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BEST PRACTICE

Radiological Dispersal Device Incident Response Planning: Decontamination

PURPOSE

Describes issues and pre-planning initiatives to address mass decontamination following a Radiological Dispersal Device (RDD) incident.

SUMMARY

Mass screening and decontamination after an RDD event is likely to be a time-consuming, resource-intensive process that could overwhelm many jurisdictions. Planners should establish standard operating procedures (SOP) that include large-scale monitoring and decontamination provisions after an RDD event.

Public demand for screening and decontamination following an RDD event could exhaust local resources at the onset of emergency response operations. RDDs such as dirty bombs or other aerosolization systems could contaminate people at and around the primary incident site as well as along the path of the plume. Contaminated victims then could cross-contaminate other people, responders, and receivers. These people will require screening and possibly decontamination. In addition, many people outside the incident area may believe that they were contaminated and demand to be screened and decontaminated. Thus, public demand for screening and decontamination could become rapidly unmanageable and overwhelm emergency response organizations in many jurisdictions.

This document discusses these and other essential issues that jurisdictions should consider when developing mass screening and decontamination plans:

- The Mass Screening and Decontamination Threshold
- Onsite Screening and Decontamination Issues
- Screening and Decontamination Issues at Locations other than the Incident Site
- Expected Number of People Undergoing Screening;
- Decontamination Mechanisms: Providing Responders and Victims with Alternative Procedures;
- Management of Contaminated Fatalities
- Selected Resources

DESCRIPTION

The Mass Screening and Decontamination Threshold

Many planners believe that resources available in their jurisdictions will be sufficient to manage mass screening and decontamination following an RDD event. However, some planners may not fully realize the number of resources required to perform mass screening and decontamination following an RDD incident and may be unprepared for these tasks. As a result, an RDD attack could quickly become a catastrophic event for many jurisdictions.

Emergency planners must be aware of the level at which local resources and expertise can become inadequate to manage mass screening and decontamination. Being aware of this upper threshold can help planners establish realistic mass screening and decontamination plans for their jurisdictions.

Regional Approach to Mass Screening and Decontamination

Experts advise jurisdictions to consider developing a comprehensive regional plan to manage mass screening and decontamination after an RDD event. Planning to use regional assets can help jurisdictions compensate for their lack of local resources and expertise. A comprehensive regional plan should include procedures:

- To help first response organizations in a jurisdiction coordinate with first receivers at healthcare facilities and any other organizations that may play a role in the screening and decontamination process after an RDD event; and
- To help jurisdictions in a region coordinate and standardize decontamination procedures, share scarce radiological resources, and deploy assets in an efficient and practical manner following an RDD incident.

The Connecticut Capitol Region Council of Governments's [*Rapid Access Mass Decontamination Protocol*](#) coordinates assets and standardizes decontamination procedures in the Connecticut Capitol Region. The Capitol Region Metropolitan Medical Response System represents 42 communities in north-central Connecticut and includes 10 healthcare facilities and approximately 100 state and local emergency response organizations.

Onsite Screening and Decontamination Issues

Experts generally advise emergency response personnel to survey and, if necessary, decontaminate externally contaminated victims without life-threatening injuries onsite after an RDD event. Only victims with life-threatening injuries should be immediately transported to a medical facility to receive emergency medical care and to undergo decontamination.

Planners should consider that emergency response organizations will be required to provide shelter, medical care, and other essential services for people waiting for an extended period of time prior to screening and decontamination. Managing a large number of people at the incident site could quickly strain local resources. For more information on providing essential services to victims waiting to be surveyed and decontaminated, please refer to the "Selected Resources" section of this Best Practice document.

The Department of Homeland Security, Working Group on Radiological Dispersal Device Preparedness: Medical Preparedness and Response Sub-Group's [*Report*](#) states, "Do not attempt to release a medically stable patient to ambulance personnel before a radiological survey has been performed. If contamination is confirmed, preliminary decontamination should be attempted."

