



# EDGEWOOD CHEMICAL BIOLOGICAL CENTER

U.S. ARMY RESEARCH, DEVELOPMENT AND ENGINEERING COMMAND  
Aberdeen Proving Ground, MD 21010-5424

ECBC-SP-036

## GUIDELINES FOR MASS CASUALTY DECONTAMINATION DURING AN HAZMAT/WEAPON OF MASS DESTRUCTION INCIDENT: VOLUMES I AND II

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## **Preface**

The work described in this report was funded by the U.S. Army Chemical Biological, Radiological and Nuclear School under GFEBS Contract No. R.0000058.41.1.1. The revised draft document was started July 2012, completed in August 2013, with additional peer review in the latter portion of FY13.

This revised Special Report, along with the original Special Report (ECBC-SP-024) were published through the Technical Release Office; however, it was edited by the Engineering Directorate, U.S. Army Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD.

The information contained herein is based upon empirical data and technical information believed to be accurate and reliable. It is subject to revision as additional knowledge and experience is gained. This report has been determined to NOT contain export-controlled technical data and therefore IS NOT subject to the Arms Export Control Act (Title 22, U.S.C., Sec 2751, et seq.) or the Export Administration Act of 1979 (Title 50, U.S.C., App. 2401 et seq).

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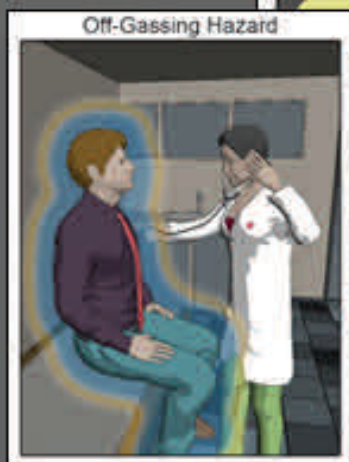
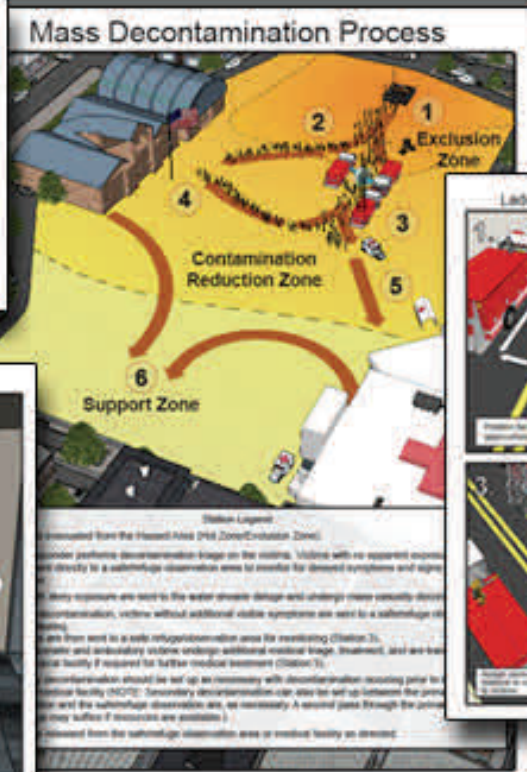
- Geisel School of Medicine at Dartmouth for their expertise and contributions to this document, and
- Dr. Ernie Braue and the staff at the US Army Medical Research Institute of Chemical Defense (USAMRICD) for reviewing this document.

In addition, ECBC would like to thank:

- The U.S. Department of Health and Humans Services, Office of the Assistant Secretary for Preparedness & Response (ASPR), and
- The Office of Health Affairs for their collaborative efforts with this document and the Mass Decontamination Working Group.

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# GUIDELINES FOR MASS CASUALTY DECONTAMINATION DURING A HAZMAT/WEAPON OF MASS DESTRUCTION INCIDENT



## VOLUMES I & II

**THE KEY TO SUCCESSFUL MASS CASUALTY DECONTAMINATION IS TO USE THE FASTEST APPROACH THAT WILL CAUSE THE LEAST HARM AND DO THE MOST GOOD FOR THE MAJORITY OF THE PEOPLE. COORDINATION OF INITIAL ASSESSMENT AND ONGOING SURVEILLANCE PROCEDURES IS CRITICAL TO ENSURE THAT THE HEALTH NEEDS OF VICTIMS CONTINUE TO BE MET AS THE INCIDENT EVOLVES.**

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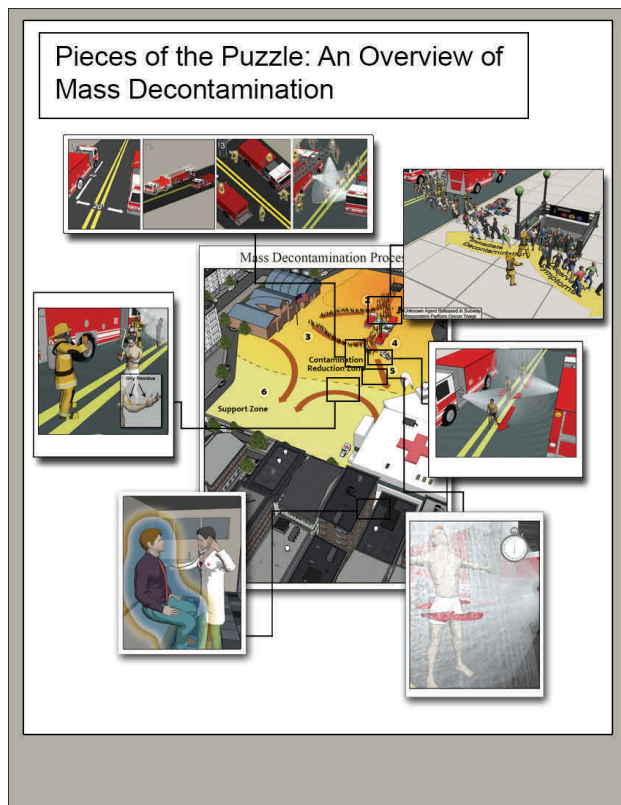


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# VOLUME I OF II

## QUICK REFERENCE FIELD GUIDE



ECBC-SP-036

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V1.1 2013



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## Principles of Mass Casualty Decontamination (\*)

1. Time is critical in order to save the most lives; a) the immediate removal of clothing outside the contaminated area for patients who have been visibly contaminated or who have been suspected of having been contaminated and b) processing the victims through a high-volume, low-pressure water shower (~50 to 60 psi) is priority. This may aid in the removal of 80-90% of physical contamination in almost all cases.
2. Provide effective mass casualty decontamination. Other activities, such as setting up commercial decontamination tents, tarps, additional decontamination equipment, and/or creating a soap-water solution should be accomplished when time permits.
3. Conduct decontamination triage prior to administering a high-volume, low-pressure water shower.
4. When the contamination involves chemical vapors, biological or radiological material, using gentle friction (such as rubbing with hands, cotton flannel or microfiber cloth, or sponges) is recommended to aid in removal of contamination. Rubbing should start with the head and proceed down the body to the feet. Extra care should be taken to prevent the spread of contamination to the mouth, nose and eyes (such as holding one's breath to avoid inhalation/close contact with mucosa and closing one's eyes while wiping the face and head).

**(\*) The key to successful mass casualty decontamination is to use the fastest approach that will cause the least harm and do the most good for the majority of the people. Coordination of initial assessment and ongoing observation procedures is critical to ensure that the health needs of victims continue to be met as the incident evolves.**

### Special Considerations

- Initial decontamination wash time should be between 30 seconds and three minutes in duration to ensure thorough soaking, depending on the situation and agent involved.
- Safe/refuge observation areas should be utilized to monitor victims for signs of delayed symptoms or evidence of residual contamination.
- Secondary decontamination should be performed as necessary, where the set up of secondary decontamination should not delay primary decontamination.

#### Non-liquid

- If responders suspect the contamination is biological, radiological, or a gas/vapor, a water-only shower is typically adequate.

#### Liquid

- A secondary decontamination shower that includes a soap-water solution will likely be required for liquid contamination to ensure effective physical removal of agent.
- When removing liquid chemical contamination (e.g., sulfur mustard), use of a wash cloth may significantly aid in decontamination by gently rubbing the contaminated area. Caution should still be exercised to prevent the spread of contamination.

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## 1.0 Introduction

Since the April 2009 publication of the United States (U.S.) Army Edgewood Chemical Biological Center (ECBC) Special Report ECBC-SP-024; *Guidelines for Mass Casualty Decontamination During a HAZMAT/Weapon of Mass Destruction Incident, Volumes I and II*, lessons have been learned from recent international research and recommendations submitted by the Mass Casualty Decontamination Integrated Project Team (IPT) that warrant revisions to this document. Terrorist organizations have used different chemical, biological, radiological, nuclear (CBRN) weapons to pursue their own agendas (e.g., in 1995, the Aum Shinrikyo cult released sarin onto the Tokyo subway system, killing 12 and injuring hundreds, in 2001, anthrax spores were sent through the U.S. Postal Service killing five postal employees and infecting 22 others). The increasing complexity and scale of these incidents suggest the possibility of a large scale attack with a Weapon of Mass Destruction (WMD) causing many thousands of casualties on US soil. Since these attacks are difficult to prevent and may happen anywhere and at any time, rapid, widely available effective mass decontamination is one of the key elements to managing the consequences of such an event, saving lives, and limiting the number of injuries.

## 2.0 Background

In April 2009, the ECBC published Special Report ECBC-SP-024; *Guidelines for Mass Casualty Decontamination During a HAZMAT/Weapon of Mass Destruction Incident, Volumes I and II.* This original Special Report provided an update to two previous reports; *Guidelines for Mass Casualty Decontamination During a Terrorist Chemical Agent Incident* (ECBC-TR-125; Jan 2000) and *Guidelines for Cold Weather Mass Decontamination* (Jan 2002), both published by the U.S. Army Soldier and Biological Chemical Command (SBCCOM) - now ECBC. This revised set of Guidelines supersede the published Apr 2009 Guidelines. The Guidelines contained herein represent the latest evolution in our approach to mass casualty civilian community based decontamination and continued refinement of decontamination doctrine for hazards (chemical, biological, radiological, unknown).

## 3.0 Objective

These Guidelines were developed for First Responders to provide information and suggested procedures for mass casualty decontamination following a hazardous material (HAZMAT)/WMD attack. Therefore, it is recommended that these Guidelines should be tailored for use based on individual resources. Also, while there is no perfect solution to mass casualty decontamination and there is no single process or method that can account for all variables (e.g., hazard, time, number of victims, environmental conditions, resource availability, etc.), the information presented in Volume I and II is presented as a means to help identify a simple, consistent mass casualty decontamination process that could be applied with reasonable effectiveness to any HAZMAT/WMD incident. In other words, ***use the fastest approach that will cause the least harm and do the most good for the majority of the people.***

Volume I focuses on providing responders succinct instructions, including checklists for performing mass casualty decontamination. Volume II provides supporting information and the reasoning behind the procedures outlined in Volume I.

## 4.0 Scope

The information presented is based on exposure to typical hazards and focus on immediate or rapid civilian mass casualty decontamination. Volumes I and II primarily focus on chemical, biological, and radiological (CBR) agents, but can be applied to Toxic Industrial Chemicals (TICs), Toxic Industrial Materials (TIMs), and toxins (collectively referred to in this document as HAZMAT/WMD). In addition, Volumes I and II do not cover each type of threat individually, however, the basic principles outlined are applicable to all HAZMAT/WMD situations that require immediate measures to decontaminate large civilian populations subjected to a no-notice or limited-notice event. The time requirements to decontaminate large numbers of civilian patients limits the countermeasures that would normally be taken if there were only a few patients. There will be no time to measure the effectiveness of decontamination on individual patients may be impractical due to time constraints. Even small additional increments of time, when added to thousands of additional patients requiring decontamination, may have a significant impact on the patients at the end of the line.

This document addresses decontamination of an overwhelming number of victims (involving hundreds to thousands of victims) resulting from a HAZMAT/WMD incident in a large urban population center involving many hundreds to thousands of patients. Mass casualty decontamination requires a slightly different approach than the individual technical and equipment decontamination applied during typical or limited HAZMAT incidents. The information presented is designed to be initiated during the first minutes of a mass casualty HAZMAT/WMD incident to reduce contamination and minimize casualties.

