Medical Response to a Nuclear Detonation: Creating a Playbook for State and Local Planners and Responders

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ABSTRACT

For efficient and effective medical responses to mass casualty events, detailed advanced planning is required. For federal responders, this is an ongoing responsibility. The US Department of Health and Human Services (DHHS) prepares playbooks with formal, written plans that are reviewed, updated, and exercised regularly. Recognizing that state and local responders with fewer resources may be helped in creating their own event-specific response plans, subject matter experts from the range of sectors comprising the Scarce Resources for a Nuclear Detonation Project, provided for this first time a state and local planner's playbook template for responding to a nuclear detonation. The playbook elements are adapted from DHHS playbooks with appropriate modification for state and local planners. Individualization by venue is expected, reflecting specific assets, populations, geography, preferences, and expertise. This playbook template is designed to be a practical tool with sufficient background information and options for step-by-step individualized planning and response.

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Key Words: nuclear detonation, disaster response, planning

The US Department of Health and Human Services (DHHS) has substantial experience planning for and supporting the medical and public health needs for large civilian gatherings and mass casualty incidents in the United States and globally. Presidential directives,[1] statutes,[2] and other regulations specify DHHS leadership in public health and medical response. DHHS has supportive responsibilities as a partner with other government agencies and departments and the private sector. The National Response Framework[2] and assignments in Emergency Support Function #8 "Public Health and Medical Services"[3] are among the key documents outlining DHHS responsibilities. The Nuclear/Radiological Incident Annex[4] outlines the roles of federal agencies for a nuclear incident.

To help all federal entities focus and coordinate their planning efforts, 15 specific types of incidents are specified in the National Planning Scenarios document, an abridged version of which is publicly available.[5] The concept was that effective plans for these 15 events would be relevant and scalable with modifications for most of the kinds of incidents. It is expected that these plans would be updated as needed. National interagency drills and exercises, often with state and local partners ("state and local" includes state, regional, local, tribal, and territorial medical and public health planners and responders), typically focus on 1 or more of these scenarios. Medical planning for scenario number 1, a ground-level detonation of a 10-kiloton (kT) improvised nuclear device (IND) in a US city, is addressed in the series of articles in this special issue of *Disaster Medicine and Public Health Preparedness*.[6-14] Of note, the Scarce Resources for a Nuclear Detonation Project uses the newer physical infrastructure damage concept in the *Planning Guidance for Response to a Nuclear Detonation*[15] and the casualty models developed for this project.[7]

Although presidential directives, statutes, and regulations specify generally what DHHS must do, how DHHS accomplishes those tasks demands detailed, intricate planning with both all-hazard and specific-hazard elements. Having appropriate, usable, realistic, effective, and easily understood plans is critically important, given the number, size, complexity, and diversity of possible incidents; the number of staff engaged; expected turnover of staff over time; the range of partners participating (federal, state, and local levels and the private sector); and the range and extent of needs that must be met for people affected by the blast in many types of venues.

DHHS has developed guidance documents, procedures, training programs, and tools for its own planning and response efforts. One of those tools, developed by the Office of the Assistant Secretary for Preparedness and Response, is the "playbook," which is part of all-hazards preparedness. A DHHS playbook has been created for each of the 15 National Planning Scenarios. Redacted DHHS playbooks for several scenarios are available to the public.[16] Although they were designed to be used by senior leadership at DHHS, the

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playbooks also serve to focus staff efforts at all levels and to guide planning and response. The goals of publishing these documents are to provide transparency and facilitate response-planning efforts by others who will be DHHS partners, so that they will know what to expect from HHS.

Playbooks have both all-hazards elements and elements that are specific for each type of mass casualty event, and they undergo revision regularly. These playbooks have been used at DHHS during weapons of mass destruction exercises and responses to actual incidents such as hurricanes and pandemic influenza. They have also been developed in collaboration with the federal Emergency Support Function #8 partners, with generally excellent reviews.

Each of the DHHS playbooks is tailored to the specific scenario, but all of them use the same basic format, including the following:
- Introduction
- Scenario
- Concept of operations
- Actions and issues
- Prescripted mission assignments
- Essential elements of information
- Briefing and decision papers for senior leadership
- Acronyms

Several state and local government partners of DHHS have suggested that they would like to adopt elements and organization of the playbook model to assist with their own medical response planning. In preparing the Hick et al[11] manuscript for this Project, it became apparent that there were sector-oriented approaches unique to state and local planners whose activities were intertwined with one another and with federal responders such as emergency medical services (EMS), initial health care facility response, public health, medical system response, evacuee medical care and fallout-related radiation illness, and recovery.

