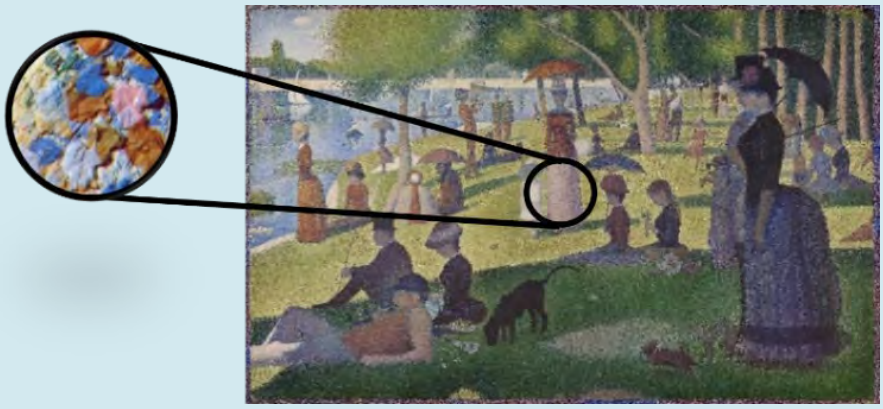

Figure 4. Georges Seurat's *A Sunday on La Grande Jatte* uses pointillism as a technique to transform thousands of tiny colored dots into a single, coherent image.[10]

Responders should collect information on impacts and conditions in their area – their "pixel" – by observing conditions in their immediate vicinity:

- The priority is to assess blast damage and radiation exposure rates.
    - Blast damage: See Table 3 for blast zone definitions and indicators. If possible, photograph conditions to help communicate damage zone details.
    - Radiation exposure: Responders that have radiation detection equipment should assess outdoor radiation dose rates and determine if they are in the Hot Zone or Dangerous Radiation Zone (see Table 4). Note that radiation readings may change rapidly with time and may vary significantly with location (even within a few hundred feet). Simply reporting approximate radiation measurements and time of reading is sufficient during the first 72 hours. Since radiation levels will change over time, fallout measurements should be re-assessed at least every 30 minutes.

[10] (Seurat)

Table 3. Blast Zone Types and Definitions

Blast Zone Type	Indicators
Light Damage Zone (LDZ)	▪ Nearly all windows shattered and building facades damaged ▪ Most injuries not life-threatening, many injuries from flying glass and debris
Moderate Damage Zone (MDZ)	▪ Light buildings destroyed ▪ Interiors of larger buildings blown out ▪ Significant number of major injuries
Severe Damage Zone (SDZ)	▪ Nearly all buildings destroyed ▪ Hazardous outdoor conditions ▪ Few survivors

Table 4. Radiation Hazard Zone Types and Definitions

Radiation Hazard Zone Type	Indicators	Outdoor Response Restrictions
N/A	▪ Below 0.01 R/h (10mR/h)	▪ Assess impacts in the immediate area. Support all operations as needed while monitoring radiation levels.
Hot Zone (HZ)*	▪ Above 0.01 R/h (10mR/h) and Below 10 R/h	▪ Assess impacts in the immediate area. Support only emergency operations (lifesaving, firefighting, etc.) as needed while monitoring radiation levels. Track dose of all responders.
Dangerous Radiation Zone (DRZ)*	▪ Above 10 R/h	▪ Do not exit shelter or enter areas if radiation exposures exceed 10 R/h outside unless there is a time-critical, life-safety issue (e.g., avoiding fire, building collapse) or to conduct quick, critical, lifesaving activities.
*The HZ and DRZ will also overlap parts of the LDZ, MDZ, and SDZ. See Tactic 3 for an illustrative graphic.		

- Observe conditions related to the categories below. These are further defined in Tactic 3.
  - Critical infrastructure, especially roadway blockages
  - Casualties (noting injury types and severity)
  - Fires

- If unable to exit shelter due to high exposure rates outdoors (>10 R/h) or because there is no equipment for detecting radiation:
    - Assess any blast damage noticeable from within shelter (e.g., broken windows, blown-in doors, structural damage) or, if outside at time of blast, observed while entering shelter.
    - Report if radiation measurements are greater than 10 R/h, if equipment is available and these levels are encountered upon entering shelter.

Communicate impacts including radiation levels, blast, infrastructure, injuries, or fire in the area – a "pixel" – to an EOC or the designated data collection point identified in Tactic 3, so they may build a common operating picture of regional impacts:

- Initially, it may be difficult to communicate out of the immediate area, but it is still critical that every responder, even those sheltered, attempt to share their local assessment "pixel" with other responding elements. Even coordination with the responders blocks away is meaningful for situational awareness and the development of a common operating picture. If possible, share photos or videos of the destruction to help communicate area access impediments, evacuation needs, and damage indicators.
- Identification of areas with high radiation is important, but it is equally important to report areas outside of the Hot Zone (reading less than 10 mR/h) for determining safe evacuation routes and response-staging areas.
- If communication means are not functional in the location where a responder is sheltered, consider alternate methods such as radio relay or, if not in the DRZ, runners to nearby facilities (e.g., firehouses, police stations, hospitals) where communications may be functional. Responders traveling far distances should have detection equipment to avoid entering areas with high exposure rates.

Refer To

FEMA's Planning Guidance for Response to a Nuclear Detonation, Third Edition

- "Chapter 1: Nuclear Detonation Impacts" for an introduction to the five response zones and their definitions.

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Tactic 3: Develop a Common Operating Picture

GUIDANCE SUMMARY:

Using locally characterized reports on impacts – "pixels" – EOCs build a common operating picture across all jurisdictions and establish a shared understanding of impacts, priorities, and operational first steps. Begin to designate and map the blast and radiation hazard zones.

Tactic 3 Checklist

- ☐ EOCs receive and map first responder or facility reports of fallout, fire, blast, casualty, and infrastructure impacts.
- ☐ Request models from FEMA's Interagency Modeling and Atmospheric Assessment Center (IMAAC) or run models to estimate nuclear detonation and fallout impacts.
- ☐ Designate and map blast and radiation hazard zones based on first responder data and modeling products (Figure 5).
  - o Blast damage zones: Light (LDZ); Moderate (MDZ); Severe (SDZ).
  - o Radiation zones: Dangerous Radiation (DRZ); Hot Zone (HZ).
- ☐ Establish communications with first response facilities/organizations and other assets, especially those in the Impacted Jurisdiction.
- ☐ Supporting and Impacted EOCs coordinate to establish a single location where local observations of impacts will be aggregated into a common operating picture.

KEY ACTIVITIES:

Emergency operations centers (EOC) in the Supporting Jurisdictions should prioritize establishing communication or connectivity with first response facilities and other assets in the Impacted Jurisdiction and identify the best methods of receiving and sending information. This will allow EOCs and incident commanders to assess local impacts and needs, and coordinate response priorities.

- Supporting Jurisdictions may quickly discover that their communications and infrastructure remain operational. The further away from the detonation site, the more connectivity and information-sharing capabilities can be anticipated. These jurisdictions should mobilize resources and be prepared to assist the Impacted Jurisdiction.

- In the first hours or day, it is likely there will be blank "pixels," or areas on the situational awareness map for which there is no information on impacts. These are the areas for which Supporting Jurisdictions should prioritize establishing contact and seeking information. Among these areas, consider prioritizing based on population density, damage, access, etc.

EOCs should receive and map "pixels" of information (impacts and conditions) received by first responders and facilities. Recognize that some information may be received from responders in neighboring jurisdictions, particularly in situations where the Impacted Jurisdiction's EOC is disabled or unable to communicate with their responders. Focus initial "pixel" information collection on fallout, blast damage, fire spread, casualties, and loss of critical infrastructure.

- Fallout: Fallout is created when the detonation occurs near the surface of the earth. If the detonation occurs sufficiently high above the ground (e.g., an air burst) there may be limited or very minimal fallout.[11] Immediately after the detonation, the EOC should begin aggregating and mapping radiation measurements received from responders (See Tactic 2). Note:
    - Quickly identifying areas with measurements greater than 10 R/h is extremely important since that will inform identification of the Dangerous Radiation Zone boundary.
    - The presence of fallout can be estimated through visual observation of the cloud and atmospheric dispersion models and confirmed with measurements of radiation levels in downwind areas.
    - To keep the common operating picture up to date, fallout measurements should be re-assessed at least every 30 minutes. While fallout travels downwind and settles on the ground, it will also continue to decay (reduce) at a rapid pace. This means that measurements may initially increase rapidly, then decrease over the first 48 hours.
    - The CBRNResponder Network, provided by FEMA, is one potential tool for recording, aggregating, sharing, and mapping radiation readings. However, internet access is required for uploading measurements and sharing them, which is critical for early characterization of fallout spread. During the first hours and days, access to CBRNResponder may not be available to some first responders operating in the Impacted Jurisdiction. Nuclear detonation response plans should account for this by identifying redundant and resilient methods of radiological data collection and aggregation (e.g., radio roll calls) during the initial response, and prepare to use CBRNResponder, or other data collection tools, when and where it is available. Even if internet access is limited early-on across the Impacted Jurisdiction, the Supporting Jurisdictions, or EOCs in the Impacted Jurisdiction who may have internet, may still consider using CBRNResponder as a method to aggregate radiological data received over radio or other means from first responders.
- Blast damage: Reports of blast damage, as defined by "zone" in Tactic 2, should be aggregated and mapped. This information will help responders and leadership prioritize areas for emergency response and is critical for identifying the zone types described later in this Tactic.

[11] Please refer to FEMA's 2022 Planning Guidance for Response to a Nuclear Detonation for additional information on height-of-burst considerations.

  - First responders may use a variety of GIS-platforms typically used to report damage after all-hazards emergencies. They can also consider using CBRNResponder, which allows for comments and photos to be attached to surveys, as a method to consolidate how initial situational awareness information is communicated from responders to an EOC during the early response.

- Fires: Due to limited firefighting resources and access, fires may expand and combine, blocking passageways and putting responders and people sheltering in place in danger. Given these challenges, firefighting should be balanced with other incident response priorities to make best use of available resources to maximize lifesaving potential. However, firefighting agencies and the EOC should make continuous identification and tracking of fires a priority and be prepared to adjust life-safety operations as conditions change. For example, fires may require earlier-than-planned evacuation of sheltered people or relocation of emergency operations.

  - Air bursts expose more surfaces to the fireball's heat. This results in a higher risk of widespread ignition. Response agencies should be especially vigilant in identifying and tracking fires if the plume is distinctly "white-capped," separated from the "stem," or if there is no "stem," since these circumstances may indicate an air burst.[12]

- Casualties: Collecting data on casualties (both injuries and fatalities), including the injury types, will help with early prioritization of where resources need to be deployed for lifesaving efforts. Pairing the type of injuries with their reported location will also help inform identification of the blast damage and fallout zones described in Tactic 2.

- Critical Infrastructure: Reports of significantly damaged, destroyed, or non-functioning critical infrastructure (e.g., bridges, tunnels, grid power, water, telecommunications) will help with both zone identification (Tactic 4) and resource movement. Refer to FEMA's Community Lifelines concept for information on the type of infrastructure that might be appropriate to assess and report on.[13]

Where possible, collect "pixels" of information through remotely accessed reporting systems, such as static networked radiation detectors, camera feeds, and infrastructure status monitors. This method of situational awareness gathering may be more reliable in the Supporting Jurisdiction's areas, due

[12] (Federal Emergency Management Agency (FEMA), 2022, p. 32)
[13] (Federal Emergency Management Agency (FEMA), 2019)

to the physical destruction and power outages faced in the Impacted Jurisdiction. It should not replace the responder/facility-level reporting discussed in this Tactic but supplement it.

EOCs should obtain initial estimates of impacted areas and fallout deposition using modeling resources immediately available. In particular:

- Planners should develop protocols that include reaching out to the Interagency Modeling and Atmospheric Assessment Center (IMAAC) for initial products. IMAAC coordinates and disseminates federal atmospheric dispersion modeling and hazard prediction products. IMAAC can provide requestors with an initial model prediction within 60 minutes of receipt of the necessary incident information. Refer to the IMAAC website for more information.

- The Nuclear Hazard Zone (NHZ) Tool: DHS S&T's National Urban Security Technology Laboratory partnered with FEMA to develop the NHZ Tool. The Tool, available through IMAAC, allows Urban Area Security Initiative (UASI) cities and state EOCs the ability to run an initial low-fidelity model based on simple inputs and predicted atmospheric winds. The model affords users information to make critical initial health and safety decisions for responders and the public. The NHZ tool's first output product has also been aligned with the IMAAC's initial product ("product 0"), which all jurisdictions may receive upon request to IMAAC after an incident.

As soon as possible, EOCs in the Supporting and Impacted Jurisdiction should coordinate to establish a single location where local observations of impacts – pixels – can be aggregated into a common operating picture.

- This may be at an EOC among the regional Supporting Jurisdictions, a state EOC (SEOC), an initial/interim operating facility (IOF), joint field office (JFO) or other multiagency coordination center stood up to coordinate the response.

- The common operating picture should be used to:

    - Inform responders where lifesaving activities can be safely conducted.

    - Identify safe staging areas unlikely to be initially affected by fallout or fire.

    - Provide (if given to FEMA or the IMAAC) situational awareness for federal assets that conduct modeling and ground measurements to develop estimates of impacts to areas not yet assessed by first responders.

EOCs should use the mapped "pixels" to designate areas according to the zone types described in Figure 5. Designating these areas allows for recommended actions to be prescribed by zone, improving efficient ad hoc implementation of lifesaving response priorities.

- These zone types and their boundaries should be communicated to other jurisdictions and responders operating in the field.

- As shown in Figure 5, the Dangerous Radiation Zone (DRZ) and Hot Zone will overlap with some sections of the blast damage zones, such as the Light, Moderate, and Severe Damage Zones. The immediate hazard of DRZ-level radiation exposures outside (greater than 10 R/h) will prevent sustained outdoor response operations and HZ-level radiation exposures (greater than 10 mR/h) will require careful planning for response operations in these areas to minimize dose to responders and the public. However, due to radioactive decay, the area the HZ and DRZ covers will shrink rapidly during the first 48 hours, improving access to damaged areas.

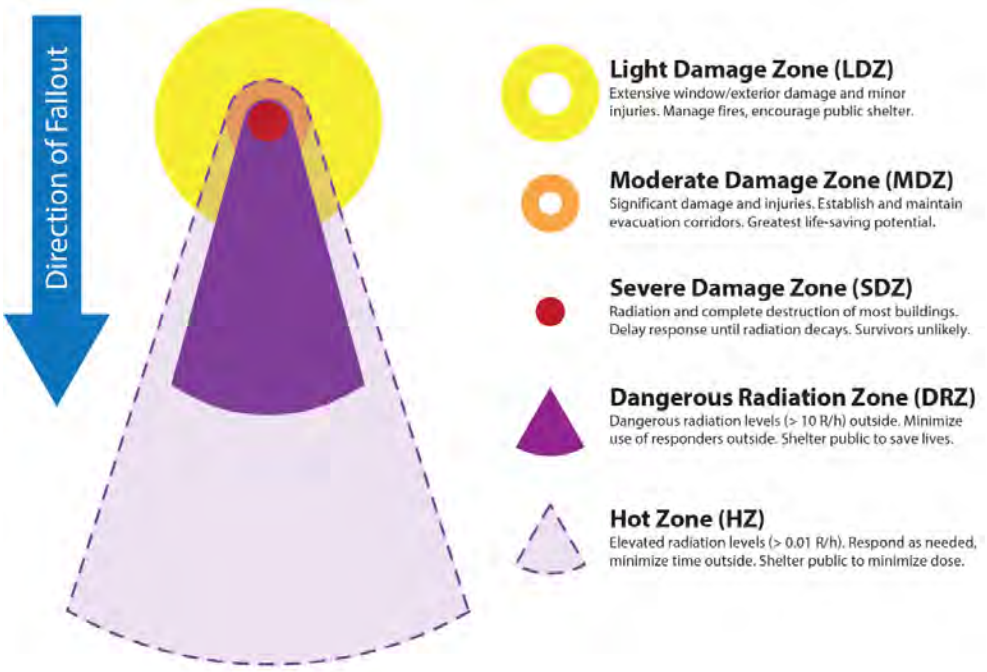

Figure 5. Emergency Response Zone Types.[14]

Refer To

FEMA's Planning Guidance for Response to a Nuclear Detonation, Third Edition

- "Chapter 1: Nuclear Detonation Impacts" for an introduction to the five response zones and their definitions.

See also the following resource:

- IMAAC Concept of Operations (CONOPS): This document, available at the IMAAC website, provides planners with guidance for developing procedures for contacting IMAAC to receive effects products for all potential atmospheric releases, including nuclear explosions.

[14] This is an abstract, representative graphic. The zones are not drawn to scale. See FEMA's 2022 Planning Guidance for Response to a Nuclear Detonation for information on the geographical extent of blast and fallout impacts for different yields and heights of burst.