## 5.0 Guidelines Format

The enclosed Guidelines have been divided into two Volumes and have been updated to include recently obtained empirical data and updated technical information:

### 5.1 *Volume I – Quick Reference Field Guide*

Volume I is a quick reference book and designed to be a short, concise description of procedures to set up and execute mass decontamination. Volume I is designed to be separated and distributed to team members for training purposes and for use during a mass casualty HAZMAT/WMD incident. Use of this Volume is to supplement pre-established planning efforts for known hazard scenarios in your particular community.

### 5.2 *Volume II - Supplemental Information*

Volume II is a more in-depth compendium of HAZMAT/WMD mass casualty decontamination and contains the reasoning behind the recommended procedures in Volume I, a review of the Guidelines development process, reference sources, potential best practices, additional considerations, and information concerning the working group that developed these Guidelines. Volume II also includes, by reference, the "*Patient Decontamination in a Mass Chemical Exposure Incident: National Planning Guidance for Communities*", which sets forth patient decontamination principles from a strategic standpoint, rather than a tactical one. Volume II is intended to be a planning guide, not to specify operational practices.

## 6.0 Overview

This section discusses the basic foundation and a recommended procedure for immediate community based or local mass casualty decontamination, which can be initiated by local fire departments anywhere in the nation. Mass Casualty Decontamination is a multi-stage, resource intensive process. The approach presented in these Guidelines represents a standard method of HAZMAT/WMD mass casualty decontamination. The concepts in this Section can be implemented quickly by a wide range of response organizations and represent the least resource intensive, and most practical and efficient method of mass casualty decontamination.

### 6.1 Principles of Mass Casualty Decontamination

It is important to note, "Decontamination," in this context, is considered to be a non-medical countermeasure and when applied properly, it can help minimize the consequences to victims stemming from exposure to a HAZMAT/WMD incident. Coordination of initial assessment and ongoing surveillance procedures is critical to ensure that the health needs of victims continue to be met as the incident evolves.

#### **The Principles of Mass Casualty Decontamination (\*) include:**

- 1. Time is critical in order to save the most lives; a) the immediate removal of clothing outside the contaminated area for patients who have been visibly contaminated or who have been suspected of having been contaminated and b) processing the victims through a high-volume, low-pressure water shower (~50 to 60 psi) is priority. This may aid in the removal of 80-90% of physical contamination in almost all cases.**
- 2. Provide effective mass casualty decontamination. Other activities, such as setting up commercial decontamination tents, tarps, additional decontamination equipment, and/or creating a soap-water solution should be accomplished when time permits.**
- 3. Conduct decontamination triage prior to administering a high-volume, low-pressure water shower. In addition, many commercial decontamination tents provide neither sufficient volume or pressure to provide effective decontamination.**
- 4. When the contamination involves chemical vapors, biological or radiological material, using gentle friction (such as rubbing with hands, cotton flannel or microfiber cloth, or sponges) is recommended to aid in removal of contamination. Rubbing should start with the head and proceed down the body to the feet. Extra care should be taken to prevent the spread of contamination to the mouth, nose and eyes (such as holding one's breath to avoid inhalation/close contact with mucosa and closing one's eyes while wiping the face and head).**

**(\*) The key to successful mass casualty decontamination is to use the fastest approach that will cause the least harm and do the most good for the majority of the people. Coordination of initial assessment and ongoing observation procedures is critical to ensure that the health needs of victims continue to be met as the incident evolves.**

## 6.2 *Definition of Decontamination Triage*

Triage is the process of determining the priority of a victim's treatments based on the severity of their condition. In this context, "Decontamination Triage" is a prioritization mechanism used by a First Responder to determine whether victims emerging from HAZMAT/WMD incident scene should be directed to area(s) of safe refuge/observation or to a mass casualty decontamination station.

**Note: Decontamination Triage is not the same as Medical Triage.**

Rapid identification of victims who may not require decontamination can significantly reduce the time and resources needed to perform decontamination. Prioritization of asymptomatic, symptomatic, ambulatory and non-ambulatory casualties is critical. Responders will look to identify signs and symptoms of exposure to determine whether mass decontamination is necessary or if observation would suffice. Observing for symptoms generally only applies to chemical, biological and radiological incidents. Medical triage for injuries sustained as the result of an explosive dissemination device or injuries suffered while evacuating the hazard area should also take place.

## 6.3 *Definition of Decontamination*

Decontamination refers to means that reduce the hazard of a contaminant. There are two basic methods of decontamination, physical removal and neutralization:

1. Physical removal involves mechanical action with techniques such as gentle friction (such as rubbing with hands, soft non abrasive cotton flannel or microfiber cloth, or sponges), blotting, and washing.

**Note: Washing aids may accumulate contaminants and could represent a substantial secondary contamination hazard itself.**

2. Neutralization involves introducing methods and/or materials to counteract the harmful effects of the contaminant.

The primary focus of mass casualty decontamination should be on physical removal of the contaminant using a water shower deluge as described in Section 7 of this Volume. The additional step of adding neutralizing agents is likely to cause delay in the execution of mass casualty decontamination, as well as create potential additional hazards and safety issues when decontaminating large numbers of personnel not familiar with the decontamination process. If physical assets are limited, one possible method of secondary decontamination is to recycle victims through the initial decontamination site, but at a slower and more deliberate pace that emphasizes thorough cleaning and removal of all residual agent. Equipment such as decontamination tents and the use of additives (such as soap) are best implemented at the secondary decontamination site. Liquid soap, if available, should be distributed for victims' use during secondary decontamination. If neutralization is deemed necessary, it should be performed by trained individuals. Chemical neutralization of acids or alkalis is never recommended and can increase harm to patients.



#### 6.4 Purposes of Decontamination

The three most important reasons for decontaminating exposed victims are:

1. To remove the contaminant from the victim's skin and clothing, thus reducing further agent exposure and physical effects.
2. Protecting emergency responders, medical personnel, family members, or others from secondary transfer exposures.
3. Preventing victims from spreading contamination over additional areas of their body.

**Note: Precautionary measures should be taken to the best extent possible to contain decontamination runoff and prevent cross contamination to other victims, personnel and equipment. In addition, contaminated PPE, washing aids, rags and soiled clothing should be disposed of in accordance with established HAZMAT/WMD procedures.**

#### 7.0 Mass Casualty Decontamination Process

The six basic steps for the process of mass casualty decontamination include:

1. Initial Situational Awareness / Identification (e.g., removal or evacuation from area)

**Note: Staging / setup of equipment and decontamination resources should occur as soon as possible after this step.**

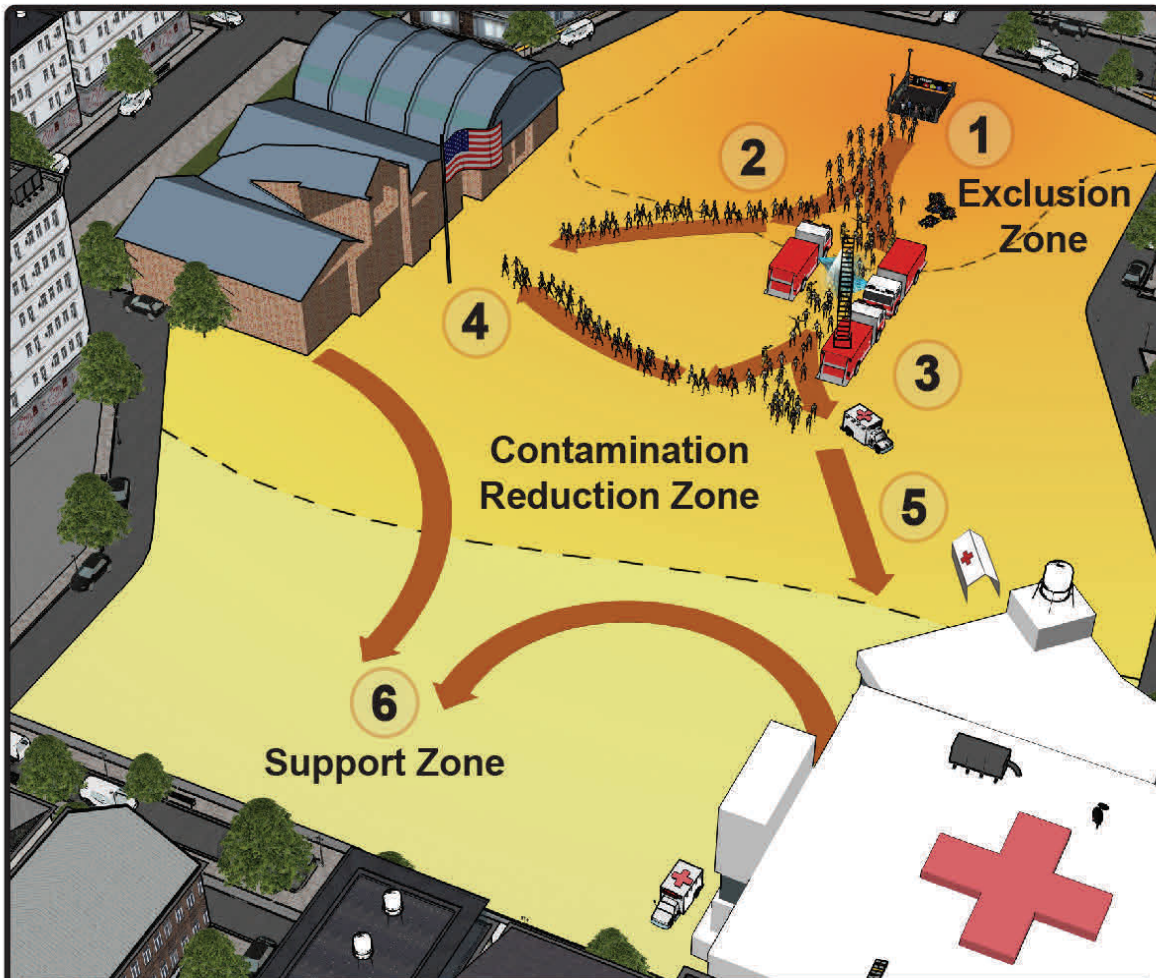
2. Victim Control and Decontamination Triage
3. Mass Casualty Decontamination Execution
4. Segregation for Observation

**Note: It is critical to initiate decontamination as soon as possible to be effective in saving lives, limiting injuries, and reducing the spread of contamination. Responders should use resources that are immediately available.**

5. Secondary Decontamination / Medical Treatment
6. Post Decontamination

These six Steps are illustrated in Figure 7-1 and have been deconstructed briefly in this Section, with more detail provided in Volume II. Appendix A of this Volume contains individual checklists for each Step. These checklists have been designed to be removed and either laminated for use as quick reference guides during training and/or response to a real mass casualty decontamination incident or enlarged up to poster size to aid in presenting the material.

# Mass Decontamination Process



## Station Legend

1. Victims are evacuated from the Hazard Area (Hot Zone/Exclusion Zone).
2. A First Responder performs decontamination triage on the victims. Victims with no apparent exposure to the hazard are sent directly to a safe/refuge observation area to monitor for delayed symptoms and signs of contamination.
3. Victims with likely exposure are sent to the water shower deluge and undergo mass casualty decontamination.
4. Following decontamination, victims without additional visible symptoms are sent to a safe/refuge observation area for monitoring.
5. Symptomatic and ambulatory victims undergo additional medical triage, treatment, and are transported to a medical facility if required for further medical treatment (Station 5). Secondary decontamination should be set up as necessary with decontamination occurring prior to the victim entering the medical facility (NOTE: Secondary decontamination can also be set up between the primary mass decontamination and the safe/refuge observation area, as necessary. A second pass through the primary water shower deluge may suffice if resources are available.).
6. Victims are released from the safe/refuge observation area or medical facility as directed.