To help meet the needs of the state and local planners and enhance communication and coordination among nonfederal and federal planners, this article provides for the first time a template that state, local, regional, tribal governments and nongovernment sectors may find useful in developing their own plans for a medical response to a nuclear detonation. (For additional guidance in planning and developing an emergency operations plan, the Department of Homeland Security developed the Federal Emergency Management Agency *Comprehensive Preparedness Guide*.[17])

This template focuses primarily on technical background information and concept of operations relevant to senior planners and responders for nonfederal entities, most of whom have limited experience with radiation incidents. All DHHS-specific sections noted above are not included because not all of them are relevant to state and local entities. Providing concise but useful information in the playbook to guide state and local planning efforts was a priority. This playbook includes the following:
- Concept of operations
- Actions and issues
- Prescripted mission assignments
- Additional information links

Presented below are excerpts from the State and Local Planners Playbook, which provide a general understanding of the organization of the playbook and the information available within. (A complete electronic version is available on the Radiation Emergency Medical Management (REMM) Web site.[18] We expect that the user will modify it to suit his or her needs. This is a living document that will be updated when there are substantive additions or modifications.)

THE PLAYBOOK

Casualties caused by a nuclear detonation result from blast, heat (thermal energy), and ionizing radiation. The distribution and severity of injuries seen depend on device yield (kilotons), height of burst (air vs ground burst), atmospheric conditions (weather, wind pattern), and protection afforded by shelter/topography of the terrain (eg, urban landscape vs rural open spaces, robustness of buildings construction).[15]

Rescue efforts after a nuclear detonation are complex because of dangerously high radiation levels, severe infrastructural damage, the number and severity of causalities, and the inaccessibility of many victims, at least initially. A summary of the key principles of the medical and public health response of the nuclear detonation is found below.

Concept of Operations: Using Damage Zones to Organize Response Activities[15]

Response tasks (including search and rescue) that are likely to be safe and effective are organized by 4 concentric physical damage zones around ground zero, some of which also include radiation. Starting at ground zero and working outward, the 4 damage zones (Figure) are the following:
- Severe damage (SD) zone
- Moderate damage (MD) zone
- Light damage (LD) zone
- Dangerous (DF) fallout

The following is a brief description of the expected damage zones for a 10-kT IND ground detonation and recommended rescue tasks within each zone.[15]

SD (no-go) zone:
- Description: few buildings structurally sound or standing; radius on the order of 0.6 mi (1.0 km) from ground zero
- Access by rescuers will be limited by massive physical damage and high radiation levels.
- Survivors in this zone will be few.

MD Zone:
- Description: at the inner boundary (entry into SD/no-go zone), all of the buildings are fallen or structurally unstable; at the outer transition from the MD to the LD zone, there

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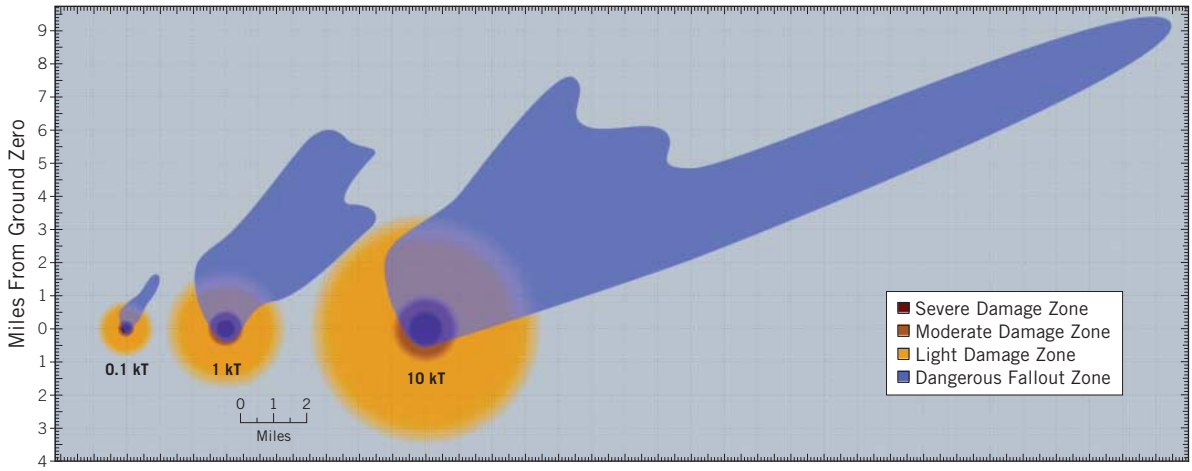
FIGURE