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Mission: Organize the Response

Tactic 4: Initiate a Zone-Based Response

GUIDANCE SUMMARY:

Initiate a zone-based response and identify areas with the greatest lifesaving potential. Focus incoming resources on lifesaving in the Moderate Damage Zone (MDZ). Initiate incident action planning for additional life-safety operations, re-establishing critical infrastructure, and mass evacuation. Communicate these operational priorities, along with responder safety requirements, to responders, commanders, and neighboring jurisdictions.

Tactic 4 Checklist

- ☐ Responders initiate lifesaving activities identified in Annex 2: Zone-Based Response Cards.
- ☐ Establish radiation exposure decision points. Example thresholds:
  - o 50 rad dose: decision point for when responders should pull back from or continue lifesaving activities.
- ☐ Base personal protective equipment (PPE) on non-radiation hazards.
  - o Outside of the Dangerous Radiation Zone (DRZ), radiation is not the biggest hazard. Inside the DRZ, the best protection is to shelter.
- ☐ EOCs/Leadership identify priority response areas for incoming lifesaving resources from Supporting Jurisdictions.
  - o Priority is the Moderate Damage Zone (MDZ), outside of the DRZ.
- ☐ EOCs/Leadership communicate response priorities to responders in the field and neighboring jurisdictions.

KEY ACTIVITIES:

First responders should initiate lifesaving activities as soon as it's safe to do so. Their initial response priorities – and whether they operate outside or from within a sheltered location – will be dependent on the zone-type they are in and the hazards in their area.

- Annex 2: Zone-Based Response Cards provides suggested immediate and early phase lifesaving priorities for first responders operating in one of the five zone types. As the response develops and command systems integrate, these priorities should be revised and integrated into incident response plans.
- First responders who are law enforcement must balance lifesaving with the need for protection of critical infrastructure and key resources and security for emergency operations and the public.

Emergency response leadership should identify areas for action that have the greatest lifesaving potential. These are areas that would benefit most from rapid deployment of resources from the Supporting Jurisdictions.

- Areas in the MDZ are considered an early response priority for incoming lifesaving resources due to the number of injuries that will need urgent care and are likely to be treatable with a high probability of survival. These areas are also a priority because of possible fires and building collapses that may threaten people who are sheltered in place.
- In the SDZ and DRZ (including where the DRZ overlaps with the MDZ and LDZ), outdoor response activities should be delayed due to the radiation hazard. Over time, as radiation decays to or below Hot Zone levels, responder access to these areas will improve.

Planning Tip

"If you can hear this, come toward the sound of my voice"

Lifesaving operations in the Impacted Jurisdiction may look very different than they do for other types of emergencies, and it is critical that emergency response planning and exercising take this into account. For example, the activities conducted initially in the MDZ are not going to be typical of how urban search and rescue (US&R) teams generally operate. Instead of a very methodical search of damaged structures, this will more likely be "holding the line" against fires to maintain an evacuation corridor, stabilizing and transporting patients as quickly as possible, and providing the public with self-help instructions, such as announcing over a bullhorn, "If you can hear this, come toward the sound of my voice."

Begin planning and prioritizing future response activities. Working together, emergency operation centers (EOC) and incident commanders in the Impacted and Supporting Jurisdictions should identify response objectives for each area of operation.

Refine emergency worker safety requirements for each zone and communicate them to first responders operating in those areas and to safety officers, as incident command posts (ICP) are established.[15] While the response will need to begin immediately, the considerations below should also be built into safety plan(s) for emergency workers, including first responders operating in the damage and fallout zones.

- Nuclear explosions are inherently dangerous, and they can create areas with multiple types of hazards. Nevertheless, it is possible to work in many of these areas safely and it will be essential

[15] Emergency workers in a radiological emergency consist of more than just firefighters and police officers. Other public and private sector staff may also take on support roles during a response, such as a bus driver assisting with an evacuation. Refer to Annex1 for more information. (National Council on Radiation Protection and Measurements, 2019, p. 3)

to do so to attend to the thousands to hundreds of thousands of people who will require assistance and/or rescue.

- Personal Protective Equipment (PPE): PPE other than radiation detection equipment should be selected based upon non-radiological hazards. In blast damage zones, this includes consideration for hazards such as sharp debris, silica dust, fires, and unstable structures. Fires and unstable structures are an especially likely hazard in the MDZ and SDZ.

- Emergency Dosimetry: Establish dose decision points, keep exposures as low as reasonably achievable (ALARA) for the mission, and implement group dosimetry techniques to support responders arriving to or operating in the HZ and DRZ. Early on, emergency workers will have minimal dosimetry resources. Group dosimetry is appropriate for people who are working in proximity and following the guidance provided in NCRP Commentary 28.[16]

    - Establish radiation exposure decision points, taking into consideration whether the mission justifies potential exposure. Example thresholds might be:

        - 50 rad dose as decision point for when to pull responders back from lifesaving activities.[17]

    - Annex 1 includes guidance on dosimetry techniques, equipment, and best practices to control and mitigate exposure to radiation in an austere (resource scarce) environment.

    - Table 5 provides general guidance for emergency dose management until comprehensive dosimetry resources become available.

Table 5. Responder Fallout Safety for Each Zone Type During the First 72 Hours

Zone Type	Radiation Exposure Rates	Detection Equipment
LDZ	Low	No
MDZ		Preferred
SDZ	Extremely High	Yes – High Range
DRZ (in MDZ)		
DRZ (in LDZ)	Moderate – High	
DRZ		
HZ	Low–Moderate	Preferred[18]
*Outdoor activities are highly discouraged in the DRZ and SDZ, unless to conduct quick, critical, lifesaving actions. Responders should remain sheltered from fallout until radiation decays to below 10 R/h.		

[16] (National Council on Radiation Protection and Measurements, 2019, p. 9)
[17] (National Council on Radiation Protection and Measurements (NCRP), 2010)
[18] (Conference of Radiation Control Program Directors, Inc., 2006, p. 26)

Refer To

FEMA's Planning Guidance for Response to a Nuclear Detonation, Third Edition

- "Chapter 2: A Zoned Approach," for elaboration on the hazards, response priorities, public protection priorities, and emergency worker protective measures for the five key response zones discussed in Chapter 1.

See also the following resource:

- National Council on Radiation Protection and Measurements (NCRP) Report No. 179 and NCRP Commentary No 28

Tactic 5: Establish Area Command

GUIDANCE SUMMARY:

Activate plans for delegation of authority and orders of succession. While identifying and consolidating incident command posts (ICPs) and other first responder operations that spontaneously mobilized ad hoc during the initial response, Impacted and Supporting Jurisdictions should work together to establish an area command (AC) or unifed area command (UAC) to improve incident management and reduce competition for resources.

Tactic 5 Checklist

- ☐ Activate plans for delegation of authority and orders of succession.
- ☐ Establish an area command or unified area command.
- ☐ Establish communications with incident command posts operating in the Impacted Jurisdiction and determine their areas of responsibility.
- ☐ Identify resource needs of ICPs and opportunities to consolidate operations.
- ☐ Request and deploy incident management teams, as available, to support or manage ICPs.

KEY ACTIVITIES:

Impacted Jurisdiction's emergency operations center (EOC), leadership, and response units should activate plans for delegation of authority and orders of succession to enable lifesaving activities while simultaneously re-establishing chain of command and consolidating emergency response operations, where needed.

- Delegation of authority will be very important should traditional hubs of information-sharing or command and control, such as EOCs and agency headquarters, become hard to contact or unavailable. While this is a standard component in most continuity of operations (COOP) and continuity of government (COG) plans, the plans for delegation of authority should be reviewed specifically for nuclear detonation scenarios to ensure the delegations and successions reach the appropriate organizational depth. Due to the unique destructive nature of nuclear weapons, these plans should address the loss of response assets (e.g., EOCs, agency headquarters) for COOP planning and loss of both state and local leadership for COG planning. These plans must be documented and staff trained on them beforehand to be most effective after an incident.

- During the first day, response units already located in heavily damaged areas at the time of the blast, such as firehouses and police stations in the LDZ and MDZ, should establish ICPs on their own and begin saving lives. If senior leaders are unavailable or unreachable, response units in these areas should not wait to execute the lifesaving activities described in Tactics 2, 3, and 4 of this guidance.

- Impacted Jurisdictions' response leadership (e.g., EOCs, incident commanders, agency leadership) should prioritize establishing communication with first responder units, ICPs, and facilities operating in the LDZ and MDZ. Leadership should work with them to consolidate operations, re-establish chain of command, and determine their resource needs and areas of operation.

Critical Concept

Area Command

During the initial response, multiple, local level ICPs will likely be established spontaneously, or in an ad hoc manner by first responders.[19] This will be particularly probable in the Impacted Jurisdiction, where direct impacts of the detonation will inhibit coordination in the early-phase and potentially incapacitate key sections of emergency response infrastructure.

Because of the severity and large geographic span of destruction, it will not be realistic for jurisdictions to expect to manage an incident of this scale with one – or even two – incident commanders. An effective response will necessitate breaking down the initially chaotic and complex landscape into more manageable pieces. Jurisdictions seeking to develop an operational capability to respond to a nuclear detonation must look to more advanced, multi-jurisdictional concepts than are typically planned, trained, or exercised when envisioning a post-detonation incident command system (ICS).

Principle among these concepts is the area command (AC). Per the National Incident Management System (NIMS), an AC is established to oversee multiple concurrent incidents or complex incidents that require more than one ICS organization. An AC is activated to address competition for resources among multiple ICPs; how many is based on the complexity of the incident and incident management span-of-control considerations. Since, following a nuclear detonation, the response will involve more than one jurisdiction, a unified area command (UAC) may be appropriate. For more information on ACs, planners are encouraged to take FEMA's ICS level 400 training, which covers AC in depth.[20]

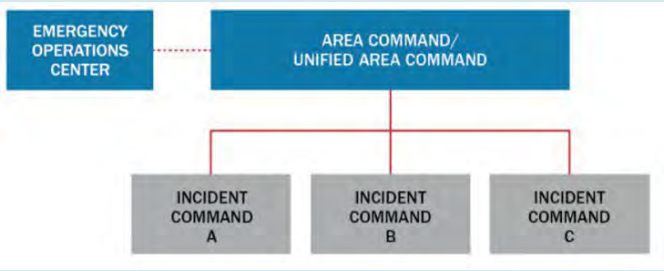

Figure 6. A Diagram Depicting the Relationship Between the AC/UAC and Separate ICPs.

[19] (Department of Homeland Security (DHS), 2008)
[20] (Federal Emergency Management Agency (FEMA), 2022); (Federal Emergency Management Agency (FEMA), 2017)

Supporting Jurisdictions should coordinate with each other and with the Impacted Jurisdiction to establish one or several ACs or UACs, as appropriate for their operational landscape. Before and after establishing an AC/UAC, they should:

- Establish communications with ICPs, first responder facilities, and response leadership in the Impacted Jurisdiction. In this circumstance, leadership may be an EOC or agency operations center. This may take longer than anticipated for some areas, due to damaged communication and power infrastructure.
- Work with ICPs and other response units in the Impacted Jurisdiction to define their area of responsibility, breaking up the operational landscape into more manageable pieces. There are a variety of criteria that can be used to draw operational boundaries, including one or a combination of the following:
    - Jurisdictional boundaries: county/town (for small counties), precinct or firehouse service areas (large cities), boroughs, zip codes, or US National Grid Zones.
    - Geographical boundaries: rivers, roadways, physical access points.
    - Capability/operational coverage of existing/established command posts.
    - Impact- or function-coverage in line with damage zones and fallout hazard zones.
- Identify the resource needs of ICPs and, where possible, opportunities to consolidate separately operating ICPs in the same or adjacent areas.
    - Response assets in the Impacted Jurisdiction will likely self-organize ICPs during the initial response, for example, setting up operations in their firehouses or precincts. The Supporting and Impacted Jurisdictions should work together to identify and consolidate these ICPs and other first responder operations that mobilized ad hoc.
    - Incident management teams (IMTs) from Supporting Jurisdictions may be deployed to support an area's existing ICP, establish a new ICP, or deploy their own ICP to conduct a specific mission or function in an area (e.g., restoration of infrastructure, evacuation coordination).

Refer To

See the following resources:

- ICS 400: Advance Incident Command System for Command and General Staff – Complex Incidents
- FEMA's Continuity Resource Toolkit, which can inform whole community efforts to develop and maintain the capability to ensure COOP, COG, and enduring constitutional government (ECG) during an emergency that disrupts routine operations.
- FEMA's Guide to Continuity of Government for State, Local, Tribal, and Territorial Governments, which provides guidance on how to ensure the resilience and preservation of government in the event of an emerge

Tactic 6: Sustain Critical Infrastructure

GUIDANCE SUMMARY:

Deploy mobile systems, repair existing, or build temporary infrastructure, to facilitate ongoing lifesaving operations, evacuation efforts, and response coordination in the Impacted Jurisdiction. Strictly limit or do not perform this Tactic in the Severe Damage Zone (SDZ) and the Dangerous Radiation Zone (DRZ).

Tactic 6 Checklist

- ☐ Initiate power restoration activities, including deploying fuel and mobile generators to support lifesaving operations in the Impacted Jurisdiction.
- ☐ Re-establish communications, focusing on repairing or deploying mobile radio and cellular towers.
- ☐ Clear debris and restore major roadways and other transportation infrastructure for evacuation and logistics corridors.
- ☐ Ensure firefighting infrastructure is functional.
- ☐ Assess unstable hazardous material infrastructure and prioritize stabilizing it.
- ☐ Identify and secure any existing emergency response stockpiles or key resources that are vulnerable to loss through destruction or theft.

KEY ACTIVITIES:

Initiate power restoration activities as soon as possible, focusing on critical infrastructure and key resources. Critical infrastructure with generators will likely function so long as they have fuel.[21]

- Supporting Jurisdictions should start moving fuel and water to support operations in the Impacted Jurisdiction.
- Supporting Jurisdictions identify and coordinate with utility services to restore power. Although regional power outages will be likely due to system disruptions and destabilization, the amount of power system equipment that is permanently damaged or temporarily disabled will be limited. Power can be quickly restored to most Supporting Jurisdictions. Occasional in-person service or automated restarts will be needed to restore power.
- The Impacted Jurisdiction will likely be able to restore power outside the LDZ as well as in some areas in the LDZ within 72 hours, depending on grid configuration, utility response plans,

[21] Generators have proven very robust against the EMP threat. (Pennington, 2021)

availability of spare relay and control equipment, and access impacts due to fallout and blocked roadways.

- Annex 1 provides radiation exposure decision points that may be applied to emergency workers conducting infrastructure repair. Consider also offering radiation safety and hazard awareness trainings to reduce fears and gain buy-in for supporting the mission.

Supporting and Impacted Jurisdictions should strengthen and re-establish communications by focusing on radio and cellular towers.[22] Employ temporary communication capability with onboard power wherever possible.[23] Supporting Jurisdictions should start collecting portable power and repeaters to deploy to the Impacted Jurisdiction. Use civilian/amateur radio networks, if available.

Figure 7. Example of Anticipated Impacts in Light Damage Zone.[24]

[22] Towers are the most vulnerable part of a communications network. Once they are restored, many battery-powered communications devices will be able to connect because they are more resilient to EMP than towers. (Federal Emergency Management Agency (FEMA), 2022).
[23] Examples of temporary/mobile radio and cellular communication equipment include P25 or other radio frequency (RF) portable and mobile command centers, base stations, and repeaters, and cellular on wheels and cellular on light trucks.
[24] (JossK / Shutterstock.com)

Planning Tip

Debris clearance during the initial response to a nuclear detonation may look very different from clearance for other types of emergencies, which often involves removing debris and consolidating it in temporary staging locations on or near the incident site. After a nuclear detonation, the primary purpose of debris clearance is to establish corridors for emergency responder access. Given the expansive debris field and urgent need for access to the blast zones, this might require debris, including disabled or abandoned vehicles, to be pushed aside rather than towed or otherwise removed.

Clear debris from and restore major roadways and other transportation infrastructure (e.g., railways, airports) for evacuation operations and movement of logistics support. Physical damage, including that from the electromagnetic pulse (EMP), will not be uniform. Supporting Jurisdictions should:

- Begin recovering roadways and re-establishing communications with the outer edges of the LDZ, moving safely from there towards (but not into) the SDZ.
- In the LDZ, focus on major highways and routes to first responder facilities like fire houses, EMS service centers, hospitals, and police stations. Then, focus on corridors through residential and commercial districts to expedite an evacuation. A considerable amount of roadblocking debris may be disabled or abandoned vehicles.
- In the MDZ, prioritize establishing firefighter access to areas where large populations may be sheltering or to collection points with groups of evacuees. In this zone, there will be significantly more debris covering the roadways. Large debris from damaged or collapsed buildings and overturned cars will need to be pushed aside or removed.
- When clearing roadways of debris – particularly overturned vehicles – be prepared for injured, trapped, or incapacitated people who will need triage, treatment, and evacuation.
- Hang/Display new signage to indicate directions to critical locations. In impacted areas where visibility and orientating landmarks are limited, indicate which direction leads away from the SDZ, DRZ, and HZ.