## 7-1. Mass Casualty Decontamination Process

## 7.1 Step 1: Initial Situational Awareness / Identification

Step 1 occurs prior to Station 1 and should be performed in accordance with (IAW) standard guidelines for First Responders when arriving at an incident scene. A risk-based response strategy is recommended before and upon arrival at the incident scene. A risk-based response process is defined as a systematic process by which responders analyze a problem involving HAZMAT/weapons of mass destruction (WMD), assess the hazards, evaluate the potential consequences, and determine appropriate response actions based on the facts, science, and circumstances of the incident. (NFPA 472, 3.3.55 (2013)). Precautionary measures should be taken to preserve the health and safety of emergency responders. This includes donning the appropriate personal protective equipment (PPE) based on the general regulations in 29 CFR 1910.120 (OSHA Hazardous Waste Operations and Emergency Response).

### Establishing Zones

In addition to the safety assessment, the First Responder should gain control of the incident site and establish Initial Isolation and Protective Action Distances (a.k.a. “Hot,” “Warm,” “Cold” Zones) IAW the latest printed edition Emergency Response Guidebook with respect to the incident particulars (such as wind direction, weather conditions, degree of hazard, identified physical properties of the release, location, number of victims affected, etc.). Refer to Appendix A for checklists to aid personnel with this Step.

### Decontamination Setup

Once the Initial Isolation and Protective Action Distances (a.k.a. “Hot,” “Warm,” “Cold” Zones) have been established IAW the latest printed edition Emergency Response Guidebook, decontamination setup should occur. This includes the primary and secondary decontamination lines.

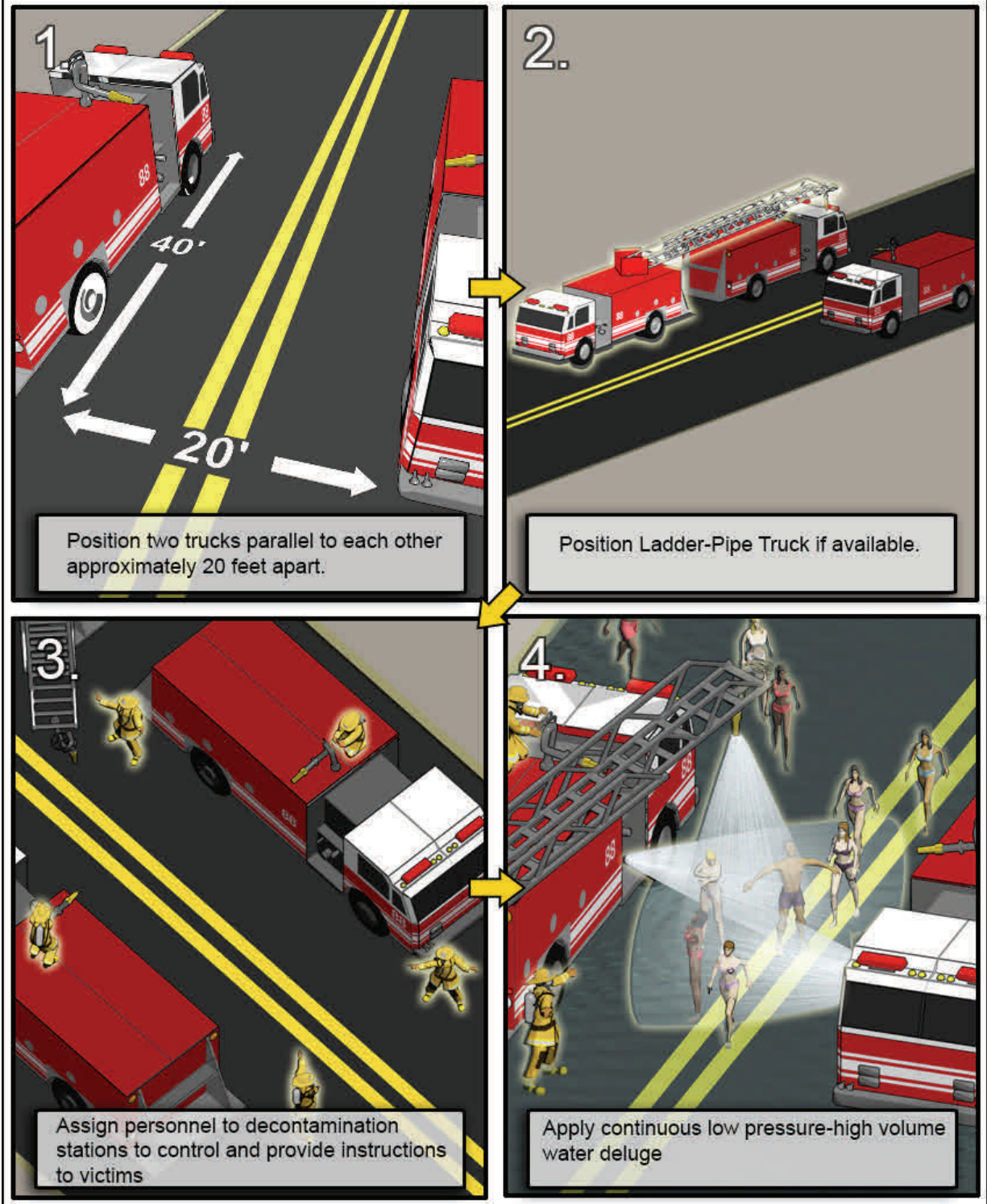
Two engines can create a corridor of water spray from both sides using hose lines and deck guns, while the ladder pipe provides high-volume, low-pressure water flow from above. This system is called a Ladder Pipe Decontamination Systems (LDS) and is illustrated in Figure 7-2.

The LDS is one example of an expedient equipment set up for establishing high-volume, low-pressure decontamination. The dimensions of the corridor should be approximately 20 feet in width (between fire trucks) and approximately 40 feet in length. The LDS provides a large capacity, high-volume, low-pressure water shower (approximately 60 psi). Ladder pipes, deck guns, and fog nozzles are positioned strategically to create a mass decontamination corridor.

Multiple LDSs use more than one ladder pipe to increase the length of the decontamination corridor to accommodate larger groups of victims and can be established to provide decontamination for different groups, such as ambulatory and non-ambulatory victims or even to provide decontamination at hospitals.

**Note: Containment of runoff must be considered at every mass casualty decontamination incident. However, the speed of decontamination, especially in the case of chemically contaminated victims, is of paramount importance.**

## Ladder Pipe Decontamination System Method



**Figure 7-2. Ladder Pipe Decontamination System (LDS) (\*)**

\* Responders should establish a mass decontamination system utilizing available resources that enables them to rapidly establish a high-volume, low-pressure water shower decontamination operation as quickly as possible. Runoff of contaminated water should be considered when setting up the LDS.

## 7.2 Step 2: Victim Control and Decontamination Triage

Step 2 (Refer to Figure 7-3) involves gaining initial control of the victims to prevent unauthorized dispersion or re-entry to the incident site or safe refuge/observation area. As previously noted, “Decontamination Triage” is a prioritization mechanism used by a First Responder to determine whether victims emerging from HAZMAT/WMD incident scene should be directed to or evacuated to area(s) of safe refuge/observation or to immediate mass casualty decontamination. Rapid identification of victims who may not require decontamination can significantly reduce the time and resources needed to perform decontamination. The “Victim Control/Decontamination Triage Checklist” included in Appendix A provides recommended priorities for victim decontamination.

Once control is gained, the First Responder should provide guidance and instruction to victims of the intent to separate them into one of the following identified groups:

1. Ambulatory and symptomatic (e.g., instruct victim to proceed to decontamination)
2. Non-ambulatory (e.g., assist victim through decontamination or transport direct to medical facility)
3. Ambulatory and non-symptomatic, but exposed to contaminant (e.g., instruct victim to proceed to decontamination)
4. Ambulatory and non-symptomatic, with no obvious exposure to contaminant (e.g., instruct victim to proceed to Safe Refuge/Observation Area)

After “Decontamination Triage” has taken place, those victims who have been contaminated and those suspected to be contaminated should be instructed to proceed to the water shower deluge for mass and undergo mass casualty decontamination.



**Figure 7-3. Victim Control and Decontamination Triage**

### 7.3 Step 3: Mass Casualty Decontamination Conduct

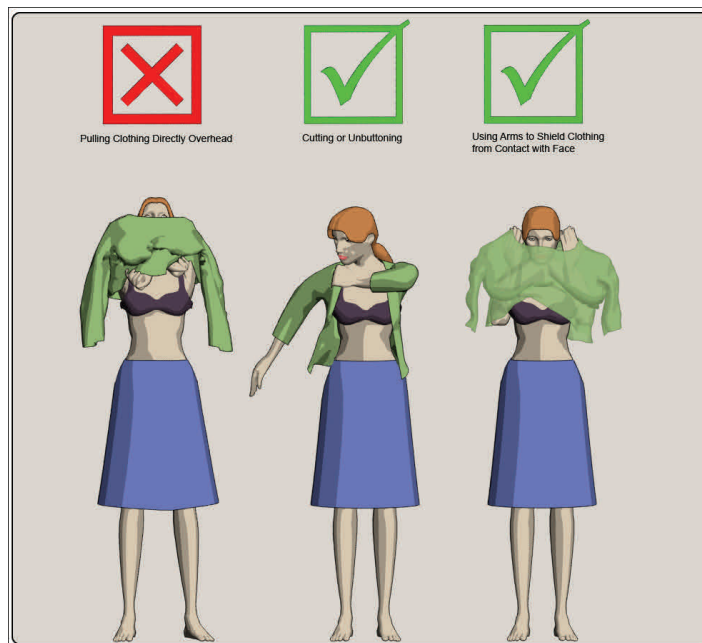
Step 3 addresses procedures for performing decontamination on a large number of victims, including providing victim instructions for properly removing clothing and proceeding through a decontamination shower corridor.

#### Clothing Removal

While it is not critical that victims remove their clothing for this process, it should be recommended that victims do so to the point of their own comfort level. Removal of all clothing would be most effective. Making this action a requirement may cause many citizens to become uncooperative and potentially delay the mass decontamination process. No delay should be caused by arguing the point. Removal of clothing down to the underwear is an effective compromise for all situations, with the exception of liquid contamination that has saturated outer clothing and contacted undergarments..

**Note: The effectiveness of disrobing prior to decontamination rapidly decreases with time, following exposure.**

If clothes must be lifted over the head, instruct victims to do so carefully by closing their mouth to avoid ingestion or inhalation, and by placing hands and arms on the inside of the garment and using the hands to pull the head opening away from the face and head as much as possible. These precautions will reduce the chance of exposing the head, face and eyes to inhalation or ingestion contamination. Whenever possible, victims should unbutton or cut clothes away rather than lift them over their head (Figure 7-4). This will reduce the chance of exposing the head, face and eyes to contamination.



**Figure 7-4. Proper Removal of Clothing**

**Note: Disrobing is generally an order of magnitude more effective than water decontamination. In addition, combined disrobing and decontamination further decreases dermal absorption of contaminants, but this effect is time limited following exposure.**

### Water Shower Deluge

The most expedient approach following the removal of clothing is to immediately apply an emergency deluge of high-volume, low-pressure (approximately 60 psi) water shower. Thorough washing increases the effectiveness of decontamination, depending on the type of contamination, ambient environment, number of victims, and resources available.

Use available water source. Warm water temperatures may aid in the rate of chemical evaporation. Use of cool water (i.e., less than 77 degrees Fahrenheit) should be avoided unless no other means of decontamination is available.