Decontamination Site Structure

Experts advise planners to incorporate provisions for establishing onsite mass screening and decontamination in their SOPs. Plans could incorporate several concepts, including ensuring that responders select a non-contaminated area as the decontamination site, pre-position radiological monitors at the zones' exits, and establish exit points in areas of relatively low background radiation, less than or equal to twice the

The New York State Department of Health's [*Radiological Terrorism Rapid Response Card for EMS Personnel*](#) lists several treatment and decontamination rules that emergency response personnel might consider when planning for RDD emergency response.

normal background level. Pre-planning for a decontamination site also could include the following:

- **Changes in weather conditions:** SOPs should include procedures to quickly move the decontamination area in case of changes in weather conditions, such as a shift in wind direction, or when onsite conditions deteriorate. The Armed Forces Radiobiology Research Institute's (AFRRI) [Medical Management of Radiological Casualties Handbook](#) advises emergency responders to plan to shift the decontamination site at least 75 meters upwind when the wind shifts by more than 45 degrees for longer than 15 to 20 minutes. The handbook also states that the ideal decontamination setup should include two separate decontamination sites.
- **Establishing separate areas for different categories of victims:** Experts advise jurisdictions to establish separated areas for contaminated and non-contaminated/decontaminated victims as well as injured contaminated and non-injured contaminated victims. This can greatly limit cross-contamination risks, facilitate crowd control, and manage mass panic.
- **Relocation of ambulatory victims:** Planners should establish procedures for the relocation of all the ambulatory victims potentially contaminated or exposed to a pre-established location for monitoring.

For more information on the structure of a decontamination site, please also refer to the "Selected Resources" section of this Best Practice document.

Providing Victims with Instructions

Planners should consider providing victims waiting to be monitored and decontaminated at an RDD incident site with clear instructions. Supplying victims with clear, pre-packaged instructions can help emergency response organizations manage onsite monitoring and decontamination of a large number of victims in an efficient manner. Victims could be directed:

- To go to the designated area;
- To follow response personnel instructions at all times;
- To not eat, drink, or smoke; and
- To provide designated personnel with personal information.

These instructions also should describe the decontamination process and provide directions for the disposal of clothing and personal items.

Screening and Decontamination Issues at Locations other than the Incident Site

Experts believe that performing mass screening and decontamination at an incident site in some cases may not be possible or advisable. Planners should be aware of these circumstances and plan to screen and decontaminate some or all the victims at other locations.

The Connecticut Capitol Region Council of Governments's [Rapid Access Mass Decontamination Protocol](#) includes instructions for victims performing self-decontamination at healthcare facilities. For more information, please see the *Lessons Learned Information Sharing Practice Note* document, "[Mass Decontamination: Connecticut Capitol Region Metropolitan Medical Response System's Guidelines for Hospital-Based Directed Self-Decontamination.](#)"

Following the 1995 Tokyo subway sarin attack, a large majority of the victims left the incident area immediately after the explosions. These victims then reported to healthcare facilities by private or public transportation.

Victims Leaving Immediately after the Incident

Some victims are likely to leave immediately after the RDD event takes place, unaware that radioactive material was dispersed onsite. Plans should include procedures to screen and decontaminate these victims at locations other than the incident site.

Insufficient Resources for Onsite Decontamination

Many jurisdictions may not have sufficient resources to screen and decontaminate a large number of people onsite in a timely fashion. In this case, it is critical that plans include alternative procedures for emergency personnel responding to an RDD event. Attempting to screen and decontaminate a large number of people onsite with limited resources would cause many victims to wait for an extended period of time.

Planners should be aware that the length of time that emergency response personnel may need to screen and decontaminate victims after an RDD event could contribute significantly to the success or failure of emergency response operations. Indeed, some victims who are asked to wait for a long time could choose to leave the incident area. The more time contaminated victims wait to be screened and decontaminated, the likelier it will be that they will contaminate additional people or locations inadvertently and/or become internally contaminated. Emergency response organizations that tried to control the spread of contamination with insufficient resources would then become quickly overwhelmed.

Inclement Weather and other Incident Conditions

Inclement weather and other incident conditions can make it unsafe for responders to decontaminate a large number of people at or near the incident site. Planners should consider the possibility that mass screening and decontamination might have to be performed at locations other than the incident site. The decision to screen and decontaminate people outdoors or indoors will likely depend on weather conditions as well as the population who is being screened and decontaminated. For instance, many experts advise emergency response personnel to plan to decontaminate the elderly, people with particular medical conditions, and small children indoors at all times.