Investigate water systems that are critical to firefighting. Water line breakage in the SDZ may impact the needed supply elsewhere. Start moving water trucks into the Impacted Jurisdiction for distribution.

Identify hazardous material infrastructure that may be a risk to surrounding sheltered populations and prioritize its stabilization. For example, chemical manufacturing facilities, fuel or oil refineries and storage sites, gas stations, power generation facilities, water treatment facilities, and any large chemical storage facilities will present large-scale hazards if they are not shutdown safely or if they are compromised by the detonation. Recurring assessments will be needed to verify safety.

Identify and secure any existing stockpiles of key resources needed for the ongoing response that are vulnerable to loss through destruction or theft. Examples of government and private stockpiles include Strategic National Stockpiles (SNS) caches, coastal storm and disaster stockpiles, healthcare supplies, and private sector warehouses.

Coordinate and continuously update infrastructure assessments and information into the data collection point or EOC established in Tactic 3.

Refer To

FEMA's Planning Guidance for Response to a Nuclear Detonation, Third Edition

- "Chapter 7: Alerts, Warnings, Notifications, and FEMA's Integrated Public Alert and Warning System" for a discussion on resilience of and impacts to communications infrastructure after a nuclear detonation.
- Appendix 1.1 for an overview of the EMP, high-altitude EMP, and geometric disturbance risks and impacts after a nuclear detonation.

See also the following additional resource:

- Source Region Electromagnetic Pulse Planning Considerations, a report by Sandia National Laboratories, for greater technical depth on the threat and impacts of source-region EMPs.

Mission: Provide Care to Survivors

Tactic 7: Evacuate

GUIDANCE SUMMARY:

Support the mass movement of people along the safest routes away from damaged or hazardous areas and towards Supporting Jurisdictions preparing to receive survivors. Amplify recommendation to shelter for all people in the Dangerous Radiation Zone. Begin planning a time-phased, prioritized evacuation for all blast damage zones and other areas where it is unsafe for people to remain.

Tactic 7 Checklist

- ☐ Facilitate movement of self-evacuees towards safety and into Supporting Jurisdictions.
  - o Clear corridors for safe egress.
  - o Do not prevent movement of spontaneous evacuees.
- ☐ Identify evacuation priorities based on each zone type (Table 6).
- ☐ Assign transportation resources to support planned and spontaneous evacuations.
- ☐ Supporting Jurisdictions prepare to receive and care for evacuees.
  - o Activate existing plans for shelter, mass care, feeding, and housing.
  - o Establish CRCs to screen people arriving to Supported Jurisdictions
- ☐ Supporting Jurisdictions identify receiving points for evacuees and communicate these locations to other jurisdictions.

KEY ACTIVITIES:

The Impacted Jurisdiction should expect that a large portion of the population will attempt to evacuate despite sheltering recommendations.[25] Unfortunately, it may initially not be feasible for Supporting and Impacted Jurisdictions to operationalize a coherent evacuation system. Instead, these jurisdictions should expect to improvise, focusing efforts on the four actions described in this Tactic:

[25] Important terminology: Self-evacuation is not the same as spontaneous evacuation. Self-Evacuees: Evacuees with the means and capability to evacuate the impacted area without government-provided transportation assistance. Spontaneous Evacuation: When individuals in threatened areas observe an incident or receive unofficial notice of an actual/perceived threat and, without receiving instructions to do so, elect to self-evacuate the area. (Federal Emergency Management Agency (FEMA), 2019)

1. Facilitate movement of spontaneous evacuees:
    - Responders should not use resources to interfere with spontaneous evacuees. Responders will have little control of people who do not heed shelter instructions and choose to move themselves out of the damaged areas. Instead, responders should focus on ensuring that people are moved away from major hazards or obstacles that would put their lives in further danger (e.g., fire, high levels of radiation, impassable exit points, debris) and direct them in a general direction towards areas where Supporting Jurisdictions can receive them.
    - Instruct the public to conduct rapid, dry self-decontamination while they evacuate as described in Tactic 9. Evacuation should not be delayed due to the presence of contaminated individuals, because they are not at imminent risk of health effects to themselves or people around them. Interrupting the evacuation movement to identify or separate and decontaminate those who are contaminated will cause delay and waste limited resources.
        - However, in the Supporting Jurisdictions there may be sufficient resources available to perform screening and decontamination. See Tactic 9 for guidance.
2. Identify and communicate evacuation priorities and routes:
    - Assign initial shelter and evacuation priorities for each zone type identified in Tactic 3. Table 6 provides recommended initial public shelter and evacuation actions for each zone type.
    - Further adjust shelter and evacuation priorities as more information on zone boundaries, evacuation resources, shelter protective factors, and hazards become available.
        - Tactic 3 highlighted the importance of tracking the spread of fires and fallout deposition. Both data points, if regularly updated, will be critical indicators for identifying when evacuation strategies must be rapidly adjusted to either direct/reroute evacuees out of harm's way or devote resources to assisted evacuations in areas where fires threaten sheltered populations.
    - While the initial response continues, begin to develop a time-phased, prioritized evacuation plan for all blast damage zones and other areas where it is unsafe for people to remain. Communicate this plan to responders and the public.
        - Identify sheltered populations with high priority for directed evacuation based on imminent or short-term hazards.
        - Identify corridors for the most efficient and safe egress towards Supporting Jurisdictions. Prioritize these corridors for roadway clearing operations (Tactic 6).
        - Communicate targeted evacuation instructions to populations though all available methods: emergency broadcast systems, social media, and even bullhorns. People who

remain in shelter will be waiting ("staying tuned") for additional information on how to evacuate and where to go.

- When communicating evacuation instructions, encourage evacuating populations to self-evacuate and inform them of safe routes. Because resources for transportation-assisted evacuation will be limited, the message should stress that those able to help themselves (and others) should do so.

Table 6. Initial Evacuation Priorities for Each Zone

Zone Type	Shelter and Evacuation Priorities
LDZ	Instruct public to shelter inside. ▪ Conduct targeted evacuation of unsafe areas (e.g., fires, heavy smoke, unstable structures). ▪ Direct evacuees towards safety and away from HZ. Do not prevent spontaneous evacuation.
MDZ	Instruct public to evacuate towards the LDZ and away from the HZ. ▪ Prioritize assisted evacuation for the non-ambulatory. ▪ Recruit volunteers to support evacuation.
SDZ	Instruct everyone – responders included – to remain sheltered indoors. ▪ Move if shelter threatened by fire, collapse, or other hazards. ▪ Prepare to evacuate once radiation levels are less than 10 R/h. ▪ Consider evacuating through subterranean structures (e.g., subways, tunnels).
DRZ*	Instruct everyone – responders included – to remain sheltered indoors. ▪ Prepare to evacuate (in 12–24 hours) once radiation levels are less than 10 R/h. ▪ Consider evacuating through subterranean structures (e.g., subways, tunnels).
HZ (beyond MDZ & LDZ)	Instruct public to shelter inside. ▪ Targeted evacuation of unsafe areas (e.g., fires, heavy smoke, unstable structures). ▪ Direct self-evacuees towards safety and away from HZ: Do not prevent spontaneous evacuation.

* For areas in the MDZ and LDZ that are also in the DRZ, follow the DRZ shelter/evacuation priorities until radiation decays below DRZ levels.

3. Assign resources to support planned and spontaneous evacuations:
    - Prioritize assigning evacuation resources to move:
        - People who require assistance to evacuate themselves and cannot self-evacuate (e.g., non-ambulatory individuals, individuals with disabilities or access, and functional needs).
        - Populations that are known to be more sensitive to the effects of radiation (e.g., infants, children, pregnant people, nursing people).[26]
        - People in areas where an expedited evacuation process is necessary to avoid loss of life due to hazards, such as fallout, fire, and smoke.
        - Injured, non-ambulatory survivors who have been triaged at ad hoc treatment sites or medical facilities in the MDZ and LDZ (Tactic 8).
    - Leverage existing mass transportation/transportation disruption plans and use all available infrastructure to assist with the movement of people – common carrier (buses, rail, metros), personal vehicles, watercraft, and aircraft. Properly assigning these resources will allow for a transition to a planned, managed, and responder-supported physical movement evacuees.
    - Deploy responders along evacuation corridors to direct self-evacuees towards safety: out of the LDZ, away from the HZ, and towards the appropriate reception points (e.g., shelters, community reception centers (CRC), service centers, etc.) in the Supporting Jurisdiction.

Planning Tip

Many components of the transportation infrastructure are owned and maintained by private entities. Engage these groups during the planning process to achieve a documented understanding of their capabilities and communication methods. Help them recognize their tremendous capacity to save lives and that they would be an integral part of a successful evacuation plan. Consider also offering radiation safety and hazard awareness trainings to reduce fears and gain buy-in for supporting the mission.

4. Prepare to receive and care for evacuees:
    - Supporting Jurisdictions should identify points of entry for receiving of evacuees and communicate these locations to all other jurisdictions' EOCs and the Impacted Jurisdiction.
    - Supporting Jurisdictions should activate existing shelter, mass care, feeding, and housing plans (e.g., plans that would be used for major coastal storms, wildfires, or earthquakes).

[26] (US Environmental Protection Agency (EPA), 2017)

These plans will need to be rapidly adapted to account for greater urgency and capacity than they were originally designed, and to integrate state and federal resources as they arrive.

- Although evacuees may not arrive in significant numbers to areas further out for several days or weeks, jurisdictions across the United States – the Nationwide Support – should, during these first few days of a response, initiate preparations to house and care for those evacuating.

Refer To

FEMA's Planning Guidance for Response to a Nuclear Detonation, Third Edition

- "Chapter 3: Shelter & Evacuation," for an introduction to the key shelter and evacuation planning considerations after a nuclear detonation.

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Tactic 8: Triage, Stabilize and Transport

GUIDANCE SUMMARY:

Early on, responders should prioritize treatment based on trauma and burn triage categories. When possible, also triage for radiation illness and combined (radiation illness and trauma) injuries. Stabilize and transport the injured to medical facilities for treatment. Assess availability of resources and activate crisis standards of care procedures, if needed. Support healthcare facilities by identifying their resource needs and establishing ad hoc treatment sites.

Tactic 8 Checklist

- ☐ Establish and support ad hoc triage sites in/near the blast damage zones, prioritizing treatment based on trauma and burn triage categories.
- ☐ Begin transporting patients to medical facilities, including facilities in the Supporting Jurisdiction.
- ☐ Healthcare providers and first responders should assess their resource availability and determine if they need to implement crisis standards of care.
- ☐ EOCs should communicate with medical facilities to assess operating status and resource needs.
- ☐ Supporting Jurisdictions should identify receiving medical facilities and inform the Impacted Jurisdiction of their location, status, and capabilities (e.g., burn units, cytokines).

KEY ACTIVITIES:

Responders should immediately mobilize to support medical triage and treatment sites and facilities to maximize lifesaving potential, especially:

1. Ad hoc and spontaneous triage sites:[27] Responders in the Impacted Jurisdiction should establish ad hoc sites for triage and initial patient stabilization in the Moderate Damage Zone (MDZ). For responders already in the Dangerous Radiation Zone (DRZ) or Hot Zone (HZ) shortly after the blast, ad hoc triage operations should be conducted in well-sheltered indoor locations. Sites will likely also be established spontaneously as survivors congregate or are brought to sites of opportunity. Proximity to the detonation site, scarcity of resources, and transportation limitations will render these sites the most austere.

[27] These may also be referred to as "Radiation Triage, Treatment, and Transport (RTR) 1," "RTR 2," and "RTR 3" sites, with the number indicating relative proximity to the detonation site or the hot zone. The RTR system is described in Chapter 4 of FEMA's "Planning Guidance for Response to a Nuclear Detonation."

- Local responders should communicate the status, number of casualties, level of care, and resource needs to the Impacted Jurisdiction's emergency operations center (EOC) as part of their "pixel" of information.

- Survivors seeking care may have physical trauma, burns, acute radiation syndrome (ARS), and combined (radiation illness and trauma) injuries requiring triage.

- Survivors with minimal or no injuries should be instructed to self-decontaminate (see Tactic 9) and, if possible, should be assessed for radiation exposure (see Annex 3).

2. Medical Facilities – Impacted Jurisdiction: Intact and partially intact medical facilities in the Light Damage Zone (LDZ) and HZ should serve as receiving points for casualties requiring lifesaving treatment or stabilization from nearby areas, including from nearby ad hoc triage sites.

    - Medical facilities in the MDZ and DRZ may be able to operate for a limited time, but facilities lacking water and electricity will be unable to sustain lifesaving care. Supporting Jurisdictions should prepare for rapid evacuation and demobilization of these facilities once it is safe.

        - Medical facilities in the DRZ will need to relocate operations into inner and/or underground areas of their building to safely sustain operations until evacuation is possible or radiation decays below DRZ levels.

    - Medical facilities that must remain open in any of the blast damage zones may have to operate in austere conditions before they can be replenished with basic supplies, personnel, medicine, fuel, etc. Impacted and Supporting Jurisdictions should attempt to make contact with these facilities to assess their status, resource availability and facility damage, and to establish timelines for arrival of resources or potential devolution and evacuation support.

3. Medical Facilities – Supporting Jurisdictions: Medical facilities and temporary field hospitals should serve as the primary point of intake for injured survivors arriving from the Impacted Jurisdiction and should be prioritized for medical resource allocation.

    - Immediately after detonation, these facilities should request resources and begin discharging and transferring patients to maximize capacity. Supporting Jurisdictions should identify and communicate the location of receiving facilities to the Impacted Jurisdiction.

    - Receiving hospitals should prepare their facilities for a catastrophic mass casualty event, activate radiation response teams, and implement surge plans to maximize staffing and capacity. Hospitals should anticipate staff leaving or not reporting to work due to fear of radiation, their caring for family members, or being unable to travel due to impacts from the detonation and emergency response. Radiation levels and dose will be critical pieces of information for hospitals to track for their staff.

    - Supporting Jurisdictions should use all means necessary to substantially increase medical treatment capacity, such as requests for help from state and federal government as well as coordination with healthcare coalitions and private sector partners for procurement of

medical staff force multipliers for existing facilities and temporary field hospitals. (e.g., federal medical stations available through HHS).

4. Expert Centers: Patients who are at risk of ARS or have thermal or radiation burns will require specialized care. The Radiation Injury Treatment Network (RITN) is a national network of medical centers with expertise in managing health consequences of ARS and radiation injuries. Jurisdictions should coordinate with RITN facilities and specialized burn centers during their planning process since these are limited in number and capacity. Expert centers may also be able to provide telemedicine support to other healthcare providers (HCPs) at medical facilities or field hospitals in the wake of a detonation.

Crisis standards of care (CSC)[28]: Responders and HCPs need to consider the availability of resources while triaging or re-triaging patients and deciding if/when to implement CSC. CSC decision-making can put enormous stress on responders and HCPs, highlighting the importance of having predetermined indicators for when to activate CSC to the extent possible. If possible, indicators and triggers should be aligned between jurisdictions and HCP organizations.

- CSC are not standardized; however, facilities should aim to develop indicators for critical space (e.g., intensive care units), staff (e.g., surgeons, nurses), and supplies (e.g., cytokines, blood products) to determine when CSC should be activated.
- Resource availability will vary by location and conditions may improve as patients are transported from Impacted into Supporting Jurisdictions, so it is important to reassess survivors and have a process for re-triage, as well as to reassess the need for CSC.
- See Annex 3: Example Triage Protocol, for steps that responders and HCPs can implement for triage during the initial response while taking into account resource availability.
- State governments should issue CSC declarations statewide, providing clear mitigation measures for localized crisis conditions and assisting facilities that are disproportionately impacted.[29]

Planning Tip

Each medical facility and treatment site must assess its own operating environment to determine when to activate CSC. Facilities close enough to experience blast damage should consider planning to activate crisis standards immediately, then reevaluate those standards once additional resources become available.

[28] Crisis standards of care refers to the level of care possible during a crisis or disaster due to limitations in supplies, staff, environment, or other factors (Institute of Medicine of the National Academies, 2009).
[29] (US Department of Health and Human Services (HHS) Administration for Strategic Preparedness & Response (ASPR) Technical Resources, Assistance Center, and Information Exchange (TRACIE), March 2022)

Triage: Implement a preestablished set of triage guidelines appropriate for the resource-scarce post-detonation environment.

- Responders and HCPs in the Impacted Jurisdiction should triage and treat for overt injuries first, such as burns and trauma, as they would in any mass casualty situation.
- Priority should be to treat people with injuries that are severe enough to lead to death without treatment but who are likely to recover with treatment. Refer asymptomatic and uninjured patients to other intake locations so they can be further assessed and connected with other social services (e.g., shelter, family reunification).
- Responders may develop or receive triage protocols from public health authorities to classify severely injured fallout casualties as "expectant." Appropriate, pre-determined policies and procedures can ensure that expectant patients promptly receive what palliative care is available.