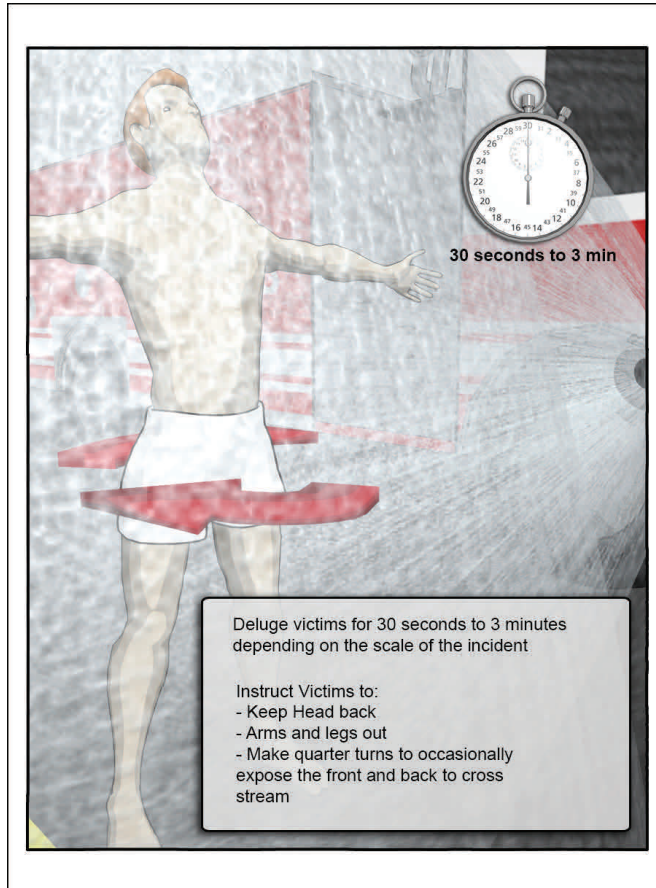
First Responders should direct victims to proceed through the water deluge shower to enable victims to receive an initial decontamination water shower as soon as possible. First Responders should adjust the shower time to enable as many victims as possible to receive an initial decontamination water shower deluge as rapidly as possible. Prolonged skin contact with water during decontamination should be avoided. The effectiveness of wet decontamination varies according to the volatility of the contaminating chemical.

Studies have demonstrated that the effectiveness of wet decontamination varies according to the volatility of the contaminating chemical. In most cases, the use of excessive amounts of water can cause an increase in the rate of chemical absorption into the skin. Shorter durations of showering should reduce this effect. Wash time should be at least 30 seconds, but not longer than 3 minutes to ensure thorough soaking.

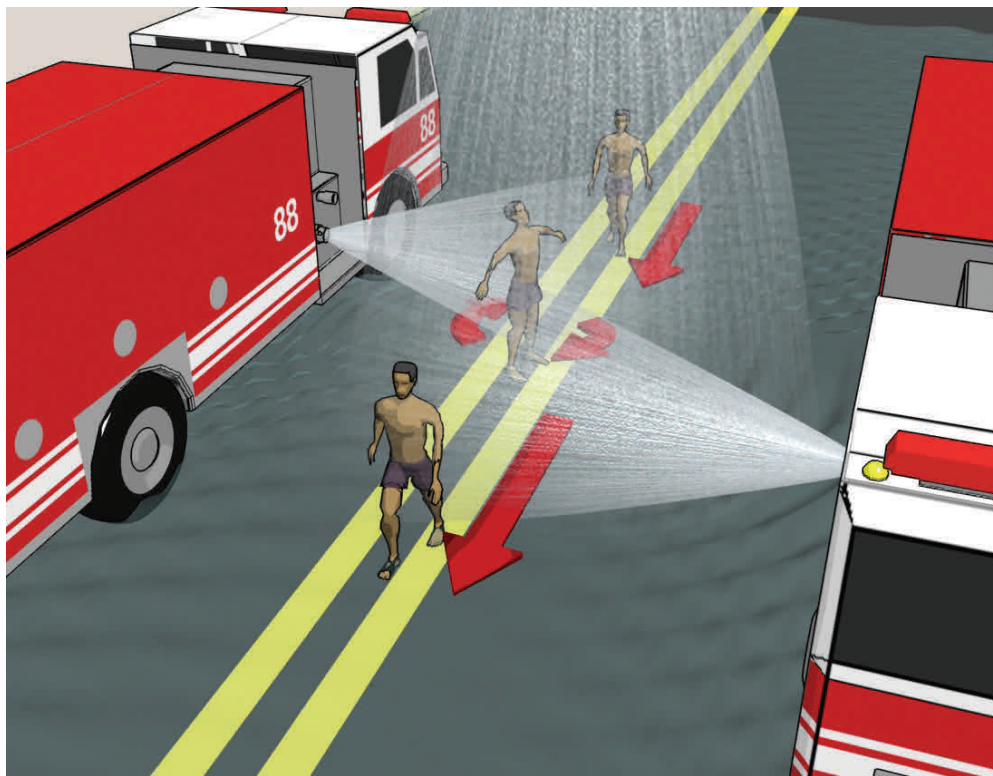
**Note: Time is critical. Initial gross decontamination is priority! DO NOT DELAY in order to set up technical decontamination tents, shelter tents, or to add soap, etc.. Current recommendations for on scene rapid mass casualty decontamination range from 30 seconds to 3 minutes. Initial research supports this range of values based on minimal levels of effectiveness at the 30 second level and possible tissue damage with increased chemical absorption at 3 minutes. Actual times must be determined at the scene and take into consideration multiple factors including number of victims, environmental temperatures, index of suspicion, and clinical symptomatology.**

While victims are waiting to be decontaminated, keep adequate spacing between individuals to avoid secondary contamination and exposure to off-gassing. When moving through the decontamination shower, victims should tilt their heads back, raise their arms and spread their legs to expose the armpit and groin areas and taking extra precaution to prevent runoff from the head/hair getting into the eyes, nose or mouth (Figure 7-5). Victims should occasionally turn 90 degrees (1/4 turn) to expose their entire bodies to the water cross stream (Figure 7-6). Deck guns can be positioned to provide additional water volume, if necessary. When the contamination does not involve an oily, liquid chemical agent (e.g., sulfur mustard), using gentle friction, such as rubbing with hands, a soft cloth, or sponges is recommended to aid in removal of the contaminants. This process must start with the head and proceed down the body to the feet.

**Note: When liquid contamination is involved, soap should be included as soon as possible in the process, HOWEVER, not to the extent that application delays initial decontamination with water. Soap may be delayed until secondary decontamination if adding it would delay initial decontamination.**

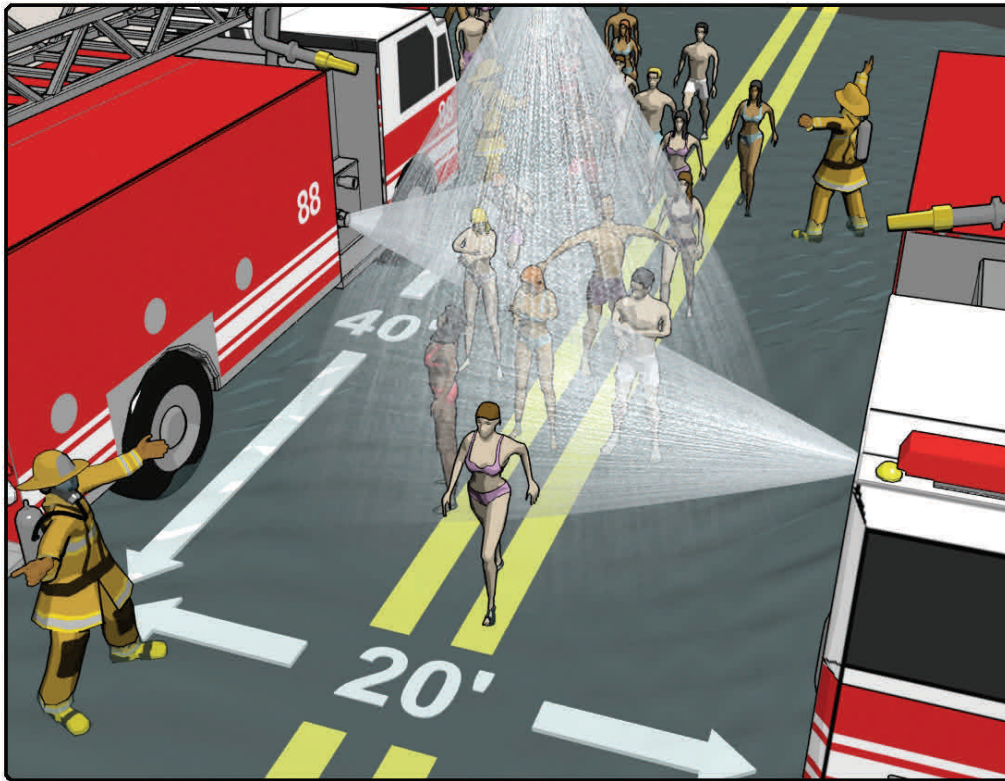


**Figure 7-5. Proper Body Positioning for Mass Decontamination**



**Figure 7-6. Proper Decontamination Corridor Walk-through Technique**





**Figure 7-7. Decontamination Using Decontamination Corridor Setup**

#### *7.4 Step 4: Segregation for Observation & Monitoring*

As illustrated in Figure 7-7, the Responders have successfully performed mass casualty decontamination. Following this, the Responder conducts a quick visual inspection of the victims as they exit the decontamination corridor. Actions to be taken following completion of initial mass decontamination includes re-robing, observing victims for delayed symptoms and determining visual evidence of residual contamination (such as off-gassing); performing secondary decontamination as necessary; arranging for clothing/cover for decontaminated victims; recovering personal items (if possible); and transporting victims to medical facilities for follow-on care.

##### Providing Victims a Means of Clothing/Cover

Whenever practical, victims should be provided a means of clothing or cover, both to restore modesty and provide warmth. Common items employed by response agencies during response exercises include a wide variety commercial off the shelf items (e.g., disposable paper suits / gowns, socks, or slippers, foil rescue blankets, sheets, and/or large plastic garbage bags).

##### Tag Victims to Identify Decontamination Status

Decontaminated victims should be identified to aid medical personnel and others in determining potential risk to themselves when treating or assisting victims. Identification should include a method that can account for both initial mass decontamination and secondary decontamination. Some examples include the use of colored rubber bands and specially developed triage tags.

### Direct Victims to Treatment or Observation

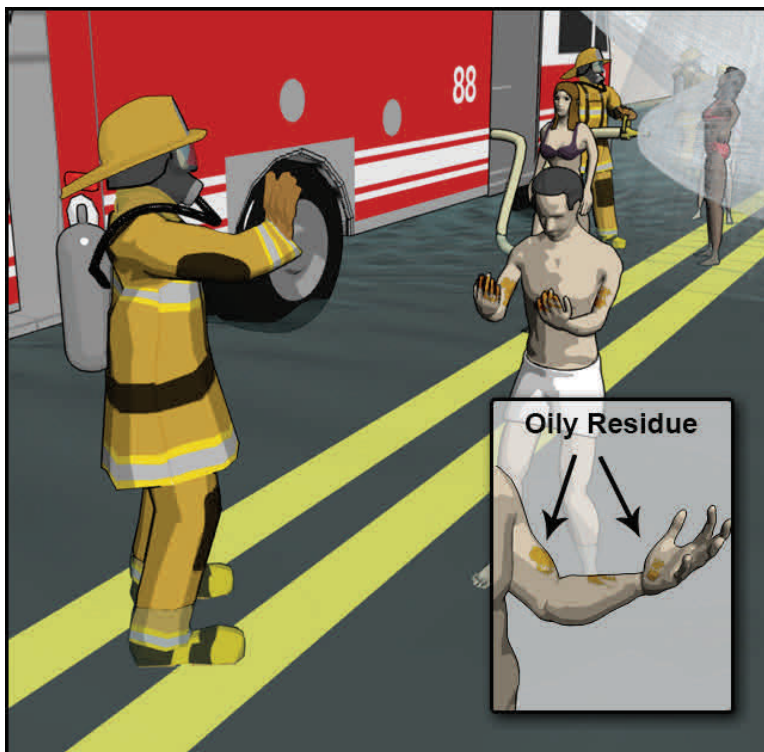
Following decontamination, victims without additional visible symptoms should be directed to the area(s) of safe refuge for observation where they can be monitored for delayed symptoms.

**NOTE: Symptomatic and ambulatory victims should proceed to Step 5 and undergo additional medical triage and transport to a medical facility/transfer station, if required, for further medical treatment.**

### Secondary Decontamination (\*)

Secondary decontamination, with an emulsifier (such as soap) (as shown in Figure 7.8), may be necessary if an oily liquid hazard (e.g., sulfur mustard) is involved, whereas initial decontamination is performed with water only. While the use of a soap-water solution is best for physical removal of gross contamination of all hazards, it will likely be required for oily liquid agents in order to provide the most effective physical removal of the agent from the victims' skin. Rubbing without the aid of soap is not recommended, as it may increase spread of the liquid agent over a larger surface area of the body, resulting in increased medical risk.