Representative dangerous fallout zones for 0.1, 1.0, and 10 kT detonations in which an early and direct threat from fallout radioactivity exists



A radiation exposure rate of 10 R/h is used to delimit this zone. Zone shapes are idealized for illustration only; actual zones are likely to be less circular in shape and boundaries between zones are less distinct. (Reprinted with permission from the Lawrence Livermore National Laboratory.)

will be significant structural damage approximately 1 mi (1.6 km) from ground zero. Sturdier (eg, reinforced concrete) buildings are likely to be standing; lighter commercial and multiunit residential buildings will be unstable; houses are likely to be destroyed.
- Limited rescue activities will be possible here.

LD zone:
- Description: inner boundary with MD zone will have more substantial building damage; outer boundary with the DF zone will have damage defined by the prevalence of broken windows (approximately 25%) out to 3 mi (4.8 km) from ground zero; window damage tapering out to 5 mi (8 km). As responders move inward toward ground zero, windows and doors will be blown in; gutters, roofs, and lighter-weight construction will have increasing amounts of damage; the amount of litter and rubble will increase; and more automobiles will be stalled and crashed, making emergency vehicle passage difficult.
- Many people will self-evacuate; some response efforts will be useful but difficult and dangerous due to high radiation levels.

DF (hot) zone:
- Description: The DF zone is distinguished not by structural damage, but by radiation levels from fallout. A radiation exposure rate of 10 R/h delimits the "hot zone" exterior boundary. Inside the boundary, responder operations are severely limited by the need to limit responder exposure time. The hot zone will shrink rapidly in size as the fallout decays, although the boundaries of the original DF zone are important for predicting initial radiation exposure. The radioactive decay rule of thumb: exposure rate from fallout declines 90% every 7 hours.
- Fallout particles may be visible as fine sandy material, either actively falling out as the plume passes or visible on clean surfaces. Visible fallout provides strong evidence of dangerous levels of radioactivity, but fallout may not be noticeable on rough or dirty surfaces, and no method is available to reliably estimate radiation dose rates based on the quantity of visible fallout. Therefore, visible fallout may possibly be used as an indicator of a direct radiation hazard, but the lack of apparent fallout should not replace appropriate radiation measurements.
- Responders should refrain from undertaking missions in areas where radioactivity may be present until radiation levels can be accurately determined and readily monitored. Any response operations within the hazardous DF zone must be justified, brief, and well planned.
- Before an incident, local protocols should be created that define operations in radiation-contaminated areas and optimize exposure risk vs the benefits of the potential missions.

A fifth zone, circumscribed by a "line" reflecting an environmental exposure rate of 0.01 R/h, is also useful in managing the response. It has also been called a radiation caution zone. This line and the zone within it will enlarge initially as fallout is deposited but will then contract quickly as radiation levels decrease due to rapid radioactive decay in the hours and days after a blast. This is not a damage zone per se, but it is the area outside the DF zone where response activities can be conducted. Responder time will be limited by federal protective action guides (PAGs)[19] or recommendations adopted by the local incident commander. The as low as reasonably achievable (more commonly known as ALARA) principle[20] will also apply in keeping radiation levels for responders as low as reasonably achievable.[19]

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Casualty recovery will be a challenge because of both physical obstacles and high radiation levels within the MD and SD zones. The wide spectrum and severity of injuries will also pose challenges to emergency response personnel, and altered triage principles will need to be adopted to consider the impact of radiation on triage priority.

Number and Spectrum of Injuries

There will be hundreds of thousands of casualties. Injuries will vary by type and severity. Many people will have trauma only (especially in and beyond the LD zones), whereas others will have radiation exposure only (especially in the DF zone), and some will have both. The list below reflects the major kinds of injuries expected:

- Blast: Injuries from pressure wave, tumbling, and crush injuries. Puncture injuries from flying debris rather than pressure-related injuries dominate because those who would have sustained classical blast injuries are likely to have been killed by the exceptional radiation doses or burns levels in the zone where classical blast injuries would be sustained.
- Burns: Thermal energy from the detonation and burns from secondary fires and contact with hot materials during the failure of a building. It may be difficult to distinguish superficial thermal from radiation burns without a patient history.
- Radiation: Injuries from prompt radiation (instantaneous and high dose rate from detonation) and fallout (lower dose rate with most of dose being given in first few hours); depends on location and duration of exposure. Sheltering in place in the hours after the detonation is important to reduce radiation dose.
- Combined injury: Defined as radiation plus blast and/or burn. This has a worse prognosis than either blast or burn alone.
- Multiple blunt trauma and lacerations: Resulting from motor vehicle accidents that are a consequence of flash blindness from detonation (the blindness lasts a few minutes, and is worse at night when the pupils are dilated); this may occur miles away, especially at night.
- Punctures and lacerations: Punctures and lacerations from glass breakage may be occur at distances up to miles from ground zero.