Assess for radiation injury: When a patient's triage category is assessed or re-assessed, signs and symptoms of radiation injury and the availability of resources should be considered. It may be difficult to assess an individual's radiation exposure during the first minutes, hours, and possibly days since medical signs and symptoms of radiation injury may be delayed. Potential strategies for early dose assessment may include:

- Survivor's geographic location (e.g., address, indoor shelter vs. outdoor)
- Known conditions in the area (e.g., damage, presence of fallout)
- Time to onset and severity of the signs or symptoms of ARS
- Time spent in the area and duration of potential exposure
    - There will be survivors with physical trauma and little or no radiation exposure, survivors in the DRZ with no trauma but with significant radiation exposure, and survivors with combined injuries (trauma and radiation illness). Radiation injury, especially if combined[30] with trauma or burn injuries, may be a reason to lower the priority of a person's triage category due to complications and lower likelihood of survival. See Annex 3 for more detailed triage guidelines.
    - Depending on resource availability, other triage, point-of-care, and laboratory-based tests may be used to predict the severity of ARS.

Transport: Begin moving patients immediately between ad hoc and spontaneous triage sites and medical facilities in the Impacted and Supporting Jurisdictions where it is safe to do so (see Figure 8). Patients should not be moved into or through the DRZ.

[30] Patients with combined injuries have worse outcomes and are time and resource intensive. If dose is > 600 rad (6 Gy), these patients will likely have a poor outcome. Those with dose estimates based on location below 50 rad (0.5 Gy) should not report for medical evaluation but should join a registry. (Coleman, et al., 2011). (Flynn & Goans, 2006).

- Clear streets to/from hospitals to enable transportation of injured people to the Supporting Jurisdiction and resources to the Impacted Jurisdiction and maximize lifesaving efforts.
- Due to the anticipated number of casualties and infrastructure damage, routine systems for patient transportation are unlikely to be available. Response assets will also have difficulty reaching sites in the damage and fallout zones (possibly for a few days). Be prepared to use all means necessary to transport injured to treatment locations.
- Most people will likely reach medical care without first being triaged or screened, therefore triage services may be needed at medical facilities. Patients will arrive by self-transport or other non-emergency medical services mechanisms until resources from Supporting Jurisdictions are available (e.g., air-based transfer).

Begin to establish an organized and coordinated process for conducting triage and transport of casualties. Consider implementing the Radiation Triage, Treatment and Transport System (RTR) to save as many lives as possible by making the best use of available resources.[31]

Figure 8 provides a high-level overview of patient movement out of the Impacted Jurisdiction. Medical facilities in the Supporting Jurisdiction must activate their surge plans and begin discharging and transferring patients immediately. People not requiring treatment should be evacuated to safety.

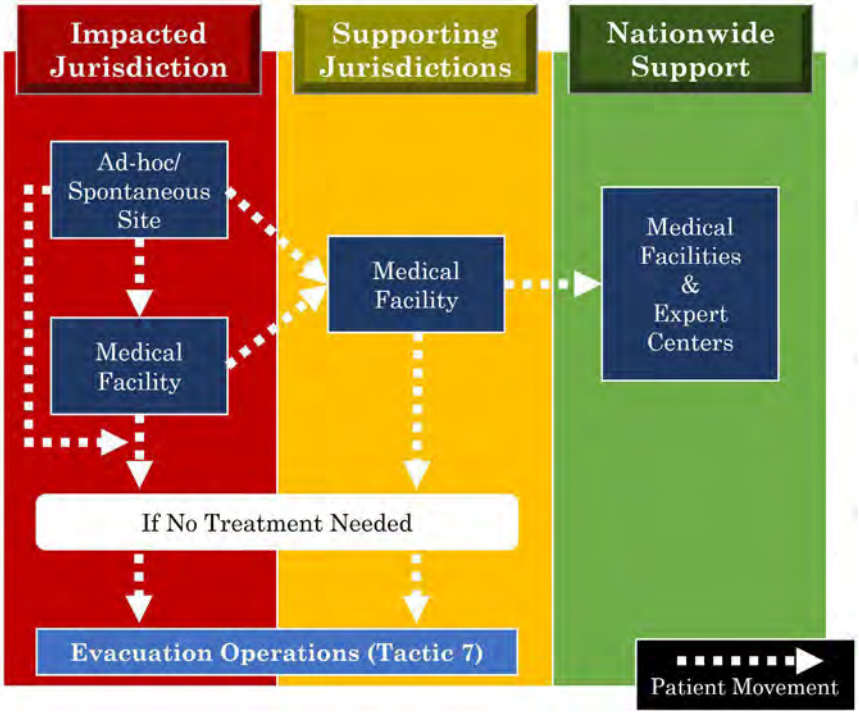

Figure 8. Simplified Diagram of Patient Movement.

[31] (Federal Emergency Management Agency (FEMA), 2022, p. 87)

Communicate: Establish communications with hospitals and other healthcare facilities in the Impacted and Supporting Jurisdictions. As part of their "pixel" of information for the common operating picture, responders and facilities should provide regular updates on:

- Operating status (e.g., number of available beds, staffing)
- Resource needs (e.g., water, fuel, supplies)
- Building blast damage and infrastructure status (e.g., windows)
- Number of casualties, types of injuries, and triage categories

Mental Health: Resource constraints may exacerbate or cause psychological and behavioral health impacts, which will be prevalent after a nuclear detonation. Responders and the public will have significant needs including housing, food, contacting/locating family members, and receiving up to date information. Psychological and behavioral healthcare providers should be included in the planning process to mitigate and prepare for issues including anxiety, post-traumatic stress disorder (PTSD), fear, and depression. Psychological first aid can be applied immediately to help the public and responders cope with the trauma of a nuclear detonation event.

Refer To

72-Hour Nuclear Response Guidance

- "Annex 3: Example Triage Protocol", for steps that responders and healthcare providers (HCPs) can implement for triage during the initial response.

FEMA's Planning Guidance for Response to a Nuclear Detonation, Third Edition

- "Chapter 4: Acute Medical Care", for an overview of the injury types expected after a nuclear detonation, considerations for conducting triage and treatment, and an overview of the radiation triage, treatment, and transport (RTR) system.
- Chapter 4 Annexes, for additional information on ARS, triage, and resources for healthcare providers, responders, and planners.

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

- Provides 24/7 subject matter expertise on the medical management of radiological illnesses and injuries, downloadable just-in-time resources, and other materials. The REAC/TS RadMed app that may be useful during pre-planning and response activities for responders and providers can be found on the REAC/TS website.

Tactic 9: Decontaminate

GUIDANCE SUMMARY:

Promote and support rapid, dry self-decontamination methods, such as changing or shaking outer layer of clothes and wiping exposed surfaces. In the Impacted Jurisdiction, minimize use of limited resources on population monitoring and technical decontamination.[32]

Tactic 9 Checklist

- ☐ Prioritize dry, rapid decontamination techniques. Population monitoring is not an early priority, especially in the Impacted Jurisdiction.
- ☐ Provide public messaging that instructs people to perform self-decontamination.
- ☐ Provide replacement clothing for potentially contaminated evacuees arriving to Supporting Jurisdictions.
- ☐ Support ad hoc sites with screening and decontamination capabilities.

KEY ACTIVITIES:

Leverage early, dry self-decontamination tactics/methods:[33]

- Early: Fallout is primarily composed of short half-life isotopes that rapidly decay in the first day, such that early self-decontamination is far more effective at reducing radiation exposures than a delayed, thorough, wash down with water.
- Dry: Since fallout is likely to be particles the size of table salt or fine sand, dry decontamination techniques are very effective at reducing levels of contamination, and thus exposure. Dry decontamination methods do not involve the use of liquid water to remove contamination; instead, they include removing the outer clothing and using a brush, adhesive tape press, moist towelettes, etc. to remove contamination.[34]

Issue frequent, clear, and consistent public messages about self-decontamination through multiple communication channels and in languages appropriate for all affected communities. Messages should be pre-scripted and developed as part of the planning process instructing people to: [35]

[32] Technical decontamination is the planned and systematic process of reducing contamination to a level that is as low as reasonably achievable. It is typically implemented by HAZMAT or medical personnel with specialized resources. (National Fire Protection Association (NFPA), 2021).
[33] (Buddemeier, Nuclear Detonation Fallout: Key Considerations for Internal Exposure and Population Monitoring, 2018), (Federal Emergency Management Agency (FEMA), 2022)
[34] (US Army, 2013)
[35] (US Department of Homeland Security (DHS), 2019)

- Perform self-decontamination by changing clothes, especially the outer layer. Contaminated material can easily be caught in the collar of shirts, top of shoes around the ankles, or similar locations.
- Place potentially contaminated clothes in a plastic bag or other sealable container and away from people.
- Shower if running water is available. If not, use moist wipes, paying particular attention to face, hands, and hair. If washing your hair, do not use conditioner.
- Decontaminate medical equipment (e.g., wheelchairs, eyeglasses), service animals, pets, vehicles, and other important items by wiping, brushing, or, if available, rinsing with water.
- Continue to follow shelter and evacuation recommendations. Do not delay self-decontamination.

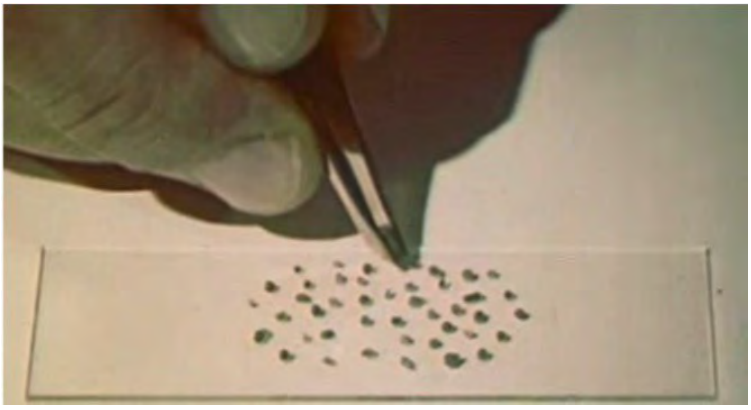

Figure 9. Fallout Particles Will Be Similar in Size to Salt and Sand.[36]

In the Impacted Jurisdiction, limited response resources should not be used on extensive population screening and decontamination operations (such as Community Reception Centers (CRCs)) in the first few days. It is also important to note:

- Rapid, dry, self-decontamination is the most efficient method to quickly reduce contamination on large numbers of people as they evacuate and should be performed without requiring screening. Limit assisted dry decontamination to individuals who cannot self-decontaminate.
- It will be important to communicate in what areas, based on where there is fallout, people should self-decontaminate, along with in what areas self-decontamination and changing clothes are unnecessary because fallout is unlikely.

[36] (Federal Emergency Management Agency (FEMA), 2022)

- Screening people for contamination will be difficult in areas where radiation levels are elevated. This includes all outdoor and some indoor areas in/near the Hot Zone. This is another reason why CRCs and contamination screening are not an early priority in the Impacted Jurisdiction.

Supporting Jurisdictions should lead organized screening[37] and decontamination operations. When resource availability allows, begin establishing dedicated CRCs or integrate screening and decontamination services into ad hoc sites, medical treatment sites, locations with replacement shoes and clothing (e.g., shopping centers), and/or at shelter and evacuation hubs.

Screening/decontamination services will be time and resource intensive, but public demand for them will be high. Supporting Jurisdictions must begin preparing for these operations during the early phase, so they can be operationalized as more resources become available.

- Locate screening, decontamination, and/or CRC operations in natural background or near-natural background radiation areas, when possible, and focus on people who may have been in the DRZ or HZ or traveled through those zones.
    - If screening must occur in high-background areas (i.e., elevated background), such as at ad hoc sites outside of the HZ and DRZ, consider focusing on partial body screening and setting release levels to twice elevated/existing background.[38] Partial body screening assesses only the areas most likely to be contaminated: the head, face, hands, shoulders, and feet. [39]
    - If screening occurs in areas of low/normal background, screening release levels may be raised to increase overall through-put while ensuring the most highly contaminated people are identified and decontaminated (or directed to self-decontaminate).[40]
    - If decontamination resources *are adequate* for the number of people requiring screening, then consider setting release levels to twice *natural* background to maintain an efficient through-put.[41]

[37] The purpose of screening is not to identify the presence of radiological contamination but, instead, to distinguish those who are contaminated above a specified contamination threshold (and, therefore, more likely to experience health effects caused by the contamination) – referred to as the "screening level" – from those who are contaminated to a lesser extent. Attempts to decontaminate people or objects to a "zero contamination level" would require enormous resources and result in negligible reduction in risk. (Buddemeier, Nuclear Detonation Fallout: Key Considerations for Internal Exposure and Population Monitoring, 2018)

[38] (US Environmental Protection Agency (EPA), 2017)

[39] (Centers for Disease Control and Prevention (CDC), 2014)

[40] (National Council on Radiation Protection and Measurements (NCRP), 2008); Low background in this context is defined as less than 0.1 mR/h or 1 µSv/h gamma exposure.

[41] Note: "Local and state officials may choose to establish a screening level expressed in measurement units (e.g., cpm, µR/h) that are compatible with radiation detection instruments being used and appropriate for local conditions, taking into account the number of people in need of screening and available resources." (US Environmental Protection Agency (EPA), 2017)

  - If decontamination resources are *not adequate* for the number of people requiring screening and the goal of two times background is impractical, then increase screening release levels up to 170 Bq/cm^2 and consider prioritizing partial screening to increase through-put.[42] The CDC's CRC SimPLER tool is a resource that responders can also use to help adjust screening criteria according to resources and estimated demand.[43]

- If there is no time, no screening equipment available, or it is expected that most of the population will be contaminated above screening release levels, instruct people to self-decontaminate with any resources that are available (e.g., water, wipes, replacement clothing) and prioritize assisted decontamination for people who cannot self-decontaminate, such as people with disabilities, access, and functional needs.

Anticipate and correct misperceptions. Public and responder misperceptions about decontamination will likely be an issue that emergency managers and decision makers should anticipate needing to correct early and frequently during the response. In particular, watch out for instances where the public and/or first responders make any of the following mistakes:

- Emphasizing or requiring wet-decontamination techniques: Wet decontamination[44] is labor and resource intensive, may result in a diversion of valuable response resources, and, in cold weather, poses a risk of hypothermia.

- Showing reluctance to provide lifesaving assistance to others due to fear of exposure to radiological contamination: Radiological contamination on people is not likely to be immediately life-threatening to the population or the responders assisting them. Decontamination is important but use judgement before spending time decontaminating people. Decontamination may delay or prevent access to lifesaving medical care, shelter from fallout, or use precious time and resources in challenging environments, such as areas where radiation levels are elevated.

- Expecting to decontaminate to background levels, or lower: There is no universally accepted screening level above which a person is considered "contaminated" (external or internal) and below which a person is considered "uncontaminated." Similarly, there is not a universal screening level for release and some people may incorrectly assume that if an area, person, or object is released, that indicates "zero" contamination is present.

[42] See also note in footnote number 41. (National Council on Radiation Protection and Measurements (NCRP), 2008). (Federal Emergency Management Agency (FEMA), 2002)

[43] (Centers for Disease Control and Prevention (CDC), 2023)

[44] Wet decontamination typically involves the use of liquid water, with or without other cleaning products. Wet decontamination methods include washing, showering, sponging, etc. to remove contamination. (US Army, 2013)

Refer To

FEMA's Planning Guidance for Response to a Nuclear Detonation, Third Edition

- "Chapter 5: Population Monitoring" for more on contamination considerations, screening, decontamination, CRCs, and registry planning.
- "Chapter 5 Annexes" for an overview of the populations that will need screening or decontamination services, as well as information on screening and decontamination techniques.

See also:

- CDC's CRC SimPLER tool, which can be used to evaluate the impact of lowering or raising screening criteria according to available resources and estimated demand.
- The Radiological Operations Support Specialist (ROSS) Toolkit, available to planners and responders with a CBRNResponder account, provides additional guidance on screening and decontamination decision-making.

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Mission: Prepare for Intermediate Response

Tactic 10: Transition to a Prolonged Response

GUIDANCE SUMMARY:

Previous Tactics focus on information gathering and executing life-safety operations. While conducting these activities, Impacted and Supporting Jurisdictions must also take initial steps to prepare for a prolonged emergency response. This includes early-phase collection of public health data, resource requests, scarce resource conservation, public communication, and fatality management to prepare for the massive response that will develop in the days and weeks ahead.