**(\*) Use this method only if responders are capable of immediately applying a soap and water solution as this method represents the best solution for all HAZMAT/WMD mass casualty decontamination situations. In the absence of soap, application of water via the LDS is the preferred primary method of decontamination.**



**Figure 7-8. Oily, Liquid Residue Requiring Secondary Decontamination**

### 7.5 Step 5: Segregation for Medical Treatment

Symptomatic and ambulatory victims should undergo additional medical triage and are transported to a medical facility, if required, for further medical treatment. Secondary decontamination should be set up as necessary with decontamination occurring prior to the victim entering the medical facility.

**NOTE: Secondary decontamination can also be set up between the primary Mass decontamination and the safe/refuge observation area, as necessary. A second pass through the primary water shower deluge may suffice if resources are available. Follow the prescribed procedure for secondary decontamination illustrated in Step 4.**

### 7.6 Step 6: Release of Victims

Once the Incident Commander has consulted with the Safety Officer, Medical Team, Technical Specialists, and other appropriate response personnel, and deems that the incident scene to be safe and secure, the victims can be released from the safe/refuge observation area.

Upon release, additional information related to delayed symptoms that should be watched for and guidance on seeking follow-up medical care, should be disseminated to the victims. Visual evidence of residual contamination (such as off-gassing) should be verified by trained medical personnel prior to release.

Additionally, the victims sent to a medical facility/transfer station will be released as directed by medical personnel.

## 8.0 Cold Weather Guidelines

Even in cold weather conditions, it is still most practical to conduct decontamination outdoors. In general, the human body can withstand very low temperatures for a brief amount of time.

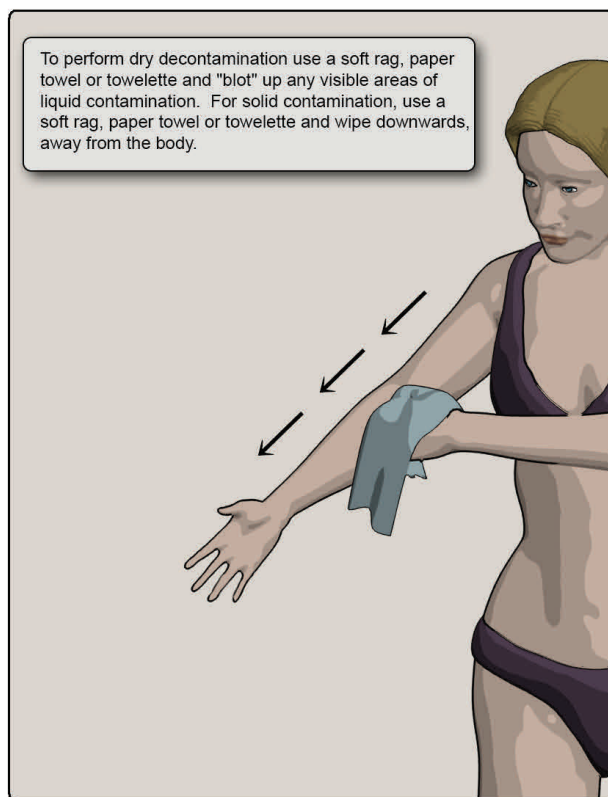
The recommended methods for mass casualty decontamination, immediate clothing removal and a high-volume, low-pressure shower, remain the same for outdoor air temperatures as low as 36° F. Once victims are decontaminated, they should be provided with clothing/cover and moved to a heated facility.

For outdoor air temperatures 35° F and below, removal of clothing and a “dry” decontamination method for removal of liquid contamination is recommended, such as blotting with paper towel, followed by high-volume, low-pressure water shower at a heated facility (Figure 8-1). Figure 8-2 provides a simple guide that indicates appropriate all weather decontamination procedures.

Hypothermia (reduction of the core body temperature to  $<95^{\circ}\text{F}$  ( $<35^{\circ}\text{C}$ )) causes approximately 600 deaths each year in the United States. Exposure to excessive cold (or excessive exposure to cold) slows enzymatic activity throughout the body, leading to potentially fatal rhabdomyolysis, coagulopathy, renal failure, and dysrhythmias. Understanding the epidemiology and pathophysiology of hypothermia is important to preventing hypothermia-related mortality.

Symptoms of hypothermia include sensation of cold, exhaustion, and numbness. Signs of hypothermia include shivering, pallor (i.e., deficiency of color, especially of the face; aka paleness) in adults, flushed skin in children, decrease hand coordination, confusion, and slurred speech. Diagnosis is made when the core body temperature is  $<95^{\circ}\text{F}$  ( $<35^{\circ}\text{C}$ ). Hypothermia can be mild ( $90^{\circ}\text{F}$  to  $95^{\circ}\text{F}$  [ $32^{\circ}\text{C}$  to  $35^{\circ}\text{C}$ ]), moderate ( $82.5^{\circ}\text{F}$  to  $90^{\circ}\text{F}$  [ $28^{\circ}\text{C}$  to  $32^{\circ}\text{C}$ ]), or severe ( $<82.5^{\circ}\text{F}$  [ $<28^{\circ}\text{C}$ ]).

Mild hypothermia can be treated with passive re-warming by using blankets. Moderate hypothermia requires active re-warming with warm intravenous fluids, oxygen, lavage, or immersion baths. Severe hypothermia might require both active re-warming and cardiopulmonary bypass. The core body temperature should be re-warmed by  $2^{\circ}$  to  $4^{\circ}\text{F}$  [ $1^{\circ}$  to  $2^{\circ}\text{C}$ ] per hour. As needed, cardiopulmonary resuscitation and supportive care should be provided, cardiac rhythm monitored, and electrolytes replenished.



**Figure 8-1. Dry Decontamination Method**

**Note: In a mass casualty decontamination situation in extreme cold, decontamination with water could create a greater hazard and result in more cold weather casualties due to hypothermia than the contamination hazard.**

# Temperature Decontamination Guide

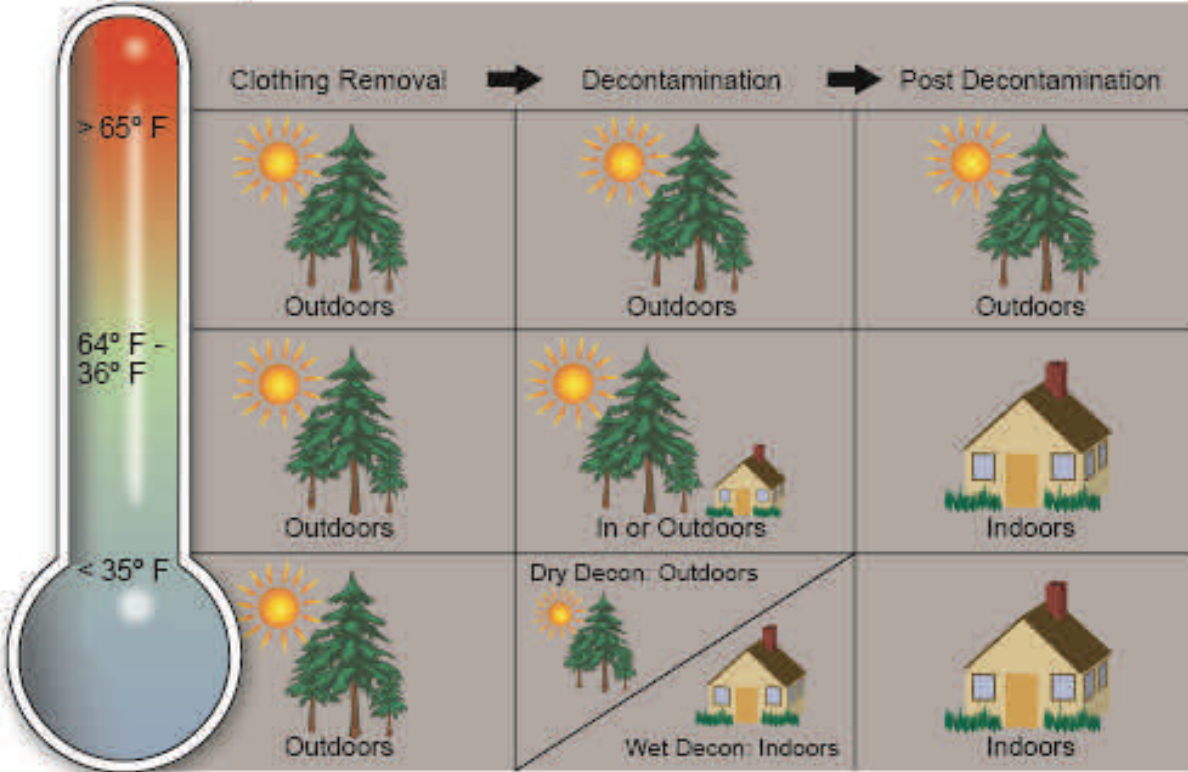


Figure 8-2. All Weather Decontamination Guide

## General Rules for Cold Weather Decontamination

- 1 - Conduct decontamination regardless of outdoor air temperature conditions.
- 2 - Remove clothing outdoors.
- 3 - If victims are outdoors in very low air temperatures (<36° F), use a dry method of decontamination (e.g., removal of clothing, blotting) instead of water shower for liquid contamination.
- 4 - After dry decontamination, victims should be moved inside or to a heated area for water/soapy water high-volume, low-pressure water shower and to mitigate the effects of cold weather.
- 5 - Observe victims for signs of hypothermia, delayed symptoms, and for completeness of decontamination.
- 6 - Follow all other General Rules for Mass Casualty Decontamination.

## 9.0 Summary

The key to successful mass decontamination is to use the fastest approach that will cause the least harm and do the most good for the majority of the victims. There is no perfect solution that can account for every variable and ensure rapid, completely effective decontamination of large numbers of victims for all hazards.

First Responders will have to determine the need for mass casualty decontamination; the extent and practicality of performing decontamination triage; the scope of resources needed versus resources available; the need for soap application in the presence of an oily, liquid chemical agent (e.g., sulfur mustard); and whether soap can be rapidly applied during initial decontamination or will have to be delayed until secondary decontamination can be performed.

Appendix A of Volume I contains the checklists and, where applicable, supporting graphics for each of the six steps described in section 7.0, as well as an overall checklist that may be used by the Incident Commander, Operations Chief, Decontamination Team Leader, or First Responder. These checklists and graphics are designed to be removed (laminated) and used by responders as a ready reference during any mass casualty decontamination and/or training situation.

## **Appendix A**

### **Quick Reference Checklists for Mass Casualty Decontamination**

The following pages are designed to be stand-alone, quick reference checklists and supporting graphics that concisely capture information to aid First Responders in a mass casualty decontamination situation for a HAZMAT/WMD incident. This section is meant to be printed, double-sided, so that the supporting graphics are on the reverse side of the checklist (lamination is recommended to preserve the integrity of the checklist and this manual). The checklists can be used as quick reference guides during training or response to a mass casualty decontamination incident.