Radiation Contamination

- Prompt radiation from the detonation will produce high instantaneous doses, but will not contaminate people.
- Contamination comes from radioactive fallout alighting on the individual. People inside shelters will not experience superficial contamination unless they go outside. Individuals evacuating from shelters later may contaminate their shoes and clothing in transit through the DF zone.
- Lifesaving interventions by responders take precedence over decontamination, as long as they occur in areas that are considered safe for responders.
- Decontamination is the responsibility of state and local responders and individuals. The need for decontamination as soon as possible after the incident and the time it takes federal assets to arrive make it crucial for state and local entities to manage this function, although guidance may be available from federal authorities.
- Removal of outer garments and shaking out hair removes ≥90% of external contamination. Thus, control of removed clothing is a priority for containment of radiation.
- Management of internal contamination from inhalation or ingestion is not considered a significant part of the initial response. Therefore, there is no initial role for potassium iodide, Prussian Blue, or chelating agents (eg, diethylene triamine pentaacetic acid).

Response Worker Safety

Search and rescue operations will be markedly impeded by the relatively high levels of radiation in and around the MD zone. PAGs and the ALARA principle will guide actions.[15,19,20] Safeguards for responders include, but are not limited to, the following:

- Personal protective equipment will protect emergency workers from contaminants, but it will not protect against external radiation doses.
- Respirator or self-contained breathing apparatus will protect workers from breathing in radioactive particulates.
- Real-time personal electronic dosimeters will provide readings to alert emergency workers to when exposure levels are about to exceed worker safety limits (PAGs).
- By knowing radiation levels in the work area, one can calculate turnaround times to account for worker entry, time on task, and worker exit from the radiation zone.

Triage

When working in areas approved for search and rescue, EMS workers will use their customary field triage system, which is based initially on the physical injury (eg, simple triage and rapid treatment assessment [START], jumpSTART [a variant of START for pediatric patients], sort-assess-lifesaving interventions-treatment and/or transport [SALT], and Delayed, Immediate, Minimal or Expectant [DIME] used by the Department of Defense). If resource adequacy is limited, the standard order for triage and transportation (sickest first) may need to change, as noted in the next section. Given the magnitude of the incident and the limited size of the EMS response assets available, most people will reach medical care without having been screened in the field.

The radiation dose can be estimated roughly by the physical location of the individual at the time of detonation and afterward. When available, blood counts or the clear presence of cutaneous radiation burns can be used to define precise dose estimates. Many individuals will not have been exposed to any radiation. Time to vomiting after exposure is 1 simple way to estimate the dose. However, because vomiting has numerous etiologies besides radiation, time to vomiting is not considered to be a particularly accurate method.

Acute radiation syndrome and its organ subsyndromes are diagnosed as follows:

- Hematological syndrome: Clinically relevant acute injury occurs typically at doses above 2 to 3 Gy, although lower doses may be detectable with complete blood counts and other tests.

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For affected individuals receiving doses >2 Gy, immediate treatment with myeloid cytokines is indicated (eg, granulocyte colony-stimulating factor). The best effects occur when administered within 24 hours of exposure. Hematologic injury may become detectable 1 to 3 weeks after exposure, after a latent phase without signs or symptoms.

- Gastrointestinal syndrome: Gastrointestinal syndrome usually results after receiving doses >5 to 6 Gy. The syndrome occurs within a few days of exposure and can be managed with aggressive treatment.
- Neurovascular syndrome: Neurovascular syndrome typically results from doses >10 Gy. It is almost always fatal, but affected individuals will benefit from palliative/compassionate care.

The general principles of triage and management by dose of whole-body exposure to radiation (with the understanding that precise dose estimation initially may be difficult) are as follows:

- <2 Gy: follow-up only (possibly for biodosimetry assessment later)
- 2 to 4 Gy: evaluation and expert monitoring within 1 to 3 weeks of exposure, with myeloid cytokines if supplies are adequate
- >4 Gy: immediate medical attention, including myeloid cytokine treatment as soon as possible
- >10 Gy: palliative/compassionate care

Combined injury is defined as significant physical trauma (and burns covering more than 20% of the total body surface area) in conjunction with a radiation dose of >2 Gy; this has much worse prognosis than either injury alone. People with only minor trauma plus radiation will be triaged and managed in the same way as those with radiation only using radiation dose as outlined above.