Tactic Checklist

- ☐ Establish a data collection framework for public health and environmental monitoring data.
- ☐ Assess existing resources and capabilities to identify current and projected needs and shortages.
- ☐ Integrate communications staff into multiple layers of the response.
- ☐ Initiate fatality management plans and acquire related resources.
- ☐ Impacted Jurisdiction should deploy representatives to Supporting Jurisdictions to advocate for their needs and provide local-level expertise.

KEY ACTIVITIES:

Document public and responder exposures: Impacted and Supporting Jurisdictions should establish a data collection framework for public health and environmental monitoring data to document hazards and exposures for the public and responders.

- Begin documenting exposures (e.g., radiation, silica dust, smoke, asbestos) early in the response to inform ongoing life-safety operations and long-term field operations, and to protect public health over the weeks, months, and years ahead. The CDC's "Emergency Responder Health Monitoring and Surveillance" framework and tools such as the "Rapid Response Registry" may help with tracking responders' health and safety pre-deployment, during deployment, and post-deployment.[45]
    - Establish a centralized radiation exposure database for emergency workers. Activate procedures for determining and implementing dose decision points. Also, use incident command system (ICS) concepts to record and communicate those doses to responders.

[45] (Centers for Disease Control and Prevention (CDC) - The National Institute for Occupational Safety and Health (NIOSH), 2022); (Agency for Toxic Substances and Disease Registry, 2015)

Annex 1 provides best practices related to emergency response dosimetry and dose management techniques in a nuclear detonation environment.

- Assess the availability of data collection equipment and capabilities. The Impacted Jurisdiction should identify capability gaps that Supporting Jurisdictions can fill or that might be requested of state/federal resources.
    - Establish data quality expectations early to optimize collected data for use during both the initial response phase as well as for long term public health monitoring.
    - Impacted and Supporting Jurisdictions should coordinate and develop a process for how to request additional information from data collection teams to reduce uncertainty and streamline these requests.

Communicate: Impacted and Supporting Jurisdictions should communicate information as it becomes available through all available communication channels.

- Joint information centers (JICs) may need to be virtually convened to improve response time for public information coordination.
- Ensure public information officers (PIO) are included in response operations planning, even if physically separated from operations during the initial response.
    - Including PIOs in planning will allow them to respond more quickly and accurately to press and questions from the public, which will reduce the burden on technical staff who may be needed to advise responders and incident leadership.
- Supporting Jurisdictions should use all available information dissemination mechanisms to share lifesaving information (e.g., when it is safe to stop sheltering, where can survivors access medical care, how to conduct self-decontamination). Depending on the extent of damage and potential impacts from an electromagnetic pulse (EMP), communications capabilities may be severely hindered in the Impacted Jurisdiction.
    - Determine most effective means of communication once cell and internet service begin to be restored. This includes determining long-term strategies for reaching people who have been displaced and/or evacuated.
    - Clearly define a timeline for informational updates to the public. This includes establishing a routine data publication process with a publicly available schedule.
    - Designate a public spokesperson to provide timely and accurate information, maintain credibility, and begin building rapport and trust with the public.

- The best spokesperson may initially be a first responder or another individual chosen ad hoc. Early selection of a single spokesperson, or a small team of spokespeople, will help a jurisdiction communicate critical information later.

- Maintain awareness of public sentiment about identified spokesperson(s).

- Monitor for and respond to misinformation, disinformation, and malinformation.

- Supporting Jurisdictions can assist by providing just-in-time media training to available public affairs staff.

Conserve resources: Technical expertise and physical resources will be constrained by transportation disruptions and increased demand throughout the region. Rapid adaptation will be necessary as resources are rotated out or used up after the first days of response.

- Simultaneously deploy all needed physical resources while also aggressively conserving those that are disposable or consumable. Conservation should occur only to the extent that it does not put lives at risk or limit response capability. A prime example of conservation is the re-use of disposable, yet functional PPE.

Prioritize resource requests: Prioritize initial resource requests based upon urgency of mission/need and estimated delivery times, such as resources that can be sourced from the immediate region. Leverage mutual aid resources and agreements, including the Emergency Management Assistance Compact (EMAC)[46] process. Requests for state/federal support should go through a state emergency management agency.

- Coordinate with FEMA and the state to request specialized radiological/nuclear resources that may be available within 72 hours for on-site or remote support. Some of these resources may be directly available to a local jurisdiction in an emergency without waiting for formal state approval. However, local jurisdictions should work with their state government in the planning process to determine the best procedures before an incident response is underway.

    - A complete list of specialized radiological/nuclear federal resources can be found in the "Nuclear/Radiological Incident Annex to the Response and Recovery Federal Interagency Operations Plan."[47]

    - Radiological subject matter expertise will be needed in all organizations and jurisdictions. The Radiological Operations Support Specialist (ROSS) is a National Incident Management System-typed (NIMS) resource who has specialized skills and training for radiological and nuclear emergencies.[48] Staff in many municipal, state, and federal agencies have gained

[46] (National Emergency Management Association, 2022)
[47] (Department of Homeland Security, 2016)
[48] (Federal Emergency Management Agency (FEMA), 2019)

ROSS certification and should be called on around the country to provide technical advice and coordination to assist preparedness and emergency response. Planners should identify in advance where those resources are in their jurisdiction as part of their planning process.

- Impacted and Supporting Jurisdictions must ensure that they are able to receive assets and personnel efficiently. This will require activating existing plans for tracking, staging, communicating, and distributing resources. Additionally, response leadership and emergency operations centers (EOC) in the Supporting Jurisdictions should immediately begin identifying the critical intake routes (e.g., roadways, airports) and infrastructure (e.g., warehouses, refrigeration) that will be needed in the days ahead. Some of the actions described in Tactic 6 will help in achieving this objective.
    - Supporting Jurisdictions should also prepare to play a leading role in sourcing, allocating, staging, and mobilizing resources. This role may expand considerably in circumstances when the Impacted Jurisdiction's emergency management capabilities are temporarily incapacitated.
- The Impacted Jurisdiction should dispatch representatives to response coordination hubs where decisions on incident objectives and resource sourcing and allocating can be made, such as: joint field offices, incident support bases, unified coordination groups, regional/state/local joint information centers (JICs), EOCs, and ICPs.
    - Determine the appropriate level of representation to advocate for their jurisdiction's needs. Staff sent to coordination hubs should be experts on their jurisdiction's landscape and will be an invaluable resource for the Supporting Jurisdictions they are deployed to.

Initiate fatality management operations: Fatality management planning and operations should begin immediately following the detonation. This will enable fatality case recovery to support investigations, remains identification, minimization of public health impacts, contribute to the EOC's common operating picture, and, although not always feasible in a post-detonation environment, the recovery and identification of decedents for return to next of kin.

- There are three general categories of fatalities that will make up the bulk of deaths in the first hours, days, and weeks. Table 7 provides a summary. Impacted and Supporting Jurisdictions will immediately have to manage fatalities that occur in the MDZ, LDZ, and DRZ. Management of fatalities that occur outside of the damage zones will primarily be a Supporting Jurisdiction function that grows in severity beyond the first 72 hours. Actions taken during the first few days can improve the ability to manage these fatalities as they occur later.
- Fatality management operations will require a rapid and substantial expansion in numbers of mortuary and recovery personnel to be most effective.
    - The Supporting Jurisdiction's medical examiner (ME) should coordinate with MEs in the Impacted Jurisdiction to set objectives and conditions for remains recovery, focusing on how

to collect and document remains in as safe a manner as possible. The CDC's Decedents Guide recommends exposure limits for mortuary and recovery teams, see Table 8.

- Supporting Jurisdictions should immediately request regional, state, and federal support, particularly for surge, force multiplier, personnel to help with managing and executing fatality management operations. This includes:
  - The Disaster Mortuary Response Team (DMORT): This resource may not become available in the area until after 72 hours. While DMORT provides technical assistance and consultation on fatality management and mortuary affairs and may be called on to provide a wide range of services, additional resources will need to be requested to surge retrieval and morgue team staff.
  - Regional, state, and federal personnel for mortuary and remains retrieval teams, as well as personnel who can be provided just-in-time training to conduct such operations within the Hot Zone.

Table 7. Fatality Management Categories for Planning[49]

Fatality Location	Description	Priority
Severe Damage Zone	Fatalities in the SDZ will largely be inaccessible or in areas where there will be little-to-no lifesaving operations or remains may be destroyed by the initial blast.	Not a priority
Moderate and Light Damage Zone, Dangerous Radiation Zone	Fatalities in the streets, in buildings, and at casualty/medical collection points, including hospitals. Many of these fatalities will be physically accessible and may pose a hazard to emergency operations and public health if not retrieved.	Priority for first 72 hours (Impacted, Supporting Jurisdictions)
Delayed fatalities, beyond the damage zones	Fatalities that occur days, weeks, and months after the detonation due to people succumbing to injuries, particularly combined injuries and/or severe radiation injury. Most of these will occur outside the damage zones, after people have been evacuated.	Priority after the first week (Supporting Jurisdictions)

Table 8. Recommended Exposure Limits for Mortuary and Recovery Teams[50]

	Field Mortuary Staff	Remains Recovery Team Staff
Dose Limit	100 mrem–5 rem[51] (1 mSv–50 mSv)	Up to 5 rem (50 mSv)
Dose Rate Limit	Up to 2 mrem/h (20 µSv/h)	Up to 100 mrem/h (1 mSv/h)

- Dispatch remains recovery teams to identify decedents and tag for removal. Recovery of decedents may be delayed depending on resources, personnel availability, and radiation levels. Management of fatalities that occur in the LDZ, MDZ, DRZ, and adjacent areas should begin at least 24-48 hours after the detonation but should not pull resources away from lifesaving activities. The fatalities that occur in the DRZ may not be accessible for retrieval until radiation levels decay to lower levels.

- Identify, acquire, and power all refrigeration capability immediately after the detonation. This includes refrigerated warehouses, trailers, trucks, rail freight, and assets specifically designed to expand temporary morgue capacity. Jurisdictions should consider pre-identifying these resources, in addition to underground internment sites, in their area as part of their nuclear response planning process.

- Transportation of contaminated remains must be coordinated carefully and take into consideration the safety of responders, limited resources, and public perception. Transport decedents carefully to locations outside of view of survivors: this location(s) should be planned to promote faster recovery and mitigate negative psychological impacts on survivors.[52]

    - During the early response, extensive decontamination of decedents is not a priority. Rapid, dry, and gross decontamination through brushing off fallout (which will continue to decay) should be sufficient to mitigate dose to people handling, transporting, and storing remains.

- Communicate fatality management plans and victim identification processes to the public. Coordinate with appropriate leaders to maintain respect for religious customs and cultural norms.[53]

[50] (Centers for Disease Control and Prevention (CDC), 2021)

[51] Rem is one of the two standard units used to measure the dose equivalent (or effective dose), which combines the amount of energy (from any type of ionizing radiation that is deposited in human tissue), along with the medical effects of the given type of radiation. Sievert (Sv) is the SI (international) unit equivalent for rem.

[52] (Lillie, Kelly, Mattis, & Rayburn, 2006)

[53] (Texas Department of State Health Services, 2015)

Refer To

FEMA's Planning Guidance for Response to a Nuclear Detonation, Third Edition

- "Chapter 4: Acute Medical Care" for a discussion of fatality management.
- "Chapter 5, part 4" for potential options for initiating a registry to track affected people and highlights frameworks and tools that may be appropriate, such as the National Institute for Occupational Safety and Health's Emergency Responder Health Monitoring and Surveillance Framework and the Agency for Toxic Substances and Disease Registry's Rapid Response Registry.
- "Chapter 6: Communications and Public Preparedness" for an overview of immediate response communication priorities.

See also:

- FEMA's Improvised Nuclear Device Response and Recovery: Communicating in the Immediate Aftermath for a list of likely questions and topics for public communication
- The Center for Disease Control and Prevention's Guidelines for Handling Decedents Contaminated with Radioactive Materials for technical information and guidance on how to advance and refine mass fatality planning efforts for radiation emergencies.
- Information about the Radiological Operations Support Specialist (ROSS) program in this factsheet.

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Annex 1: Emergency Response Dosimetry and Dose Management Techniques in a Nuclear Detonation Environment

INTRODUCTION

This annex provides planners with steps that first responders and incident commanders can implement to mitigate and track responder radiation exposure during a nuclear detonation response. The guidance in this annex is most relevant during the first minutes, hours, and days of a response when (1) a comprehensive dosimetry tracking process is still being established and (2) first responders are conducting lifesaving activities in a resource austere and organizationally challenged environment. Much of the guidance in this annex is derived from recommendations by the National Council on Radiation Protection and Measurements (NCRP). For more information on implementing emergency response dosimetry, planners are strongly encouraged to review the following documents:

- The 2022 Planning Guidance for Response to a Nuclear Detonation. FEMA. 2022.
- Protective Action Guides (PAG) Manual. EPA. 2017.
- National Council on Radiation Protection and Measurements (NCRP) Report No. 179 and NCRP Commentary No 28.

MITIGATE DOSE TO EMERGENCY WORKERS

Only emergency workers with radiation detection equipment should operate outdoors, until radiation hazards and fallout conditions in their area are known.

- All responders, regardless of whether they have radiation detection equipment, should keep radiation doses to a level that is as low as reasonably achievable (ALARA) through time, distance, and shielding.
- Responders without radiation monitoring instruments should follow the same guidance as members of the public and should remain in shelter until advised that it is safe to respond. Even when conditions are known, responders without radiation monitoring instruments should not operate outdoors in the DRZ, and preferably not in the HZ.
    - If working in the HZ without detection equipment is necessary, responders should only operate in areas where the exposure rates are well known.

- Responders with radiation detection instruments should monitor their total dose, avoid high-exposure areas, record their dose, and abide by the following guidance:[54]
    - Exit shelter to perform lifesaving actions ONLY when safe to do so.
    - Make every effort to report all local conditions through appropriate agency chain of command or to a designated emergency operations center, even if this means sending a messenger.
    - Do NOT operate in the DRZ, except to conduct critical, planned activities with appropriate detection equipment.

Maximize availability of detection equipment.

- Radiation detection equipment will be a critical, but scarce, resource during a nuclear detonation response. There are several techniques responders can plan to use that can help maximize availability of equipment to enhance responder safety in or near fallout areas. For example:
    - Use all available equipment appropriate for the job. Common types of radiation detection equipment, including equipment typically purchased for search, detection, and interdiction, may be appropriate.
    - Buddy systems and group dosimetry:[55] maximize dose monitoring coverage by issuing one piece of equipment for each pair or group of responders that deploys, works, and returns together.
    - Equip all responders with communications equipment. Communications equipment (e.g., handheld radios) should be considered essential PPE for responders. Relaying potential hazards between responders and command staff is critical for current and future operations.

Reduce exposure when moving through fallout areas.

- Monitor exposure rate frequently: Fluctuations in exposure rates will occur as people move through areas with fallout. This is because fallout will not deposit uniformly (even at the city-block level), and the presence of buildings and other structures can significantly alter the amount of shielding.
- Move through areas with less or no fallout: For example, cut through buildings, underground parking garages, tunnels, or subways.[56]

[54] (National Council on Radiation Protection and Measurements, 2019, p. 20)
[55] (National Council on Radiation Protection and Measurements, 2019, p. 9)
[56] (National Council on Radiation Protection and Measurements, 2019, p. 20)

- Conduct reconnaissance: Send scouts ahead to determine a safe path. If scouts measure a significant decrease in radiation, the rest of the team should follow. Consider visually marking those routes as safer alternatives, to help direct responders and the public who may be passing through.[57]
    - If scouts measure continuously increasing radiation levels, responders should head in a different direction or seek shelter in a nearby building that offers adequate protection.

Establish dose threshold decision points.

- NCRP does not recommend a dose limit for emergency responders performing time sensitive, mission-critical activities such as lifesaving. Instead, decision points should be established by the incident commander based upon operational awareness and mission priorities.[58]
- Follow responder dose guidelines, as summarized in Table 9. Incident commanders may need to consider raising the property and lifesaving response worker guidelines to prevent further loss of life and massive spread of destruction (e.g., through preventing fire spread).[59]
- The NCRP recommends that, when the cumulative absorbed dose to an emergency responder reaches 50 rad (0.5 Gy), a decision must be made on whether to withdraw the emergency responder from the Hot Zone. NCRP considers the 50 rad (0.5 Gy) cumulative absorbed dose to be a decision dose, not a dose limit.[60] Table 9 provides a more comprehensive list of recommended dose decision points, which vary across different organizations, for planners to consider.

ENABLE EMERGENCY RESPONSE DOSIMETRY

Record location, occupancy times, and exposure rates (if available) for all responders.

- Data about occupancy times and locations, such as indoor versus outdoor, and work assignments should be captured. Even in circumstances where a responder without detection equipment is unknowingly in a fallout area, recording this basic information can help with dose reconstruction later-on (although, this is not ideal). At a minimum, the incident commander needs three pieces of information for every responder:[61]
    - location of the responders (including indoor vs outdoor);
    - dose rate at that location; and

[57] (National Council on Radiation Protection and Measurements, 2019, p. 20)
[58] (National Council on Radiation Protection and Measurements, 2019, p. 8)
[59] (National Council on Radiation Protection and Measurements, 2019, p. 20)
[60] (National Council on Radiation Protection and Measurements, 2019, p. 20)
[61] (National Council on Radiation Protection and Measurements, 2019, pp. 26, 29)

- occupancy time at that location.