Screening and decontamination SOPs should incorporate procedures that emergency responders can select in case onsite mass screening and decontamination becomes unfeasible, including:

- **Identifying indoor facilities for mass screening and decontamination:**

Planners might wish to identify indoor facilities that could be used for mass screening and decontamination after an RDD event. Indoor decontamination could help control the influx of people and prevent hypothermia, especially during the cold weather season. Decontamination at a facility also can provide people with a comfortable setting and be less traumatic for such victims as small children, seniors, or people with particular medical conditions. Facilities could include:

 - **Schools:** Emergency planners might consider, for example, using the shower facilities at local schools to perform supervised decontamination. These facilities also usually have large spaces, such as physical education buildings

The Anchorage, Alaska, Fire Department's [*Operations Plan: Cold Weather Decontamination and Triage*](#) includes comprehensive guidelines for cold weather decontamination in the northern and arctic environments. This plan also provides information on decontamination methods and resources that responders could use when decontamination equipment is not readily available.

For more information on cold weather decontamination, also refer to the *Lessons Learned Information Sharing Practice Note* document, "[*Mass Decontamination: Connecticut Capitol Region Metropolitan Medical Response System's Cold Weather Protocols*](#)."

or auditoriums, which can be used to shelter people waiting to be decontaminated.

- **Underground parking structures:** These structures have the advantage of having sprinkler systems, sewage systems, and built-in ramps that can be used for the deflux of contaminated water.
- Other facilities that planners could consider are shopping malls, some large buildings, and convention centers.
- **Identifying outdoor locations for mass screening and decontamination:** Responders could use sport arenas and outdoors concert halls for outdoor mass screening and decontamination.

Expected Number of People Undergoing Screening

The total number of people that might ask to be screened after an RDD event could be significantly higher than many planners expect. Experts generally anticipate that only a small group of people who were at or near the incident site at the time of the event may require screening and possibly decontamination. Nevertheless, a large number of people may fear they have been exposed to radiation following a radiological release event. These people could crowd local healthcare facilities or fire stations demanding to be screened and decontaminated. Planners should consider that public demand for screening could overwhelm the local healthcare system very quickly.

Approximately 112,000 out of 1 million city residents demanded to be screened after the discovery in 1987 of a cesium-137 release in Goiânia, Brazil. Brazilian authorities set up a triage area in the local stadium to manage the influx of people. Some Goiânia residents showed up every day to be monitored. Many panicked and fainted while waiting in line. The management of these people absorbed a vast amount of local, national, and international resources and expertise for more than 2 weeks. For more information on this cesium-137 release event, please refer to the *Lessons Learned Information Sharing* Lesson Learned document, "[Radiological Incident Response: Post-Release Psychological Management](#)."

Experts advise jurisdictions to include in their plans a list of local, state, and federal resources that could supplement local assets in the event that public demand for screening becomes unmanageable. These additional resources could be essential for managing mass screening and decontamination following an RDD incident.

Federal and State Resources

Many federal and state agencies employ transportable radiation monitors that could be used to perform mass screening. For more information on federal and state resources, please refer to the *Lessons Learned Information Sharing* Best Practice document, "[Radiological Dispersal Device Incident Response Planning: Roles and Responsibilities of Emergency Response Organizations](#)."

The Los Angeles County Emergency Medical Services Agency recommends that hospitals that employ radiation portal monitors to survey outgoing garbage trucks consider using these monitors for mass screening after a radiological release event. For more information, please see the *Lessons Learned Information Sharing* Practice Note document, "[Radiological Incident Response: Los Angeles County, California, Emergency Medical Services Agency's Guidelines for Mass Screening at Hospitals](#)."

Local Assets

Planners should consider that in many cases federal and state resources may not be available for several hours following an RDD event. Therefore, jurisdictions need procedures to manage mass screening before specialized federal and state resources arrive. Planners could consider including in their screening and decontamination plans:

- A list of local facilities and organizations that could help responders survey large numbers of concerned people after an RDD event. These facilities can include hospitals, universities, and research centers.
- Procedures for employing radiation detection equipment routinely used by such facilities as metal scrap yards or waste disposal sites. Many of these facilities use radiation monitoring instruments and could become remote radiation survey centers to screen the public.

The Pennsylvania Department of Environmental Protection requires all residual solid waste facilities to monitor incoming waste for the presence of radiation and radioactive material. Other states are considering similar regulations. Several large national waste disposal companies also have voluntarily installed radiation detection systems at the entrances of their facilities to detect radioactivity on inbound vehicles.

Decontamination Mechanisms: Providing Responders and Victims with Alternative Procedures

Decontamination plans should incorporate a range of procedures that emergency response personnel could employ following an RDD event. The choice to adopt particular procedures should be based upon several considerations, including incident conditions and the number of victims requiring decontamination. The following procedures could be listed in these plans.