The scarcity of medical resources (eg, staff, space, equipment, medicines) will vary greatly by location of the medical care facility and time after the incident; this will affect the ways in which people exposed to radiation are triaged and cared for. Conventional triage attends to "the sickest first." Resource scarcity after an IND detonation will result in a change of triage priority to provide the greatest good to the greatest number, which includes providing palliative/compassionate care. In cases of severe scarcity, the sickest victims who require intensive rescue resources may no longer be assigned first priority (see Casagrande et al[8] and Coleman et al[9]).

The standards of care that are available to victims will be affected by resource scarcity. It is expected that at least initially in nearby locations the provision of care may need to change from conventional to contingency (functionally equivalent) to crisis for some period of time.[21] Each institution should have a plan in place to determine when and how it will transition from normal or conventional triage guidelines and standards of care. It is crucial that these decisions be made by senior management and the reasons be communicated promptly and effectively to staff and the public. This will help to minimize chaos, inconsistency, and excessive stress in decision making, and to ensure adequate liability protections for practitioners.

It is essential that victims be reassessed and retriaged iteratively because resource adequacy may change rapidly over time. It is expected that facilities close to ground zero will experience marked resource limits initially, followed by subsequent improvement, as assets begin to arrive after 24 to 48 hours.

Background information and triage tools for use in a scarce resource setting can be found in the other articles in this issue[6-14] and on the REMM Web site. Planners and responders should consult these resources in advance to be able to implement their plans effectively and efficiently.

Venues for Medical Response

The radiation treatment, triage, and transport system (RTR system)[22] presents a functional approach to the various activities of the medical response (detailed information about the RTR structure is included in the electronic version of the Playbook).

The following list illustrates the various kinds of activities and where they would likely be located in relation to the zones of response noted above and regional assets.

- Phase 0: Preincident: Preparation (and possible ramp up based on intelligence, although there may be no notice for a terrorist event like an IND detonation)
- Phase I: Early phase: 0 to 24 hours
- Phase II: Intermediate phase: 24 to 96 hours (in addition to ongoing 24 hours starting in Phase I)
- Phase III: Later phase: >96 hours

There will likely be multiple RTR 1, 2, and 3 sites, each with different types of activities. Using this terminology allows responders to collaborate using common language for situational awareness, deployment or resources, and planning.

The medical response after a nuclear detonation requires the identification of assembly centers and medical care centers that are equipped to handle medical surge and have the ability to assess where the damage zones are located relative to the assembly centers and medical care sites. The medical response is organized following the RTR system and MedMap.[23]

Response Actions/Issues and Information Resources

Table 1 is adapted for this article from the DHHS IND Playbook. It lists selected tasks and issues for the Phase 0: preincident phase. Phases I through III will be on or linked to the REMM Web site.

Table 2 provides additional information resources that inform the activities of the medical response. These resources help responders to know where to find the background documents supporting administrative and medical activities.

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TABLE 1

Action Steps/Issues Emergency Support Function-8: Preincident Preparedness Activities for a Nuclear Detonation