Establish A Dose-Tracking Process that Leverages the Incident Command System (ICS).

- Emergency dosimetry plans must include information gathered from the beginning of the incident for purposes of future dose reconstruction. If early data is not recorded, it will be difficult to reconstruct doses later.[62]

- The standard ICS personnel accountability system can be used to track individual/group dose. It will be important to establish and use a separate dose tracking or data management unit within the ICS structure.[63]

- Establish a process to collect and track responder exposures. The NCRP's Commentary No 28 contains template forms that can be used to record this information for each responder. At a minimum, the following information should be collected and maintained:[64]

  - Name of exposed individual.

  - If operating as an assigned team, name of team and all personnel on the team.

  - Occupancy time(s) and location(s) and nature of the shelter (e.g., brick building, underground structure).

  - Exposure rate if a radiation instrument is available.

  - Dose, if monitoring equipment is available, list instrument/dosimeter type, model, and serial number.

- The beginning and ending dose should be recorded for each operational period, or more frequently, as practical.[65]

Communicate Risk to Responders.

- Comprehensive risk communication with responders is an investment in their understanding of their short- and long-term risks in their duties.

  - Responders will look to one another for reinforcement of their perception of the risks they will be undertaking. Supervisors or group leaders should deliver statements about risk to their

[62] (National Council on Radiation Protection and Measurements, 2019, p. 8)
[63] (National Council on Radiation Protection and Measurements, 2019, p. 8)
[64] (National Council on Radiation Protection and Measurements, 2019, p. 29)
[65] (National Council on Radiation Protection and Measurements, 2019, p. 29)

teams and should be assisted by both subject matter experts in radiation science and in risk communication.

- Assess prior levels of training and knowledge quickly. Baseline knowledge of the group's understanding of risk can be instrumental to appropriately conveying risk to responders.
- Have just-in-time radiation training material prepared and available for deployment.

- Before responders deploy: Explain the possible dose rate to responders, either if known through monitoring or projected through modeling. Explicitly state the health effects associated with their potential dose, using relevant comparisons where appropriate. Finally, be sure to emphasize ALARA and restate the protective actions that are being taken to keep doses appropriate for the mission (e.g., limiting time spent in the area, using appropriate respiratory protection).
- Following each mission and/or operational period: The incident commander or designee (e.g., Safety Officer) should inform each responder of their estimated accumulated dose and the significance of that dose (e.g., if they've achieved a threshold decision point).

AFTER THE EMERGENCY

Emergency workers who receive a dose in excess of 5 rem (50 mSv) in an emergency should not be precluded from returning to work, provided the additional exposure is voluntary, and the emergency worker receives counseling from radiological protection and medical personnel regarding the potential consequences of the exposure. The dose accrued in an emergency should not be added to the dose of record or count against routine annual or lifetime occupational exposure limits, nor should it preclude employment that may result in additional occupational exposure.[66]

Table 9. Dose-Tracking Categories for Each Responder

Guideline	Activity	Condition
Exposure rate in area (R/h, Gy/h)		
> 10 mR/h (0.1 mGy/h)	Work in Hot Zone	All personnel working in Hot Zone should have appropriate training and PPE (including radiation dosimeters) for all hazards they are expected to encounter.
> 10 R/h (1 Gy/h) [a, b, g]	Work in Dangerous Radiation Zone (DRZ) – lifesaving activities	Entry into the DRZ should only be made to conduct lifesaving actions or attempting to prevent a catastrophic situation and with the informed consent of those making the entry.

[66] (National Council on Radiation Protection and Measurements, 2019, p. 9)

Guideline	Activity	Condition
> 100 R/h (1 Gy/h) [a, b, g]	Work in DRZ – to perform lifesaving actions or when attempting to prevent a catastrophic situation.	In addition to the requirements to enter the DRZ, entry should only be made with the permission of the incident commander.
Total dose to the worker (rem, Sv)		
5 rem (50 mSv) [a, c, d, e, f, h, i]	Occupational limit for radiation workers under routine circumstances	All reasonably achievable actions have been taken to minimize dose.
5-10 rem (50-100 mSv) [a, b, e, i]	Protecting critical infrastructure necessary for public welfare (e.g., a power plant)	Exceeding 5 rem (50 mSv) is unavoidable and appropriate actions have been taken to reduce dose. Monitoring is available to project or to measure the dose to individuals
10-25 rem (100-250 mSv) [a, b, e, h, i]	Lifesaving or protection of large populations	Exceeding 5 rem (50 mSv) is unavoidable and all appropriate actions have been taken to reduce dose. Monitoring is available to project or to measure dose.
25-50 rem (500 mSv) [a, b, e, h, i]	Lifesaving or protection of large populations	All conditions for exceeding a dose of 25 rem have been met and those making the entry are fully aware of the risks involved.
50-100 rem (1 Sv) [a, b, e, g, h, i]	Lifesaving or protection of large populations	

[a] Medical monitoring should be considered for potential doses in excess of 5 rem (50 mSv)

[b] In the case of very large incidents (e.g., nuclear detonation) the incident commander should consider raising the dose guidelines to prevent large-scale loss of life and widespread destruction

[c] (US Environmental Protection Agency (EPA), 2017)

[d] (National Council on Radiation Protection and Measurements (NCRP), 1993)

[e] (International Commission on Radiological Protection (ICRP), 2005)

[f] (Conference of Radiation Control Program Directors, Inc., 2006)

[g] (International Atomic Energy Agency (IAEA), 2006)

[h] (Department of Homeland Security (DHS), 2008)

[i] (National Council on Radiation Protection and Measurements (NCRP), 2010)

Annex 2: Zone-Based Response Cards

OVERVIEW

This annex provides quick-reference checklists which operationalize the zone-based response framework introduced in Chapters 1 and 2 of the Federal Emergency Management Agency's (FEMA) Planning Guidance for Response to a Nuclear Detonation, 3rd Ed. The checklists are intended for first responders (including, but not limited to, firefighters, police officers, and emergency medical technicians) who are already in or are immediately deployed to areas impacted by a nuclear detonation to perform lifesaving activities.

Emergency planners should review the content carefully and make changes as necessary to account for their jurisdiction's unique operational landscape and integrate the guidance into their preferred method of training/delivery to first responders.

This annex supplies two resources (Figure 10):

- The First Responder's Checklist summarizes the key actions first responders should initiate immediately after a nuclear detonation. The final step on this checklist references the Zone-Based Response Cards, which are the second resource in this document.
- The Zone-Based Response Cards suggest immediate and early-phase lifesaving priorities for first responders operating in one of the five zones described in FEMA's Planning Guidance for Response to a Nuclear Detonation: Light Damage Zone (LDZ), Moderate Damage Zone (MDZ), Severe Damage Zone (SDZ), Dangerous Radiation Zone (DRZ), and Hot Zone (HZ).

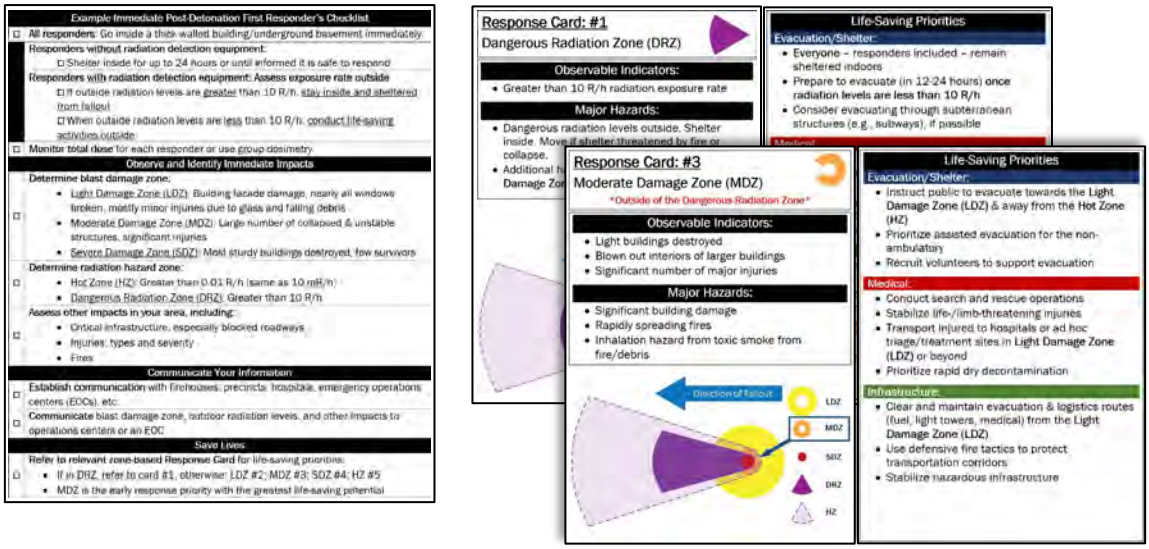

Figure 10. First Responder's Checklist (left) and Zone-Based Response Cards (right).

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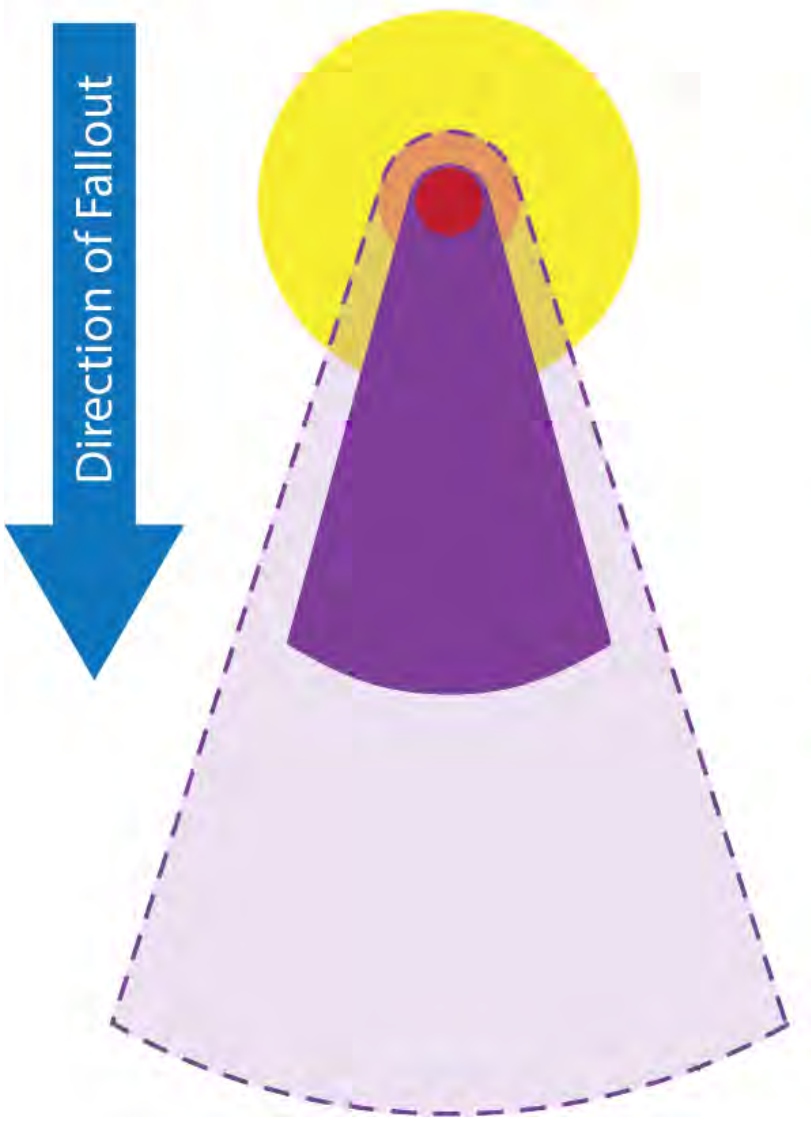
Example Immediate Post-Detonation First Responder's Checklist	
☐	All responders: Go inside a thick-walled building/underground basement immediately. Move if shelter threatened by fire or collapse.
	Responders <u>without</u> radiation detection equipment: ☐ Shelter inside for up to 24 hours or until informed it is safe to respond
	Responders <u>with</u> radiation detection equipment: Assess exposure rate outside ☐ If outside radiation levels are <u>greater</u> than 10 R/h, <u>stay inside and sheltered from fallout.</u> Only conduct quick/critical lifesaving outside. ☐ When outside radiation levels are <u>less</u> than 10 R/h, <u>conduct lifesaving activities outside</u>
☐	Monitor total dose for each responder or use group dosimetry
Observe and Identify Immediate Impacts	
☐	Determine blast damage zone: • <u>Light Damage Zone (LDZ)</u>: Building facade damage, nearly all windows broken, mostly injuries due to glass and falling debris • <u>Moderate Damage Zone (MDZ)</u>: Large number of collapsed and unstable structures, significant injuries • <u>Severe Damage Zone (SDZ)</u>: Most sturdy buildings destroyed, few survivors
☐	Determine radiation hazard zone: • <u>Hot Zone (HZ)</u>: Greater than 0.01 R/h (same as 10 mR/h) • <u>Dangerous Radiation Zone (DRZ)</u>: Greater than 10 R/h
☐	Assess other impacts in your area, including: • Critical infrastructure, especially blocked roadways • Injuries: types and severity • Fires
Communicate Your Information	
☐	Establish communication with firehouses, police stations, hospitals, emergency operations centers (EOCs), etc.
☐	Communicate blast damage zone, outdoor radiation levels, and other impacts to operations centers or an EOC
Save Lives	
☐	Refer to relevant zone-based Response Card for lifesaving priorities: • <u>If in DRZ, refer to card #1</u>, otherwise: LDZ #2; MDZ #3; SDZ #4; HZ #5 • MDZ is the early response priority with the greatest lifesaving potential



Light Damage Zone (LDZ)

Extensive window/exterior damage and minor injuries. Manage fires, encourage public shelter.

Moderate Damage Zone (MDZ)

Significant damage and injuries. Establish and maintain evacuation corridors. Greatest life-saving potential.

Severe Damage Zone (SDZ)

Radiation and complete destruction of most buildings. Delay response until radiation decays. Survivors unlikely.

Dangerous Radiation Zone (DRZ)

Dangerous radiation levels (> 10 R/h) outside. Minimize use of responders outside. Shelter public to save lives.

Hot Zone (HZ)

Elevated radiation levels (> 0.01 R/h). Respond as needed, minimize time outside. Shelter public to minimize dose.

Response Card: #1

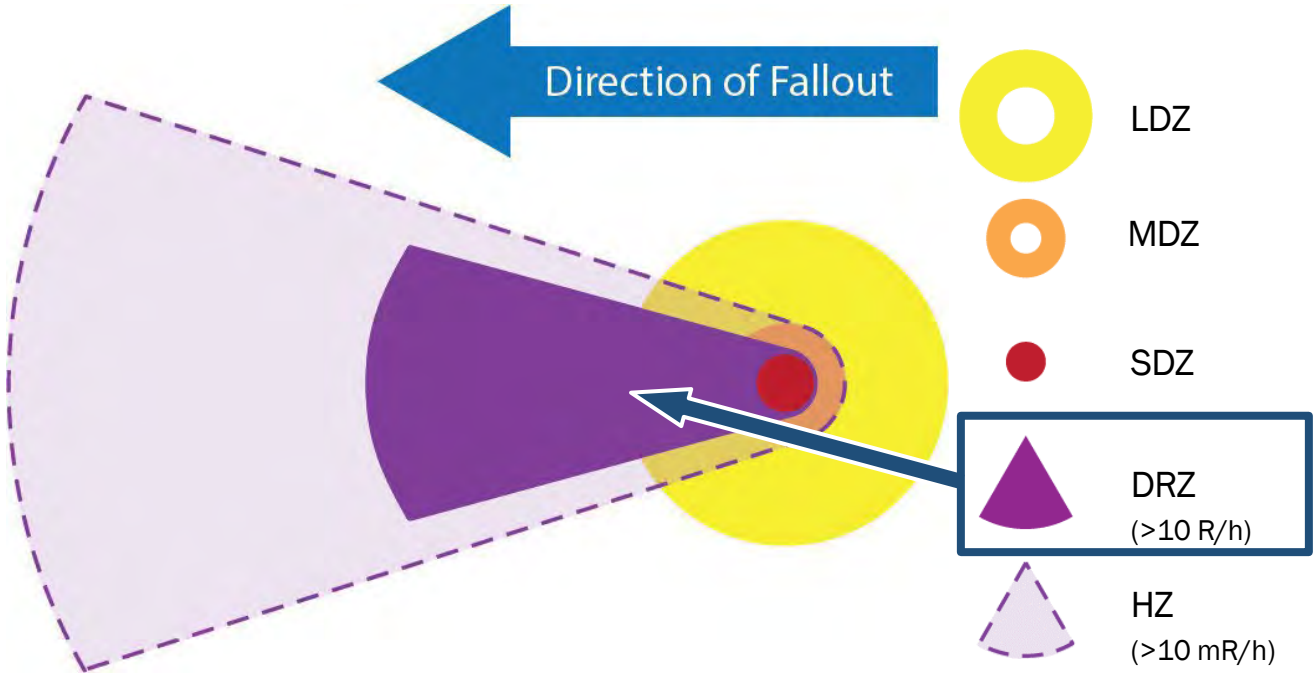
Dangerous Radiation Zone (DRZ)

Observable Indicators:

- Greater than 10 R/h radiation exposure rate

Major Hazards:

- Dangerous radiation levels outside. Shelter inside. Move if shelter threatened by fire or collapse.
- Additional hazards if in Light or Moderate Damage Zones (e.g., toxic smoke, fire, debris). Avoid these hazards and wear appropriate PPE.