Dry Decontamination

Many experts advise emergency response organizations to consider planning primarily for dry decontamination following an RDD event. For instance, the AFRRRI's [*Medical Management of Radiological Casualties Handbook*](#) states that "the simple removal of outer clothes and shoes, in most instances, will effect a 90% reduction in the patients' contamination." Dry decontamination could be especially appropriate when adverse weather conditions make mass decontamination with cold water unsafe for victims.

Wet Decontamination

External contamination resulting from an RDD is easy to remove. Water alone or soap and water are considered satisfactory decontamination solutions following an RDD event. Warm water should be used whenever possible during decontamination. However, planners need to consider that it may be difficult to locate a sufficient amount of warm water for the decontamination of a large number of people at an RDD incident site. Many emergency response organizations routinely employ cold water for mass decontamination during RDD exercises. RDD plans need to stress that cold water can cause thermal shock and hypothermia and to list alternative means of decontamination that the incident commander could select if necessary.

Field decontamination methods that jurisdictions also could consider include:

- Using hoses to establish a fog stream and to spray victims from the top down; and
- Placing pumpers in a "V" formation and using fog nozzles to provide a fog pattern into the decontamination corridor between the pumpers for victims to walk through.

Decontamination Levels after a Radiological Release Event

Decontamination following a radiological release aims to decrease contamination to a pre-identified level, as complete decontamination generally is not possible. Many experts advise emergency responders to cease external decontamination of victims in one of the following three cases:

- When decontamination efforts produce no significant reduction in contamination;
- When the level of radiation is less than twice background; or
- Before intact skin becomes abraded.

During the [*Delta Fire—General Motors Radiological Dispersions Device Exercise*](#), emergency responders performed “hasty decontamination” of victims by spraying them with fire hoses over a lawn area. The incident commander chose to perform this type of decontamination because the dirty bomb explosion occurred inside the General Motors factory and produced a limited dispersion of the radioactive material. As a result, many of the victims in the building at the time of the event were highly contaminated and needed to be decontaminated quickly.

The decontamination teams distributed towels, blankets, and other items to keep the victims warm after decontamination. Emergency response personnel then monitored each person for remaining contamination and directed the ones that needed further decontamination to one of three decontamination tents.

Self-Decontamination

Medically significant levels of contamination are not expected in the general population of uninjured contaminated persons in most RDD scenarios. Thus, many experts advise responders to encourage victims to perform self-decontamination if the number of evacuees is very large.

Planners could consider providing contaminated but not injured people, when appropriate, with clear self-decontamination instructions. Self-decontamination can reduce the staffing need, speed up the decontamination process, and reduce modesty issues. Planners might find it helpful to know that self-decontamination guides could list several basic concepts for people who have been exposed to radiation. These people should:

- Remove their clothes and put them in a sealed plastic bag. This should be done, if possible, prior to entry into their domiciles to prevent contamination;
- Isolate the bag away from themselves or other people;
- Take a shower or wash as thoroughly as possible with lukewarm water without causing skin abrasions; and
- Monitor media sources for disposal and other instructions.

A number of organizations have created self-decontamination instructions that could be distributed after an RDD event. Examples of self-decontamination instruction documents are:

- The Morris County, New Jersey, Department of Health’s [*Pocket Guide to Emergency Preparedness*](#) and
- The Logan County, Illinois, Health Department’s [*Your Pocket Guide to Emergency Preparedness*](#).

Self-Decontamination Issues

Jurisdictions planning to employ self-decontamination after an RDD event should consider the following:

- Many victims may not regard self-decontamination as an equally effective substitute for decontamination performed by emergency responders or receivers. These people then could demand to be screened and decontaminated by emergency response personnel.
- It is likely that people who self-decontaminate at home will then report to healthcare facilities requesting a medical evaluation. Jurisdictions should include in their plans procedures to manage this influx of victims.

- Self-decontamination instructions generally direct victims to place their contaminated clothes in a sealed plastic bag. Jurisdictions should plan to collect these bags. Collection and decontamination of these discarded clothes could be an overwhelming task for a number of jurisdictions.

Containment of Runoff Water

Experts believe that victims' decontamination following an RDD event should not be delayed due to runoff concerns. The decision to contain decontamination water should be based upon the severity of the incident, the immediacy of the decontamination need, and the resources available. Flushing the water down standard drains might be appropriate during mass casualty decontamination after an RDD event.