Line No.	Actions/Issues	Information Source
General readiness planning and emergency management		
0-1	Provide preincident general education for responders, medical personnel, responsible officials, and the public; includes where to find information when a disaster strikes	1
0-2	Educate public safety agencies on the impact of a nuclear detonation and operational zones (SD, MD, LD, DF); work with medical care and public health entities to define possible medical care and assembly center sites per planning guidance for nuclear detonation including RTR system	2, 3
0-3	Educate public: Duck and cover if person witnesses a bright flash of light. Seek shelter as for a tornado after any catastrophic explosion in the community until advised further. Information about the advantage of time, distance, and shelter to increase survival likelihood	
0-4	Develop checklist for possible nuclear detonation specific to community that incorporates initial actions and notifications	
0-5	Establish plan to immediately activate EAS in wake of detonation for those areas immediately adjacent the blast	
0-6	Establish plan to liaison with National Weather Service and visual sources of information about detonation plume	
0-7	Ensure COOP plans for emergency management that include consideration of electromagnetic pulse effects around likely target zones	
0-8	EOC planning including law enforcement, fire, transportation, communication, medical care networks, medical distribution (pharmacies), debris removal, public information, utilities, private sector	
0-9	Educate nonfederal planners how to access federal information including DHS and DHHS via state and local means; radiation and plume modeling expertise will assist in situational awareness, even within the first few hours	
0-10	General and medical planners should work with DHHS (ASPR) for familiarization with MedMap GIS mapping of medical infrastructure in surrounding region	4
0-11	Use NIMS terminology and ICS structure for consistency among responders	5
0-12	Transportation issues to consider include creating immediate access along roads clogged by disabled vehicles and (especially) broken glass, transporting injured out of area by nonambulance means, transporting response personnel and supplies; transporting noninjured people; identify key transportation routes and modes that will require law enforcement to open and safeguard	
0-13	Designate regional staging areas for incoming personnel and supplies (eg, ambulances) and plan allocation and orientation (eg, maps) mechanisms	
0-14	Designate forward movement points (rail, air, ground) for evacuees/patient evacuation via NDMS and other means	www.hhs.gov/aspr/opeo/ndms 6
0-15	Assess fragility of 9-1-1 and other key communications systems relative to likely locations for a nuclear detonation and the impact (out to 2 mi) of EMP	
0-16	Validate public communication plan for settings where many usual technologies may not be available or work to reach displaced people or those within range of EMP effects (s *Planning Guidance* for information on communication)	7
0-17	Gain familiarity with planning for scarce resource situations	8 www.ahrg.gov/research/mce/mceguide.pdf
EMS		
0-18	Understand resources available under local MOUs, EMAC, and the Federal Ambulance Contract and their timeframe for arrival	
0-19	Define aeromedical resources available within region and neighboring regions and establish MOU and/or coordination mechanism for catastrophic circumstances	
0-20	Establish plan with regional partners to automatically report for briefing and assignment to designated staging areas within the region following a nuclear detonation	
0-21	Educate providers on zones of operation after a nuclear detonation (as above) and sheltering actions should they be in the DF zone at time of the attack; providers should be aware that immediate response may not be possible due to requirements for sheltering from fallout	
0-22	Educate providers about variation of a nuclear detonation from usual incident response plan, basic triage after a nuclear detonation, principles of mass casualty care and triage, appropriate personal protective equipment, and focus on patient care rather than decontamination	
0-23	Plan with public health and medical system for EMS support for and transport to medical care and assembly center sites and evacuation hubs	
0-24	Obtain radiation detectors and dosimeters for response vehicles, facilities, and individuals; plan for distribution and use according to community planning and risk profile	
0-25	Ensure coordination mechanism and communication plan for the multiple EMS agencies that will be involved with the response	
0-26	Review and update COOP plan including for situations in which the 9-1-1 system may be nonfunctional in certain areas (ie, what instructions are conveyed to public and how does EMS provide coverage)	
0-26	Ensure that crisis operations plans for agency/system are accomplished including triage of calls at public safety answering point, medical dispatch centers, on-scene, staffing configurations, and transport destinations (eg, delivering patients to nonhospital locations such as RTR3/medical care locations)	
Health care facility response		
0-27	Understand the implications of the declaration of a public health emergency on facility and provider liability	
0-28	Ensure internal and external communication redundancy in case of EMP or other effects	
0-29	Understand and practice coordination mechanisms with the area hospitals (HMCC)	
0-30	Define surge capacity assets and develop plan for maximal expansion of facility capacity	
0-31	Identify sites close to the facility that may serve as appropriate referral area for minor injuries (medical care center)	
0-32	Ensure facility infrastructure damage assessment and evacuation planning completion	
0-33	Ensure adequate COOP planning for utilities failure, other logistical and service interruptions	
0-34	Develop a strategy for crisis medical care including management of critical medical supplies; consider what to stockpile and contingencies for vendor delivery interruption	8 www.ahrg.gov/research/mce/mceguide.pdf
0-35	Consider resource-sharing arrangements within locale and region; include medical care facilities and suppliers	

(continued)

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TABLE 1

Action Steps/Issues Emergency Support Function-8: Preincident Preparedness Activities for a Nuclear Detonation (continued)