## INCIDENT COMMANDER'S OVERVIEW CHECKLIST

(Side 1 of 2)

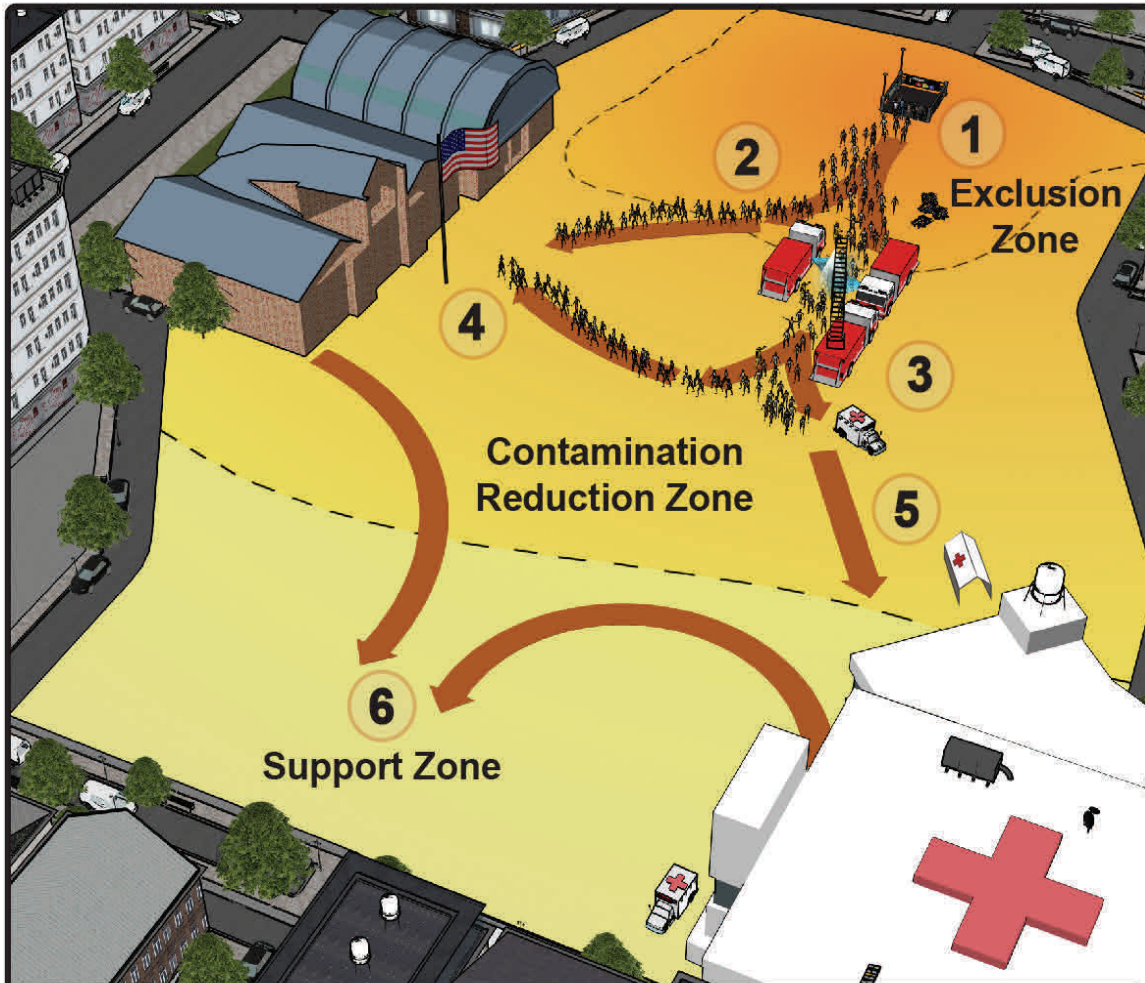
- Assess the incident situation.
- Determine wind direction and establish safe area for decontamination set up.
- Protect yourself and establish a visible command post in the cold zone.
- Conduct scene safety assessment, to include secondary devices.
- Approximate the number of casualties.
- Notify medical facilities/transfer stations of potential impact.
- Determine type/state (liquid, solid or gas) of the hazard.
- Assess risks and determine need for decontamination (\*).
- Call for additional resources and response personnel and determine need for Unified Command (as required).
- Supervise reporting support personnel and ensure welfare / safety of incident personnel.
- Activate appropriate Command, General Staff, and Safety Positions.
- Establish Initial Isolation and Protective Action Distances (aka "Hot", "Warm", "Cold" Zones).
- Conduct Decontamination Triage to prioritize victims and set up decontamination site.
- Contain victims and communicate decontamination process to the victims (e.g., remove garments down to underwear immediately, proceed through LDS, etc.).
- Execute mass casualty decontamination.
- Observe victims for delayed symptoms.
- Perform Secondary decontamination (as necessary).
- Transport casualties to medical facility (as necessary).
- Release non-symptomatic victims when deemed safe.

**(\* When responders are unable to determine if actual chemical agent exposure has occurred, and in those situations where actual exposure appears unlikely, decontamination should be deferred PENDING OBSERVATION AND/OR SCENE INVESTIGATION. If symptoms develop, individuals should be treated followed by prompt field decontamination by the most expeditious means available.**



**INCIDENT COMMANDER'S OVERVIEW CHECKLIST**  
(Side 2 of 2)

## Mass Decontamination Process



**Station Legend**

1. Victims are evacuated from the Hazard Area (Hot Zone/Exclusion Zone).
2. A First Responder performs decontamination triage on the victims. Victims with no apparent exposure to the hazard are sent directly to a safe/refuge observation area to monitor for delayed symptoms and signs of contamination.
3. Victims with likely exposure are sent to the water shower deluge and undergo mass casualty decontamination.
4. Following decontamination, victims without additional visible symptoms are sent to a safe/refuge observation area for monitoring.
5. Symptomatic and ambulatory victims undergo additional medical triage, treatment, and are transported to a medical facility if required for further medical treatment (Station 5). Secondary decontamination should be set up as necessary with decontamination occurring prior to the victim entering the medical facility (NOTE: Secondary decontamination can also be set up between the primary mass decontamination and the safe/refuge observation area, as necessary. A second pass through the primary water shower deluge may suffice if resources are available.).
6. Victims are released from the safe/refuge observation area or medical facility as directed.

**FIRST RESPONDER'S INITIAL SITUATIONAL AWARENESS / IDENTIFICATION**  
**CHECKLIST** (\*)  
**(Side 1 of 2)**

- Assess the incident situation.
- Determine wind direction and establish safe area to protect yourself.
- Do not rush into the incident scene.
- If First Responder is not EMS, report incident specifics to arriving EMS personnel.
- Conduct scene safety assessment.
- Notify other First Responders, Federal Resources, and medical facilities / transfer stations of incident.
- Establish Initial Isolation and Protective Action Distances (aka "Hot", "Warm", "Cold" Zones)
- Direct arriving personnel and equipment to staging area.
- Approximate number of casualties and notify medical facilities of potential impact.
- Local law enforcement should check for possible secondary devices near decontamination site.
- Look for signs and symptoms of exposure and utilize detectors, if available.
- Estimate how many suspected victims are involved.
- Determine whether mass decontamination is required.
- Determine what resources are needed and readily available for mass decontamination.
- Determine the impact of weather conditions on decontamination operations (air temperature, wind speed, wind direction).
- Decontamination should be set up upwind from the incident. If the outdoor air Temperature is below 65° F, consider cold weather decontamination.
- Alert hospitals to prepare for victims exposed to contamination.
- Communicate the incident details to additional responders, local law enforcement, and arriving Incident Commander.

**(\*) Note: First Responders should be trained and appropriately attired before entering the Hot Zone. If the proper equipment is not available, assistance should be obtained from properly equipped First Responders organization.**

**FIRST RESPONDER'S INITIAL SITUATIONAL AWARENESS / IDENTIFICATION**  
**CHECKLIST**  
**(Side 2 of 2)**

**First Responder Personal Protection Equipment (PPE) Selection Guide**

The intent of first response is to facilitate rapid medical identification and possible intervention of a victim or victims to a chemical exposure or at the scene of a Hazardous Materials Incident, or Weapons of Mass Destruction event.

When a chemical is unidentified, worst-case possibilities concerning toxicity must be assumed. The potential for severe local effects (e.g., irritation and burning) and severe systemic effects (e.g., organ damage) should be assumed when specific rescuer-protection equipment is selected. Therefore, the level of personal protective equipment (PPE) selected is critical. First Responders should select PPE IAW OSHA, NFPA, or local jurisdiction requirements. The primary goal is to ensure emergency First Responders have select the proper PPE, both percutaneous (skin) protection and respiratory protection. PPE providing percutaneous protection includes protective ensembles, footwear, and gloves. PPE providing respiratory protection from CBRN threats includes air-purifying respirators (APRs), powered air-purifying respirators (PAPRs), self-contained atmosphere supplying respirators (SCBAs), and escape respirators.

**Principles of Mass Casualty Decontamination (\*)**

1. Time is critical in order to save the most lives; a) the immediate removal of clothing outside the contaminated area for patients who have been visibly contaminated or who have been suspected of having been contaminated and b) processing the victims through a high-volume, low-pressure water shower (~50 to 60 psi) is priority. This may aid in the removal of 80-90% of physical contamination in almost all cases.
2. Provide effective mass casualty decontamination. Other activities, such as setting up commercial decontamination tents, tarps, additional decontamination equipment, and/or creating a soap-water solution should be accomplished when time permits.
3. Conduct decontamination triage prior to administering a high-volume, low-pressure water shower.
4. When the contamination involves chemical vapors, biological or radiological material, using gentle friction (such as rubbing with hands, cotton flannel or microfiber cloth, or sponges) is recommended to aid in removal of contamination. Rubbing should start with the head and proceed down the body to the feet. Extra care should be taken to prevent the spread of contamination to the mouth, nose and eyes (such as holding one's breath to avoid inhalation/close contact with mucosa and closing one's eyes while wiping the face and head).

(\*) The key to successful mass casualty decontamination is to use the fastest approach that will cause the least harm and do the most good for the majority of the people. Coordination of initial assessment and ongoing surveillance procedures is critical to ensure that the health needs of victims continue to be met as the incident evolves.

## VICTIM CONTROL/DECONTAMINATION TRIAGE CHECKLIST (\*)

(Side 1 of 2)

- Ensure all responders are properly protected prior to entering the warm or hot zones. Follow recommended guidelines for Personal Protective Equipment (PPE)**
- Don't panic...the amount of victims may appear overwhelming but can be managed.
- Gain control of the victims as rapidly as possible (e.g., public address systems, instructional signs) and direct victims to area(s) of safe refuge to begin decontamination or quarantine for observation.
- In multi-lingual communities, use multi-lingual personnel or illustrated signs to provide instructions to victims.
- Perform decontamination triage by separating and prioritizing victims into categories in preparation for mass decontamination:
  - Ambulatory and symptomatic (e.g., instruct victim to proceed to decontamination)
  - Non-ambulatory (e.g., assist victim through decontamination or transport direct to medical facility)
  - Ambulatory and non-symptomatic, but exposed to contaminant (e.g., instruct victim to proceed to decontamination)
  - Ambulatory and non-symptomatic, with no obvious exposure to contaminant (e.g., instruct victim to proceed to Safe Refuge/Observation Area)
- ENCOURAGE VICTIMS TO REMOVE AS MUCH CLOTHING AS POSSIBLE, BUT AT LEAST REMOVE OUTER GARMENTS DOWN TO UNDERWEAR.** Cutting and/or unbuttoning is preferred to pulling clothing over the head.
- If clothes must be lifted over the head, instruct victims to do so carefully by placing hands and arms inside the garment and using the hands to pull the head opening away from the face and head as much as possible.

(\*) **Note: It is possible that the severity of conventional injuries may require certain victims to receive an elevated priority during triage, regardless of whether they are showing obvious signs/symptoms of exposure.**

## VICTIM CONTROL/DECONTAMINATION TRIAGE CHECKLIST

(Side 2 of 2)

### Chemicals of Interest (COI)

Appendix A of 6 CFR Part 27 “The Chemical Facility Anti-Terrorism Standards Final Rule Federal Register / Vol. 72, No. 223; U.S. Department of Homeland Security; 20 Nov 07,” has a list of chemicals of interest, or COI. There were 325 chemicals on this list at the time of this publication.

In developing the list, the DHS looked to existing expert sources of information including other federal regulations related to chemicals. In addition, the DHS has also identified three security issues related to chemicals:

- **Release**—Toxic, flammable, or explosive chemicals or materials that, if released from a facility, have the potential for significant adverse consequences for human life or health.
- **Theft or Diversion**—Chemicals or materials that, if stolen or diverted, have the potential to be misused as weapons or easily converted into weapons using simple chemistry, equipment or techniques, in order to create significant adverse consequences for human life or health.
- **Sabotage or Contamination** —Chemicals or materials that, if mixed with readily available materials, have the potential to create significant adverse consequences for human life or health.