On [September 17, 1999](#), the Environmental Protection Agency (EPA) stated that the "EPA will not pursue enforcement actions against state and local responders for the environmental consequences of necessary and appropriate emergency response actions. During a hazardous materials incident (including a chemical/biological agent terrorist event) first responders should undertake any necessary emergency actions to save lives and protect the public and themselves. Once an imminent threat to human life is addressed, first responders should immediately take all reasonable efforts to contain the contamination and avoid or mitigate environmental consequences and an expanded scope of work for mitigative response actions."

In September 1987, an accidental release of cesium-137 in Goiânia, Brazil, caused the second largest nuclear accident after Chernobyl. The Brazilian National Nuclear Energy Commission sent an emergency team to Goiânia the following day. Team personnel found that 22 contaminated patients had been isolated in 8 civil defense tents inside the Olympic Stadium since the day before. Decontamination baths had been set up in the stadium, but victims had been denied access to these facilities. The stadium's coordinators feared that the water used for victims' decontamination could contaminate the area.

Management of Contaminated Fatalities

Victims deceased after an RDD event may have minimal contamination and may not constitute a serious health threat for emergency responders. The following resources may help jurisdictions plan for handling contaminated remains:

- The Department of Energy, Transportation Emergency Preparedness Program's [Model Procedure for Medical Examiner/Coroner on the Handling of a Body/Human Remains that are Potentially Radiologically Contaminated](#) lists procedures to be implemented when handling casualties after a radiological event.
- In chapter VIII, "Decontamination of Human Remains and Personal Effects," the Joint Chiefs of Staff's [Joint Publication 4-06: Mortuary Affairs in Joint Operations](#) describes procedures for onsite decontamination of fatalities.

Selected Resources

Several resources are available to help emergency response organizations identify appropriate decontamination procedures, establish decontamination sites, and screen and decontaminate a large number of victims.

- The Connecticut Capitol Region Metropolitan Medical Response System's [Rapid Access Mass Decontamination Protocol](#) provides a system for region-wide mobilization of decontamination assets following a large-scale incident. The plan is applicable to accidental or intentional releases of chemical, biological, and radiological materials. The protocol includes incident-site mass decontamination procedures, hospital-based mass decontamination procedures, and decontamination techniques.

- The Department of Commerce, Technology Administration, National Institute of Standards and Technology's [Aid for Decontamination of Fire and Rescue Service Protective Clothing and Equipment after Chemical, Biological, and Radiological Exposures](#) provides basic decontamination information for contaminated equipment and clothing.
- The Department of Homeland Security, Working Group on Radiological Dispersal Device Preparedness, Medical Preparedness and Response Sub-Group's [Report](#) includes a section on patient decontamination.
- The State of Connecticut's [Mass Decontamination Mobilization Plan](#) (Draft) includes a decontamination trailer deployment process; chemical, biological, and radiological agent information; decontamination methods; a decontamination tent appendix; and a hospital-based decontamination outline and process.
- The Tempe, Arizona, Fire Department's [Radiological Decontamination](#) includes a list of steps to be taken during decontamination as well as instructions on how to remove contaminated equipment and clothing.
- The Department of Energy, Transportation Emergency Preparedness Program's [Model Procedure for Radioactive Material or Multiple Hazardous Materials Decontamination](#) provides guidance for performing decontamination of emergency response personnel exiting the hot zone of a radiological incident. It includes a list of equipment that might be needed to perform decontamination as well as examples of decontamination procedures for personnel wearing different levels of personal protection equipment. The model also describes step-by-step decontamination procedures.
- United States Army, Center for Health Promotion and Preventive Medicine's [The Medical NBC Battlebook](#) includes a specific section on personnel decontamination.

The National Nuclear Security Administration's *Municipal Radiological/Nuclear Emergency Preparedness Plan* states that decontamination is recommended for many isotopes with readings exceeding 100 counts per minute (CPM) above background level. Many jurisdictions also use twice background or 100 CPM above background as a positive indication of contamination in their plans. However, some experts noted that this reference may not be correct for all instruments and potential scenarios.

The Centers for Disease Control and Prevention, Public Health Training Network's [Preparing for Radiological Population Monitoring and Decontamination](#) Web cast describes basic populations monitoring procedures and challenges.

Jurisdictions also might consider international sources such as the United Kingdom Home Office, Ministry of State for Counter-Terrorism and Resilience's [Strategic National Guidance: The Decontamination of People Exposed to Chemical, Biological, Radiological or Nuclear \(CBRN\) Substances or Material, Second Edition](#).

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