Line No.	Actions/Issues	Information Source
Health care facility response		
0-36	Based on threat assessment, stockpile "dry decon" kits allowing patients to control clothing or plan to accommodate large numbers of these patients	
0-37	Establish plan for victim flow, decontamination/clothing control, control of hospital environment in regard to radiation contamination (note that after a nuclear detonation, priority is on patient care with containment rather than full decontamination, which would be emphasized in RDD or other limited-exposure events)	
0-38	Ensure dosimeters and Geiger-Müller counters are available to the emergency department and ensure presence of radiation safety/nuclear medicine personnel who can assist with radiation monitoring and involvement in planning; establish radiation exposure standards, possibly in collaboration with other facilities in the region for consistency	
0-39	Consider radiation portal-monitor system for emergency department EMS entrance to identify individuals requiring further decontamination	
0-40	Understand the RTR system	3
0-41	Work with local/state/regional/tribal planners to define medical care facilities, including alternate care facilities, and assembly centers	3
0-42	Define plans for receipt and distribution of supplies from Strategic National Stockpile (including basic medical supplies and cytokines)	9, 11
0-43	Define plans for requesting resources from air and ground EMS services; understand the physical limitations of facility helipad and anticipate excessive demands on external EMS services	
0-44	Establish tools and/or methods for patient and victim tracking that integrate into community plan, disaster plan to include how documentation may be simplified during mass casualty incident	6
0-45	Establish plans for missing persons/patient hotline at facility	10
0-46	Download REMM and join REMM listserv	11
Public health		
0-47	Educate staff about impact of a nuclear detonation, likely effects, priorities, and the terminology of the RTR system	7
0-48	Understand process to request any emergency health declarations/powers and their implications	
0-49	Exercise with EOC and HMCC coordination between public health and hospitals/emergency management/EMS, which will be critical to successful response	
0-51	Ensure coordinated Medical Reserve Corps planning with neighboring jurisdictions and a mechanism to request assistance from these and other jurisdiction and state-based assets	
0-52	Strategic National Stockpile plans must include ability to staff reception point in conjunction with other demands on public health personnel (consider memorandum of agreement with adjacent region); vendor-managed inventory of cytokines and push-packs, among other supplies, will likely be enroute shortly after the incident	
0-53	Develop plan to provide guidance for sheltering in place and for evacuation; initial decisions on sheltering based on plume must be made immediately by emergency management/public safety; public health must be prepared to liaison rapidly with emergency management and, using initial models, define additional shelter and evacuation instructions Identify mass emergency shelters for evacuees of DF and other affected zones	7
0-54	Identify sites for assembly (screening) and medical care centers	
0-55	Coordinate medical care site planning with assistance from medical system and EMS	
0-56	Develop registration/screening form to include demographic information and symptom/epidemiologic assessment of radiation exposure for use at assembly centers, shelters, medical care areas	
0-57	Plan to coordinate messaging about who should not go to a medical facility to allow resources to be used for seriously injured people and provide instructions for self-care	7
0-58	Gain familiarity with issues regarding scarce resources and facilitate public discussions regarding what a scarce resources setting will mean.	8
0-58	Educate public about in-home and in-office emergency supplies and initial actions (see also first section of table)	
0-59	Educate public regarding decontamination and how to self-decontaminate (preincident and just in time); this may not need to be specific for radiation, but could address a broader range of exposures	
0-60	Ensure mass fatality management plan incorporates aspects of victim contamination and catastrophic casualty numbers	12
0-61	Establish plans for psychological support including risk communication, psychological first aid, and targeted interventions by local and regional/national means (hotlines, designated referral locations); offer training in psychological first aid	13
Medical system response		
0-62	Ensure that HMCC that include the hospitals in the area/region have practiced and that there is redundancy in case select facilities/personnel are rendered inoperative	
0-63	Determine the actions that adjacent regions and HMCC will take automatically after a nuclear detonation; is there also a plan in place for succession if the local HMCC is rendered nonfunctional due to the scope of the incident?	
0-64	Ensure the HMCC is integrated into a multiagency coordination center (eg, EOC) so that requests and issues may be sent via proper channels and situational awareness is improved	
0-65	Assess regional medical capacity (surge capacity) including planning for alternate care sites (medical care centers)	
0-66	Ensure communications system compatibility and redundancy planning between agencies and facilities	
0-67	Prepare list of potential critical medical supplies and develop local strategy for obtaining them	
0-68	Establish resource sharing plans and mechanisms for request of necessary resources	
0-69	Understand and practice mechanisms for health care facilities to move requests to appropriate emergency management partners at the local/regional/state level	
0-70	Prepare to provide consistent information on medical triage to ensure fairness; consider using information from the Scarce Resources for a Nuclear Detonation Project	14 www.ahrg.gov/research/mce/mceguide.pdf
0-71	Download REMM and join REMM listserv	11
0-72	Awareness of NDMS and other DHHS assets and how these are requested during an incident	
0-73	Awareness of local/regional resources for blood supplies	
0-74	Awareness of the Radiation Injury Treatment Network	16
0-75	Work with local Veterans Affairs hospitals and military facilities to ensure federal facility integration	

(continued)

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TABLE 1

Action Steps/Issues Emergency Support Function-8: Preincident Preparedness Activities for a Nuclear Detonation (continued)