## MASS CASUALTY DECONTAMINATION SETUP CHECKLIST (\*)

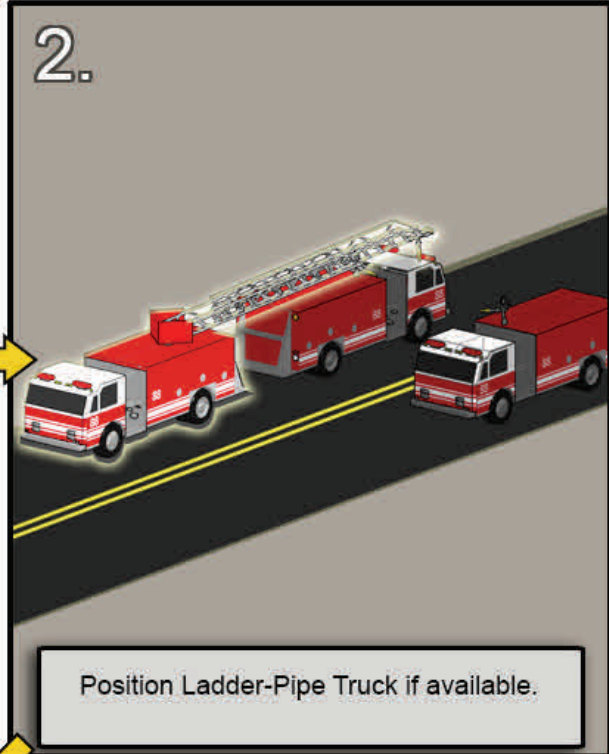
(Side 1 of 2)

- If not already accomplished**, establish Initial Isolation and Protective Action Distances (a.k.a. “Hot,” “Warm,” “Cold” Zones). Set up barriers or police tape to delineate zones. Post signs directing victims on where to go and what to do.
  
- Ensure all responders are properly protected prior to entering the warm or hot zones.***
  
- Local law enforcement should check for possible secondary devices near the selected decontamination site(s).
  
- If not already accomplished**, instruct victims to remove as much clothing as possible. Cutting and unbuttoning is preferred to pulling clothing over the head. Collect clothing in the Warm zone.
  
- Ensure all non-ambulatory, pediatric, and functional needs victims are sent through (and/or assisted through) the decontamination corridor.
  
- Set up decontamination site upwind of the hot zone. Ideally, it should be uphill from the hot zone, easily accessible for responders, and have good drainage.
  
- Suggested setup: Ladder Pipe Decontamination System (or other expedient system) to dispense high-volume, low-pressure water (~50 to 60 psi pumper truck pressure) with wide fog pattern.
  
- Establish victim observation area(s) and secondary decontamination area(s) as necessary.

**(\*) Note: Decontamination of exposed and/or symptomatic victims should not wait for set up of decontamination tents or additives such as soap. In addition, start spray of LDS as soon as possible utilizing first arriving unit and augment the LDS with additional responding units as they arrive.**

**MASS CASUALTY DECONTAMINATION SETUP CHECKLIST**  
(Side 2 of 2)

**Ladder Pipe Decontamination System Method**



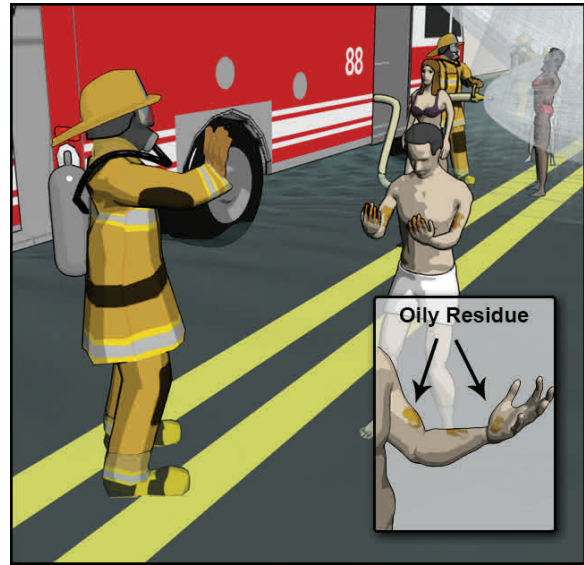
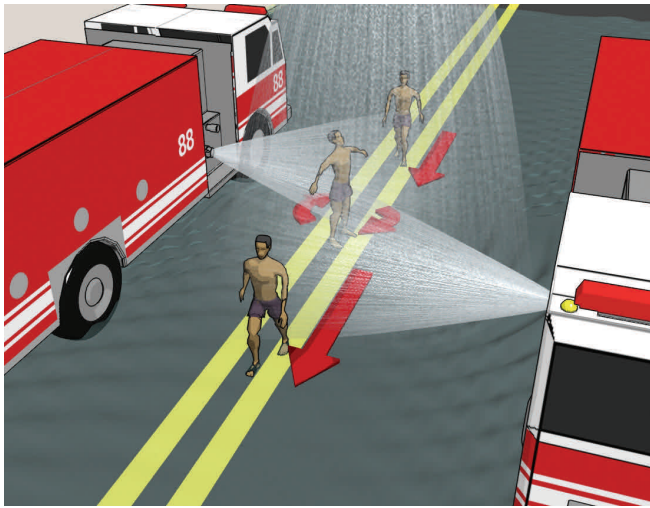
## MASS CASUALTY DECONTAMINATION CHECKLIST

(Side 1 of 2)

- Instruct victims to move to specific areas depending on medical and decontamination triage status.
- If not already accomplished**, instruct victims to remove as much clothing as possible.
- Establish a method for collecting and tracking personal items (e.g., bag labeled with victim name/number).
- Based on decontamination triage prioritization, instruct victims to move through the decontamination corridor. Wash time should be between 30 seconds and three minutes in duration to ensure thorough soaking. Do not delay the high-volume, low pressure water shower to create a soap-water solution.
- Instruct victims to:
  - ❖ Tilt head back.
  - ❖ Raise and spread arms and spread legs to expose armpits and groin.
  - ❖ Walk through shower system slowly, and periodically turn 90 degrees (1/4 turn).
  - ❖ When the contamination involves chemical vapor, biological or radiological materials, victims should apply gentle friction by using their hands, a cloth, or a sponge to aid in removal of contamination.
  - ❖ Rubbing should start with the head and proceed down the body to the feet.
  - ❖ When the contamination is a liquid chemical agent, DO NOT apply friction without the aid of soap as this may spread the hazard over the body and increase medical risk.
- After passing through decontamination corridor, provide victims with clothing/cover if available.
- Use some means to identify victims that have been decontaminated.
- Direct symptomatic patients to additional treatment or secondary decontamination area(s) as appropriate.
- Direct non-symptomatic victims to observation area(s).



**MASS CASUALTY DECONTAMINATION CHECKLIST**  
(Side 2 of 2)

An illustration of a shirtless male victim standing in a stream of water. The victim's arms and legs are outstretched. A stopwatch is shown in the upper right corner of the illustration, with the text '30 seconds to 3 min' below it. The background shows a fire truck and other victims being deluged.

30 seconds to 3 min

Deluge victims for 30 seconds to 3 minutes depending on the scale of the incident

Instruct Victims to:

- Keep Head back
- Arms and legs out
- Make quarter turns to occasionally expose the front and back to cross stream

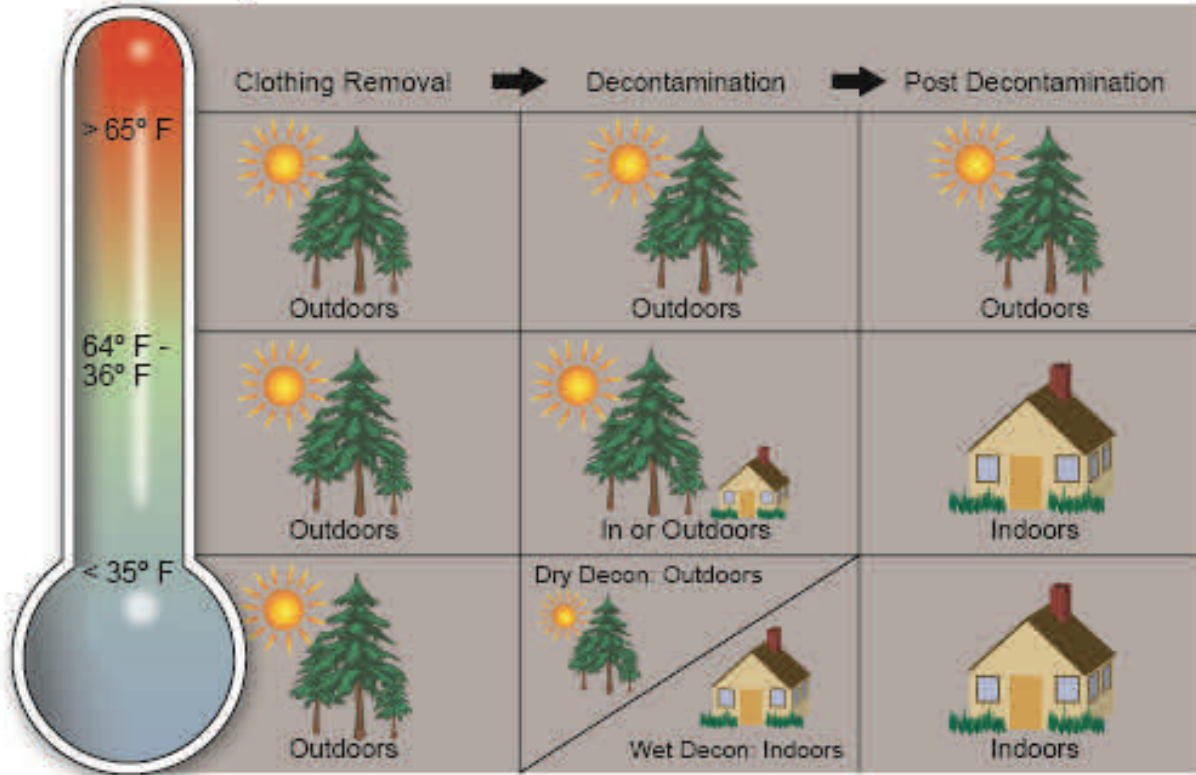
**COLD WEATHER DECONTAMINATION (<65°F) CHECKLIST (\*)**  
(Side 1 of 2)

- Conduct some form of decontamination regardless of temperature conditions.
- Remove clothing outdoors
- If victims are outdoors in very low temperatures (<36°F), use a dry method of decontamination (e.g., removal of clothing, blotting) instead of water for liquid contamination.
- After dry decontamination, victims should be moved inside or to a heated area for water/soapy water high-volume, low-pressure water shower and to mitigate the effects of cold weather.
- Physically identify decontaminated victims (e.g., tag around neck).
- Observe for signs of hypothermia, delayed symptoms, and for completeness of decontamination.
- Follow all other General Rules for Mass Casualty Decontamination

**(\*) NOTE: Even in cold weather conditions, it is still most practical to perform some form of decontamination and to conduct the decontamination procedure outdoors. In general, the human body can withstand very low temperatures for a brief amount of time.**

**COLD WEATHER DECONTAMINATION (<65°F) CHECKLIST**  
(Side 2 of 2)

## Temperature Decontamination Guide



### Wind Chill Chart



Wind (mph)	Temperature (°F)																			
	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63		
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72		
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77		
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81		
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84		
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87		
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89		
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91		
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93		
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95		
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97		
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98		

■ Frostbite Times 30 minutes   
 ■ 10 minutes   
 ■ 5 minutes

**Wind Chill (°F) = 35.74 + 0.6215T - 35.75(V<sup>0.16</sup>) + 0.4275T(V<sup>0.16</sup>)**  
 Where, T= Air Temperature (°F) V= Wind Speed (mph)      *Effective 11/01/01*

## **POST DECONTAMINATION CHECKLIST**

**(Side 1 of 1)**

- Observe victims for delayed symptoms and for completeness of decontamination.
- Perform secondary decontamination as necessary.
- Transport symptomatic victims to medical facilities for assistance.
- Release non-symptomatic victims when deemed safe.
- Arrange for clothing/cover if available and possible recovery of personal effects.
- Collect contaminated personal items for possible decontamination.
- Provide follow-up information to the victims (e.g., symptoms to watch for).
- Provide instructions to victims prior to release (e.g., care, follow-up).
- Decontaminate all responders, equipment, and incident site.
- Conduct medical check on all responders.
- Complete victim and First Responder documentation and accountability.