Lifesaving Priorities (DRZ)

Evacuation/Shelter:

- Everyone – responders included – remain sheltered indoors
- Prepare to evacuate once radiation levels are less than 10 R/h (likely in 12-24 hours)
- Consider evacuating through subterranean structures (e.g., subways, tunnels), if possible

Medical:

- Responders already in DRZ: Establish ad hoc triage/treatment sites inside sturdy, thick-walled structures
- Conduct only quick, critical, lifesaving activities outdoors in the DRZ
- Prioritize rapid dry decontamination methods: Remove outer clothing or wipe exposed surfaces

Infrastructure:

- Conduct remote/unmanned damage assessment and fire management, if possible
- Stabilize hazardous infrastructure if failure presents immediate danger to life and safety

Special Consideration:

- Responders with radiation detection equipment should closely monitor their exposure/total dose

Response Card: #2

Light Damage Zone (LDZ)

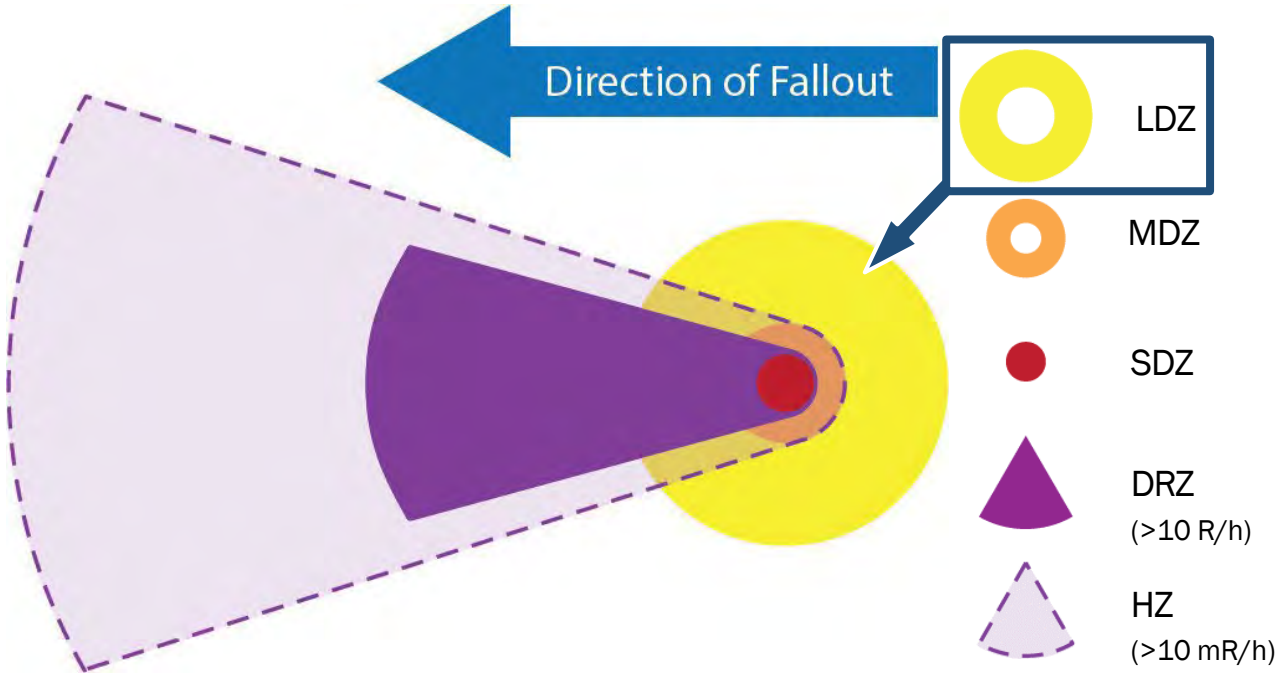
Outside of the Dangerous Radiation Zone

Observable Indicators:

- Nearly all windows shattered
- Damage to building facades
- Mostly injuries from flying glass and debris

Major Hazards:

- Inhalation hazards from toxic smoke from fire/debris. Avoid these hazards and wear appropriate PPE.



Lifesaving Priorities (LDZ)

Evacuation/Shelter:

- Instruct public to shelter inside
- Targeted evacuation of unsafe areas (e.g., fires, heavy smoke, unstable structures)
- Do not prevent spontaneous evacuation. Direct self-evacuees towards safety and away from the Hot Zone (area > 10 mR/h).

Medical:

- Establish ad hoc triage/treatment sites for injured evacuees
- Stabilize life-/limb-threatening injuries
- Prioritize rapid dry decontamination methods: Remove outer clothing or wipe exposed surfaces

Infrastructure:

- Clear and maintain evacuation & logistics routes (fuel, light towers, medical) from the Moderate Damage Zone (MDZ) to supporting areas outside the LDZ
- Isolate and manage spot fires
- Stabilize hazardous materials and infrastructure

Special Consideration:

- The Moderate Damage Zone (MDZ) is an early response priority with the greatest lifesaving potential: Consider responding to MDZ first.

Response Card: #3

Moderate Damage Zone (MDZ)

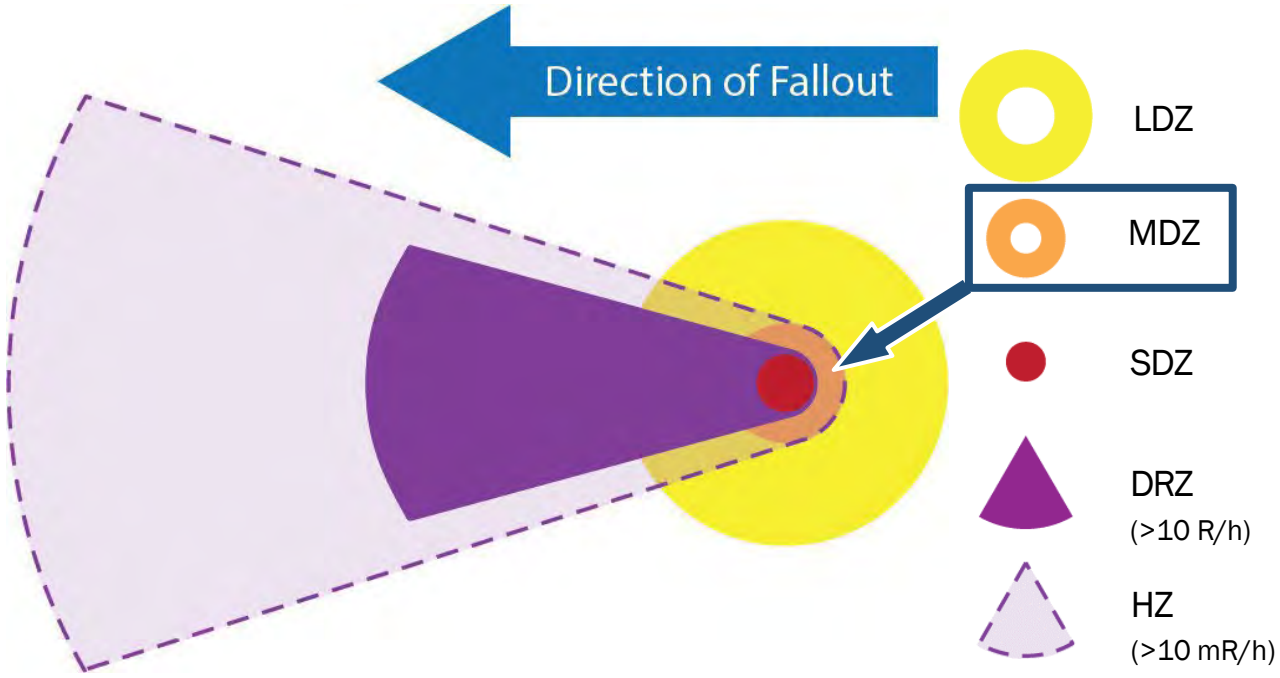
Outside of the Dangerous Radiation Zone

Observable Indicators:

- Light buildings destroyed
- Blown out interiors of larger buildings
- Significant number of major injuries

Major Hazards:

- Significant building damage
- Rapidly spreading fires
- Inhalation hazard from toxic smoke from fire/debris. Avoid smoke, wear appropriate PPE.



Lifesaving Priorities (MDZ)

Evacuation/Shelter:

- Instruct public to evacuate towards the Light Damage Zone (LDZ) and away from the Hot Zone (HZ)
- Prioritize assisted evacuation for the non-ambulatory
- Recruit volunteers to support evacuation

Medical:

- Conduct search and rescue operations
- Stabilize life-/limb-threatening injuries
- Transport injured to hospitals or ad hoc triage/treatment sites in Light Damage Zone (LDZ) or beyond
- Prioritize rapid dry decontamination methods: Remove outer clothing or wipe exposed surfaces with a brush, adhesive tape, or moist towelettes

Infrastructure:

- Clear and maintain evacuation & logistics routes (fuel, light towers, medical) from the Light Damage Zone (LDZ)
- Use defensive fire tactics to protect transportation corridors
- Stabilize hazardous infrastructure

Response Card: #4

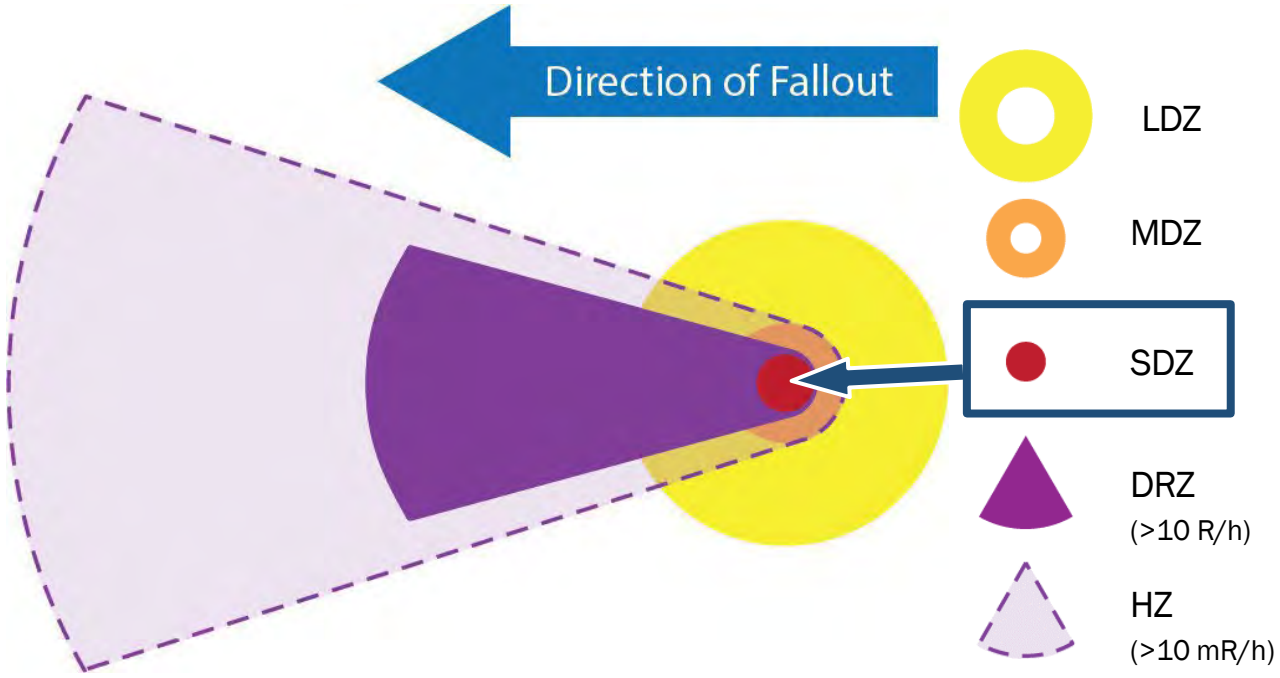
Severe Damage Zone (SDZ)

Observable Indicators:

- Nearly all buildings destroyed
- Few survivors
- Impassable, high piles of debris

Major Hazards:

- Immediate dangerous radiation levels outside. Shelter inside. Move if shelter threatened by fire or collapse.
- Significant secondary hazards: fire, smoke, etc. Avoid these hazards and wear appropriate PPE.



Lifesaving Priorities (SDZ)

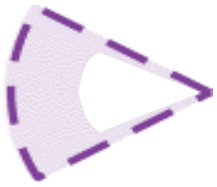
Evacuation/Shelter:

- Everyone – responders included – remain sheltered indoors
- Seek very robust shelter: Thick cement walls and deep subterranean structures
- Move if shelter threatened by fire, collapse, or other hazards
- Prepare to evacuate once radiation levels are less than 10 R/h
- Consider evacuating through subterranean structures (e.g., subways, tunnels), if possible

Medical:

- Conduct medical triage and stabilization indoors. May conduct outdoors if necessary and radiation levels are less than 10 R/h.
- Prioritize rapid dry decontamination methods: Remove outer clothing or wipe exposed surfaces with a brush, adhesive tape, or moist towelettes

Response Card: #5



Hot Zone (HZ)

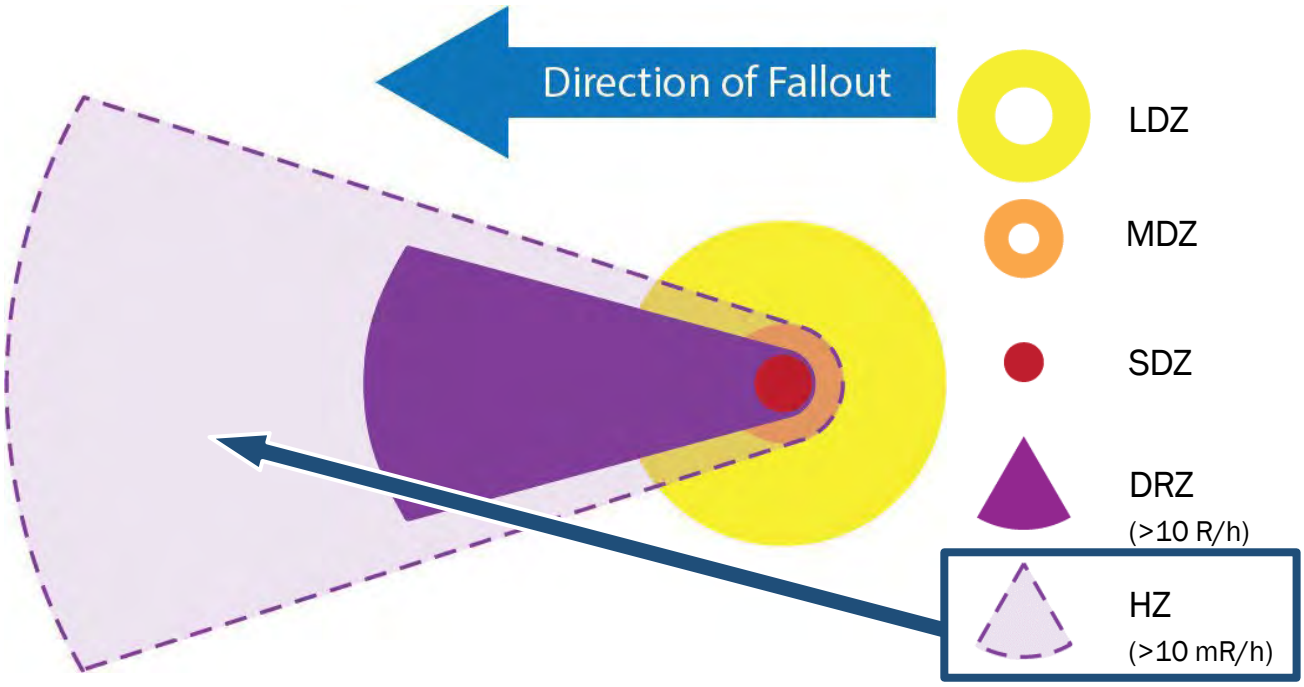
Outside of the Light & Moderate Damage Zones

Observable Indicators:

- Greater than 0.01 R/h (same as 10 mR/h) radiation exposure rate, but less than 10 R/h

Major Hazards:

- Fallout may take several hours to arrive
- Outdoor radiation levels not life-threatening and will significantly decrease over first 48 hours



Lifesaving Priorities (HZ)

Evacuation/Shelter:

- Instruct public to shelter inside their building/home. Large-scale public evacuation is not necessary in first 72 hours.
- Do not prevent spontaneous evacuation. Direct self-evacuees towards safety/away from Hot Zone (HZ).