Line No.	Actions/Issues	Information Source
Evacuee medical care and fallout-related radiation illness		
0-76	Educate population regarding importance of ducking and covering after a brilliant flash is seen, sheltering in place immediately after the incident, avoiding fallout by sheltering, evacuating based on official advice	
0-77	Distribute educational material regarding radiation injury and that those small amounts of radiation are not as harmful as many people assume	
0-78	Ensure education regarding decontamination, including self-decontamination	16
0-79	Ensure education that potassium iodide is not a part of a nuclear detonation response	
0-80	Emphasize family resilience planning (food, water, other supplies for 96 h)	
0-81	Emphasize for any major disaster the effects on 9-1-1, EMS, and medical care system and to avoid all nonemergent use of the medical care system	
Recovery		
0-82	Reassure people that there will be many survivors despite the disastrous nature of the incident	
0-83	Educate about the importance of community resilience.	
0-84	Educate about normal responses to stress and mitigating actions that can be taken	
0-85	Discuss guidelines for people returning to their homes and offices	
0-86	Plan for long-term registry and who should be studied for long-term cancer risk	
0-87	Establish plans for long-term psychological support	13

ASPR, Office of the Assistant Secretary for Preparedness and Response; COOP, continuity of operations; DF, dangerous fallout; DHS, Department of Homeland Security; DHHS, Department of Health and Human Services; EAS, emergency alert system; EMAC, Emergency Medical Assistance Compacts; EMP, electromagnetic pulse; EMS, emergency medical services; EOC, emergency operations center; GIS, geographic information system; HMCC, Health and Medical Coordination Center; ICS, incident command system; LD, light damage; MD, moderate damage; MOU, memorandum of understanding; NDMS, National Disaster Medical System; NIMS, National Incident Management System; RDD, radiological dispersal device; REMM, radiation emergency medical management; SD, severe damage.

TABLE 2

Additional Resources

Information Source	Topic	Where to Locate Information
1	Key principles for medical responders	Medical management guidelines available at REMM http://www.remm.nlm.gov/index.html
2	Structural, radiation, and medical response	Planning Guidance 2nd Ed,[15] page 41 available at http://www.remm.nlm.gov/PlanningGuidanceNuclearDetonation.pdf Also in Appendix Folder
3	Radiation treatment, triage, and transport system description	Planning Guidance 2nd Ed,[15] page 84 available at http://www.remm.nlm.gov/PlanningGuidanceNuclearDetonation.pdf Also in Appendix Folder
4	MedMap	Access available when needed through Department of Health and Human Services Secretary's Operations Center
5	National Incident Management System	*http://www.fema.gov/emergency/nims*
6	Patient registration and tracking	Planning Guidance 2nd Ed,[15] page 113 also available at http://www.remm.nlm.gov/PlanningGuidanceNuclearDetonation.pdf Also in Appendix Folder
7	Public health announcements	Planning Guidance 2nd Ed,[15] pages 121-124 also available at http://www.remm.nlm.gov/PlanningGuidanceNuclearDetonation .pdf Also in Appendix Folder
8	Scarce resources environment	Knebel et al[7] Figure 4
9	Strategic National Stockpile	*http://www.bt.cdc.gov/Stockpile*
10	Establishment/activation of a missing persons hotline/Internet site	Planning Guidance 2nd Ed,[15] pg 113 available at http://www.remm.nlm.gov/PlanningGuidanceNuclearDetonation.pdf Also in Appendix Folder
11	Radiation emergency medical management	*http://www.remm.nlm.gov*
12	Mass fatality planning	Planning Guidance 2nd Ed,[15] pages 96-97 available at http://www.remm.nlm.gov/PlanningGuidanceNuclearDetonation.pdf Also in Appendix Folder
13	Psychological issues	Planning Guidance 2nd Ed,[15] pages 93-96 available at http://www.remm.nlm.gov/PlanningGuidanceNuclearDetonation.pdf
14	Scarce resources triage guidelines	Casagrande et al,[8] Caro et al,[11] http://www.ahrq.gov/research/mce/mceguide.pdf
15	Radiation Injury Treatment Network	http://www.nmdp.org/RITN
16	Decontamination operations-persons	Planning Guidance 2nd Ed,[15] page 110-112 also available http://www.remm.nlm.gov/PlanningGuidanceNuclearDetonation.pdf
17	Scarce Resources for a Nuclear Detonation	Series published in *Disaster Medicine and Public Health Preparedness,* Vol 5, Suppl 1, March 2011 (see below)

Information Source 17:

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