Medical:

- Conduct lifesaving activities, but minimize time outside when possible
- Prioritize rapid dry decontamination methods: Remove outer clothing or wipe exposed surfaces with a brush, adhesive tape, or moist towelettes

Infrastructure:

- Clear and maintain evacuation & logistics routes (fuel, light towers, medical) into the Light Damage Zone (LDZ)
- Begin to stabilize and restore infrastructure, where possible

Special Consideration:

- The Moderate Damage Zone (MDZ) is an early response priority with the greatest lifesaving potential: Consider responding to MDZ first.

Annex 3: Example Triage Protocol

INTRODUCTION

After a nuclear detonation, a challenge will be implementing a strategy to assess injuries and radiation exposure among survivors and triage them appropriately for transportation and treatment. The goal of any triage system is to save as many lives as possible by making the best use of available resources. Ad hoc/spontaneous triage sites and medical facilities in the Impacted (and possibly Supporting Jurisdictions), will be operating in resource scarce environments. The radiation triage, treatment, and transport (RTR) system[67] will be helpful for organizing the response as it accounts for the presence of radiation. The closer a site is to ground zero, the more likely it is they will have poor resource availability and crisis standards of care (CSC) will be implemented.

The specifics about how trauma, radiation illness, and combined injuries are triaged and treated will depend on several factors including:

- Where the facility is in relation to the epicenter.
- How long after detonation the survivor is triaged/re-triaged.
- Number of patients, types of injuries, and available resources.
- Capacity and capabilities of the staff/facility.[68]

It is nearly impossible to always recommend triage protocols for all sites. This annex provides steps that responders and healthcare providers (HCPs) can implement for triage during the initial response.

Steps 1, 2, and 3 in this annex generally apply to anyone providing treatment and triage during the initial response: Field responders and HCPs should assess their facility's current resource availability and whether CSC are necessary, then triage first based upon trauma. However, Steps 4 through 7 are more complex and might be more appropriate for HCPs and medical facilities operating under austere conditions at the front lines, such as those located in or close to the blast damage zones.

[67] (Federal Emergency Management Agency (FEMA), 2022, p. 87)
[68] (Hick, et al., 2011)

EXAMPLE TRIAGE PROTOCOL[69]

1. Assess resource availability for the site, facility, area, and/or jurisdiction. Determine if resource availability is normal, good, fair, or poor. (Note: While resource availability may not be known immediately, it should be a priority as it informs resource requests, allocation, and the decision about whether to implement CSC).[70]
    - Normal: Normal operations.
    - Good: Conditions allow for maintenance of care through contingency operations.
    - Fair: Conditions require delaying care for severe injuries after moderate injuries.
    - Poor: Conditions require classifying severe injuries as expectant.
2. Determine if CSC are necessary, considering resource availability and any predetermined policies, indicators, or triggers. (Note: To the extent feasible, CSC and the activation triggers should be developed as part of the planning process).[71] There are three levels of standards of care:[72]
    a. Conventional standards: The spaces, staff, and supplies used are consistent with daily practices.
    b. Contingency standards: The spaces, staff, and supplies are providing care that is *functionally equivalent* to usual patient care practices. Patient care areas may be repurposed, staff responsibilities or priorities may change, staff may be managing a larger group of patients, and supplies may be adapted, substituted, or re-used for conservation when the demands of the incident exceed community resources.
    c. Crisis standards: Adaptive spaces, staff, and supplies are lacking and triage decisions shift from individual patient needs to community-centered decision making (i.e., greatest good for greatest number of survivors). Facilities may be damaged or unsafe and non-medical spaces may be used for patient care. Trained staff may be unavailable or unable to care for the volume of patients, and critical supplies are lacking.
3. Treat life or limb threatening injuries first (regardless of contamination or radiation exposure) and organize patient transport to medical facilities for treatment. Initially, survivors should be triaged and referred for treatment based on the severity of their acute medical/trauma symptoms, since their radiation dose may be unknown or symptoms of radiation exposure may be delayed. Later, other factors should/could be used to modify the triage category (e.g., radiation dose, co-morbid conditions). The below trauma category definitions and Table 10 from the Scarce Resources

[69] (Coleman, et al., 2011)
[70] (Coleman, et al., 2011)
[71] Definitions of crisis standards of care and response resource availability are also summarized here: https://remm.hhs.gov/stdsofcare.htm
[72] (Knebel, et al., 2011)

Project illustrate how resource availability and standards of care can impact a survivor's triage category based on trauma/injury only.[73]

a. Severe trauma:
   - Stabilization requires complex treatment.
   - >20% chance of death even with treatment.

b. Moderate trauma:
   - Without stabilization, potential for death within hours.
   - <20% chance of death with stabilization and treatment.

c. Minimal trauma:
   - Injuries pose no significant risk to life and limb in the next 3–4 days.
   - Limited or no treatment prior to referral in the next 3–4 days.

Table 10. Injury Only Triage Categories

Trauma Category	Triage Category			
Severe trauma	Immediate	Immediate	Delayed	Expectant
Moderate trauma	Delayed	Delayed	Immediate	Immediate
Minimal trauma	Minimal	Minimal	Minimal	Minimal
Resource availability	Normal	Good	Fair	Poor
Standard of care	Conventional	Contingency	Crisis	Crisis

*Note: If adding > 20% total body surface area (BSA) burn to trauma, lower triage priority 1 level. Resource availability and standards of care impact those with moderate or severe trauma and do not affect those with minimal trauma.

4. Estimate whole body dose from external radiation to determine risk of radiation-related illness[74] for survivors using the Exposure and Symptom Triage (EAST) tool. The EAST tool combines estimates of radiation exposure from modeling or environmental radiation measurement maps with clinical assessments and single lymphocyte counts (if available).[75] Absolute lymphocyte

[73] Definitions of Trauma Categories are also available here: https://remm.hhs.gov/traumaseverity.htm; Triage Categories are also available here: https://remm.hhs.gov/triagecategories.htm: (Coleman, et al., 2011)
[74] Radiation dose estimation likely to occur at RTR 3 sites or field hospitals (prior to arrival at hospital or medical facility) as time and resources allow.
[75] Unlike other radiation-only triage tools, the EAST Tool takes into consideration ALC, geographic location, signs of acute radiation syndrome (ARS), and onset of symptoms to estimate radiation dose. If ALC is not available, other indicators on the

count (ALC) is likely to be available only at medical facilities with a blood lab that have sufficient resources and lab capacity, which may not be feasible in volume needed during the initial response.

a. If available, use official products from the Interagency Modeling and Atmospheric Assessment Center (IMAAC) to estimate radiation dose based on the survivor's geographic location, shelter conditions, and time spent in the area. (Note: Dose decreases as distance from the detonation site increases. Survivors may self-report their location and responders should attempt to track the area from which survivors are rescued). Be aware that there may be damage zones that will not have significant radiation and the DRZ may impact areas that do not have extensive physical damage but have significant fallout.

b. If official IMAAC products are <u>not</u> available, consider using radiological monitoring data (from responders or other fixed locations) or indicators of damage zones to help estimate a survivor's dose based on geographic location and known conditions. Survivors who are/were in the DRZ should be prioritized for further dose assessment.

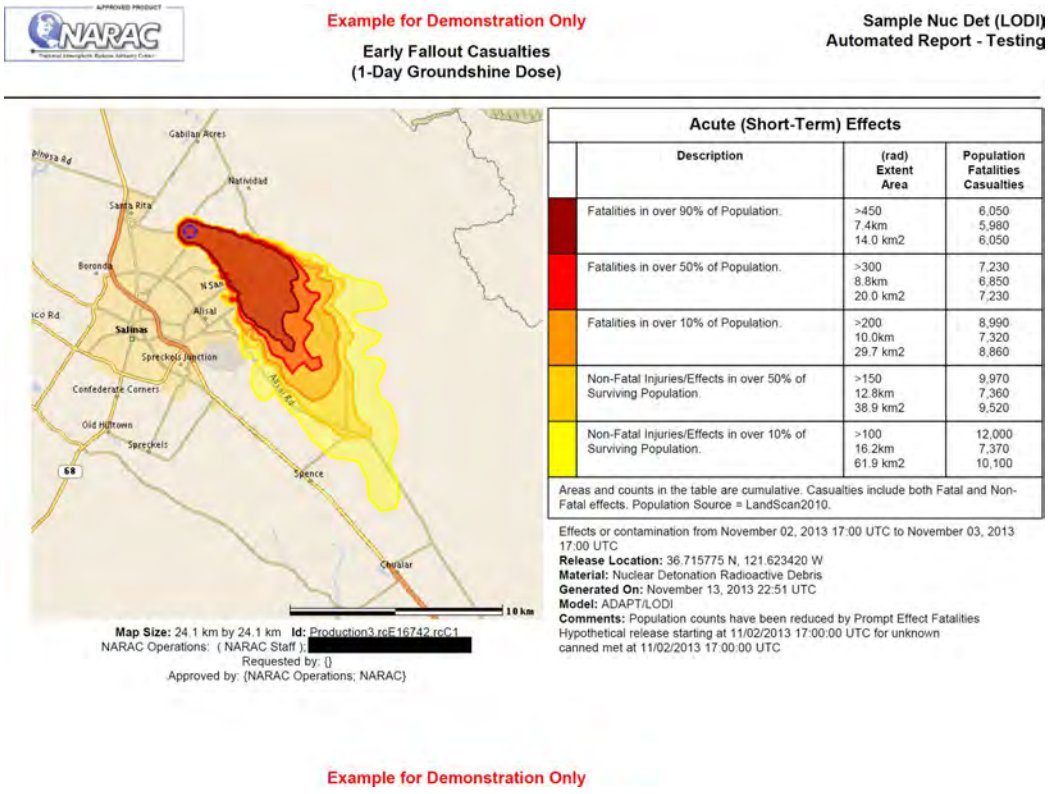


Figure 11. Geo-locate Patient on Official Dose maps to Estimate Whole Body Dose.[76]

EAST Tool can be used to estimate exposure prior to medical evaluation. The tool is intended to be used in the field prior to triage by more sophisticated data-driven triage methods and provides a structure for fairness and consistency.

[76] (Foster, et al., 2014)

c. Sort survivors into 3 prioritized groups using the EAST tool (see Table 11):

i. Priority 1: Most likely to benefit from myeloid cytokines and priority evacuation and require moderate medical care interventions (moderate acute radiation syndrome (ARS), exposure of 200-600 rad predicted).

ii. Priority 2: Possible benefit from cytokines but likely to need intensive medical support after evacuation (severe ARS, exposure >600 rad predicted).

iii. Priority 3: Unlikely to benefit from cytokines or need medical care requiring evacuation (mild ARS, exposure <200 rad predicted).

Table 11. EAST Tool to Assess Radiation Exposure after Nuclear Detonation[77]

ARS Severity Prediction	Severe ARS (>600 rad)	Moderate ARS	Mild ARS (<200 rad)
Absolute Lymphocyte Count (if available)	< 0.7 at 24 h < 0.4 at 48 h	0.7 – 1.1 at 24 h 0.4 – 0.9 at 48 h	>1.1 at 24 h >0.9 at 48 h
Vomiting time to onset	Rapid (within 1 h) after exposure	Intermediate (1-4 h)	Delayed > 4 h
Vomiting per day	> 6x or worsening with time	Moderate (3-6x)	1-2 or resolved
IMAAC 12-24 h estimated dose map	>600 rad (modify to 200-600 rad if good shelter for 24 h)	200-600 rad (modify to < 200 rad if good shelter for 24h)	< 200 rad
Location in damage or fallout zone 12-24 h (non-IMAAC map)	In damage or fallout zone with minimal / no sheltering	In damage or fallout zone with good sheltering (e.g., concrete)	Not in damage or fallout zone
Diarrhea (per day)	Severe (> 6x)	Mild / moderate (< 6x)	None
Headache	Severe, interferes with activities	Mild/moderate	None/minimal
Fever (unexplained)	High/sustained	Low (<101 F) or resolved	None
Skin burns (beta)	Burns/blisters > 3% of body	Burns/blisters < 3% of body	None

[77] (US Department of Health and Human Services (HHS), 2022), (Hick, et al., 2018)

ARS Severity Prediction	Severe ARS (>600 rad)	Moderate ARS	Mild ARS (<200 rad)
Match dominant signs/symptoms in column above to suggested triage category below.			
GCSF/cytokine priority	2 – Possible benefit	1 – Most Benefit	3 – Unlikely benefit
Evacuation group	2 – Second Evacuated	1 – First Evacuated	3 – Third Evacuated
Base cytokine and evacuation priority on column with majority or strongest predictive variables. Major predictors listed first.			
Notes: Currently, the most efficient method to estimate whole-body dose is to determine the patient's ALC and how many hours after exposure began was complete blood count (CBC) drawn. The ALC test is unlikely to be available on the scale required to assess the at-risk population initially, so other indicators of ARS severity can be helpful to prioritize survivors for appropriate treatment and transport. The EAST tool is not designed for use in a medical care facility where combined traumatic and radiation injuries can have much worse prognosis than either traumatic or radiation injury alone and where the focus should be on serial ALCs[78].			

5. Triage survivors for combined injuries (trauma and radiation). If other more sophisticated or accurate methods for radiation dose assessment are not available, responders may consider using information gathered using the EAST tool to estimate radiation dose for survivors with combined injuries after they are triaged based on trauma or injury alone.[79]
    a. Combined injury: Moderate or severe trauma and/or burn injury plus whole body radiation dose of > 200 rad.
    b. See Table 12 for how to triage survivors with combined injuries when resource availability is normal or good.
    c. See Table 13 for how to triage survivors with combined injuries when resource availability is fair or poor.

[78] Serial ALCs over time provide a more accurate estimate of dose than a single ALC. See REMM Dose Estimator Tool to input multiple ALC values (https://remm.hhs.gov/ars_wbd.htm).
[79] (Coleman, et al., 2011)

Table 12. Combined Injury with Normal/Good Resource Availability

Exposure	Radiation Only or Minimal Trauma	Combined Injury	
	Minimal Trauma	*Moderate Trauma*	*Severe Trauma*
>1000 rad Likely Fatal	Expectant Immediate	Expectant	Expectant
>600–1000 rad Severe	Immediate	Delayed	Expectant
≥ 200–600 rad Moderate	Immediate	Immediate	Delayed
Resource Availability	Normal or Good		

Table 13. Combined Injury with Fair/Poor Resource Availability

Exposure	Radiation Only or Minimal Trauma		Combined Injury	
	Minimal Trauma		*Moderate Trauma*	*Severe Trauma*
>1000 rad Likely Fatal	Expectant	Expectant	Expectant	Expectant
>600–1000 rad Severe	Delayed	Expectant	Expectant	Expectant
≥ 200–600 rad Moderate	Immediate	Immediate	Delayed	Expectant
Resource Availability	Fair	Poor	Fair and Poor	
Note: If > 20% total body surface area (BSA) burn to trauma, lower triage priority 1 level.				

6. Survivors should be re-triaged when they are transported through the RTR system and to medical facilities for treatment.[80]

[80] (Hick & Coleman, Population-Based Triage, Treatment, and Evacuation Functions Following a Nuclear Detonation, 2018), (US Department of Health and Human Services (HHS) Administration for Strategic Preparedness and Response (ASPR), 2019)

a. Re-triage is critical as resource availability changes and as survivors and patients are transported to facilities for treatment. A person triaged as "expectant" might change to "immediate" with the influx of resources and personnel.

7. Those triaged as "expectant" should receive palliative care if available, particularly treatment of pain.

Refer To

Scarce Resources Project

- Includes resources for planning and responding to medical and public health consequences of a nuclear detonation.

Exposure and Symptom Triage (EAST) Tool

- Combines estimates of radiation exposure from maps with clinical assessments and single lymphocyte counts if available, which may be used to help sort survivors efficiently near the damage and fallout zones and enable rapid prioritization for appropriate treatment and transport.

FEMA's Planning Guidance for Response to a Nuclear Detonation, Third Edition

- "Chapter 4: Acute Medical Care" for an overview of the injury types expected after a nuclear detonation, considerations for conducting triage and treatment, and provides an overview of the radiation triage, treatment, and transport (RTR) system.
- "Annex 4.4" for additional information on ARS, triage, and resources for healthcare providers, responders, and planners.

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