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## **PUBLIC INFORMATION CHECKLIST**

**(Side 1 of 2)**

In a medical emergency, it is vital for response personnel to disseminate accurate and timely public information, to inform and instruct the population in ways that enhance emergency response, prevent rumors from spreading, and avoid public panic. Messages can include:

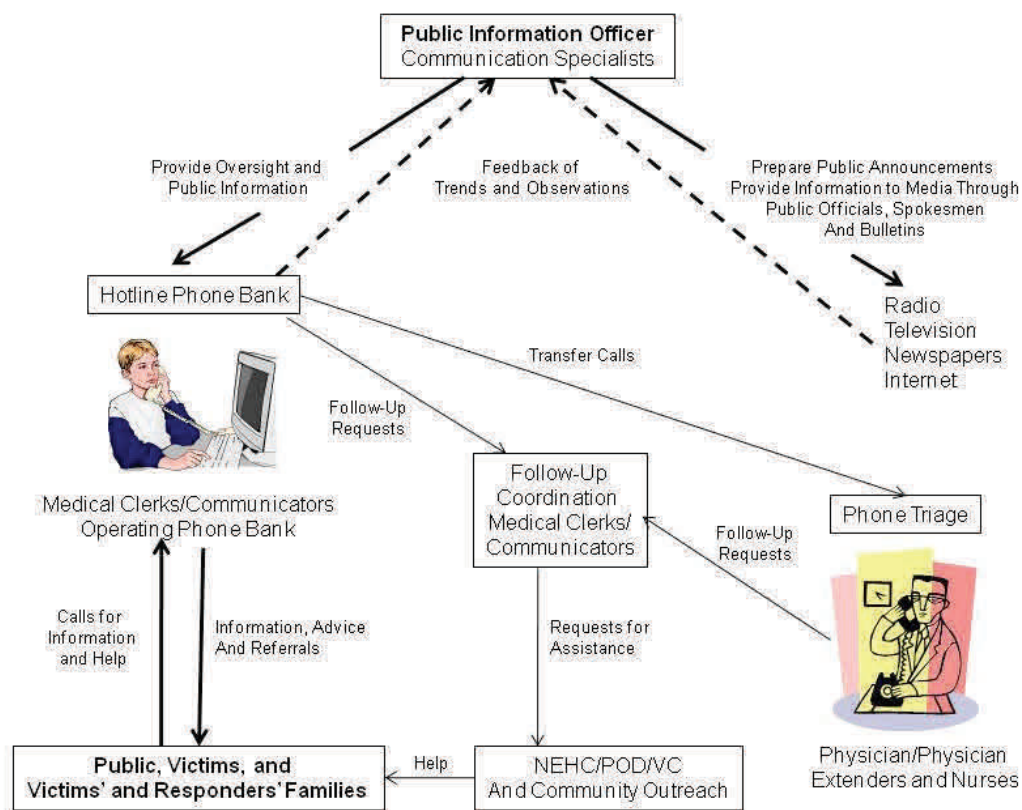
- An overview of the present risk or situation.
- Methods for reducing individual risk.
- Information on who should receive treatment.
- Where to receive treatment and/or where to go for more information.
- What Individuals can expect / not expect to happen next.

The Public Information Officer (PIO) is responsible for all official public communications within a region during a catastrophic emergency. The PIO should use a variety of methods to contact the public, including:

- Distributing emergency information through regional media (TV, radio, newspapers).
- Establishing websites and posting current information.
- Operating regional hotlines.
- Sending reverse-911 calls.
- Distributing printed information and informing the public in person (door to door or at public events).

The PIO should coordinate closely with the media, who are essential participants in disseminating official information and updates, and may also be able to obtain and supply information about the current situation. Generic emergency information and distribution methods should be developed in advance of an actual emergency. The public should be familiar with how they may receive information during an event, and communities should test these methods for operability. Considerations must be made for special populations, including the hearing-impaired and visually-impaired, the home bound, the elderly, those who are mentally challenged, and those who do not speak English. The conditions of the event will determine how rapidly information must be spread and which methods are most appropriate. Public Information may also include phone triage, particularly during contagious disease outbreaks or pandemics. In this case, the incoming phone calls must be directed to a physician / physicians extender or nurse. Response actions to be taken as a result of the phone conversations must be transmitted by a follow-up coordinator to the Neighborhood Emergency Help Center, Point of Dispensing/Vaccination Clinic NEHC (POD/VC) that covers the area of the caller. Resources to administer phone triage should be include within Community Outreach.

## PUBLIC INFORMATION CHECKLIST (Side 2 of 2)



The **PIO** will usually be located at the Emergency Operations Center (EOC). With the aid of communications specialists, the PIO will coordinate and prepare public announcements and identify the delivery timeframe and methods.

The **Hotline Phone Bank** will be answered by the medical clerks / communicators who will receive calls from the public, victims, families of victims, and responders' families. They will provide information and advise based on the PIO's latest released information.

**Phone Triage** will be very helpful when an emergency involves a contagious disease outbreak or pandemic. Through Phone Triage, a physician / physician's assistant or nurse will interpret the caller's condition, give appropriate self-help advice, and determine if follow-up action is needed.

**Follow-Up Coordination**, performed by medical clerks / communicators, will handle requests for additional assistance from hotline and phone triage personnel. They will forward each assistance request to the appropriate NEHC (POD/VC) that covers the area of the specific caller.

## **SAFETY OFFICER CHECKLIST**

**(Side 1 of 1)**

The following checklist should be considered as the minimum requirements for the Safety Officer. Note that some of the tasks are one-time actions; others are ongoing or repetitive for the duration of the incident.

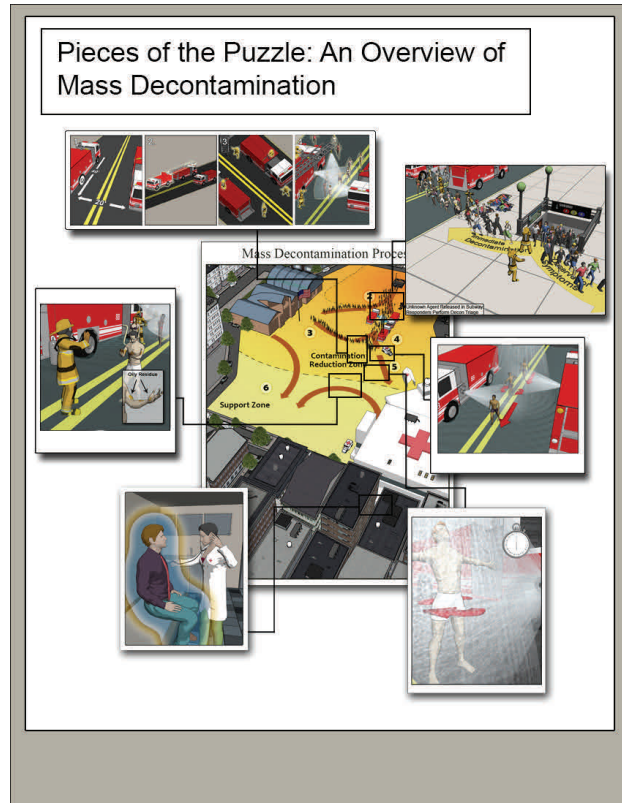
- Upon arrival, obtain briefing from Incident Commander and/or from initial on-scene Safety Officer.
- Identify hazardous situations associated with the incident. Ensure that adequate levels of protective equipment are available, and being used.
- Staff and organize the Safety function, as appropriate.
- Identify potentially unsafe acts.
- Identify corrective actions and ensure implementation.
- Ensure adequate sanitation and safety in rest areas and food handling / preparation areas.
- Investigate accidents that have occurred within the incident area or during mass decontamination operations.
- Ensure proper documentation is maintained for accidents.
- Prepare accident report(s) and updates for release to PIO.
- Recommend corrective actions to Incident Commander.
- Coordinate critical incident stress, hazardous materials, and other debriefings, as necessary.



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# VOLUME II OF II

## SUPPLEMENTAL INFORMATION



ECBC-SP-036

RELEASED AUGUST 2013

V1.1 2013



U.S. Army CBRN School  
Fort Leonard Wood, MO 65473-8926



U.S. Army Edgewood CB Center  
APG, MD 21010-5424



Geisel School of Medicine  
at Dartmouth  
Lebanon, NH 03756

Approved for Public Release; Distribution is Unlimited.

## Principles of Mass Casualty Decontamination (\*)

1. Time is critical in order to save the most lives; a) the immediate removal of clothing outside the contaminated area for patients who have been visibly contaminated or who have been suspected of having been contaminated and b) processing the victims through a high-volume, low-pressure water shower (~50 to 60 psi) is priority. This may aid in the removal of 80-90% of physical contamination in almost all cases.
2. Provide effective mass casualty decontamination. Other activities, such as setting up commercial decontamination tents, tarps, additional decontamination equipment, and/or creating a soap-water solution should be accomplished when time permits.
3. Conduct decontamination triage prior to administering a high-volume, low-pressure water shower.
4. When the contamination involves chemical vapors, biological or radiological material, using gentle friction (such as rubbing with hands, cotton flannel or microfiber cloth, or sponges) is recommended to aid in removal of contamination. Rubbing should start with the head and proceed down the body to the feet. Extra care should be taken to prevent the spread of contamination to the mouth, nose and eyes (such as holding one's breath to avoid inhalation/close contact with mucosa and closing one's eyes while wiping the face and head).

**(\*) The key to successful mass casualty decontamination is to use the fastest approach that will cause the least harm and do the most good for the majority of the people. Coordination of initial assessment and ongoing observation procedures is critical to ensure that the health needs of victims continue to be met as the incident evolves.**

### Special Considerations

- Initial decontamination wash time should be between 30 seconds and three minutes in duration to ensure thorough soaking, depending on the situation and agent involved.
- Safe/refuge observation area(s) should be utilized to monitor victims for signs of delayed symptoms or evidence of residual contamination.
- Secondary decontamination should be performed as necessary, where the set up of secondary decontamination should not delay primary decontamination.

#### Non-liquid

- If responders suspect the contamination is biological, radiological, or a gas/vapor, a water-only shower is typically adequate.

#### Liquid

- A secondary decontamination shower that includes a soap-water solution will likely be required for liquid contamination to ensure effective physical removal of agent.
- When removing liquid chemical contamination (e.g., sulfur mustard), use of a wash cloth may significantly aid in decontamination by gently rubbing the contaminated area. Caution should still be exercised to prevent the spread of contamination.

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## 1.0 Introduction

Since the April 2009 publication of the United States (U.S.) Army Edgewood Chemical Biological Center (ECBC) Special Report ECBC-SP-024; *Guidelines for Mass Casualty Decontamination During a HAZMAT/Weapon of Mass Destruction Incident, Volumes I and II*, lessons have been learned from recent international research and recommendations submitted by the Mass Casualty Decontamination Integrated Project Team (IPT) that warrant revisions to this document. Terrorist organizations have used different chemical, biological, and radiological (CBR) weapons to pursue their own agendas (e.g., in 1995, the Aum Shinrikyo cult released sarin onto the Tokyo subway system, killing 12 and injuring hundreds, in 2001, anthrax spores were sent through the U.S. Postal Service killing five postal employees and infecting 22 others). The increasing complexity and scale of these incidents suggest the possibility of a large scale attack with a Weapon of Mass Destruction (WMD) causing many thousands of casualties on US soil. Since these attacks are difficult to prevent and may happen anywhere and at any time, rapid, widely available effective mass decontamination is one of the key elements to managing the consequences of such an event, saving lives, and limiting the number of injuries.

## 2.0 Background

In April 2009, the ECBC published Special Report ECBC-SP-024; “*Guidelines for Mass Casualty Decontamination During a HAZMAT/Weapon of Mass Destruction Incident, Volumes I and II.*” This original Special Report provided an update to two previous reports; “*Guidelines for Mass Casualty Decontamination During a Terrorist Chemical Agent Incident* (ECBC–TR-125; Jan 2000)” and “*Guidelines for Cold Weather Mass Decontamination* (Jan 2002),” both published by the U.S. Army Soldier and Biological Chemical Command (SBCCOM) - now ECBC. This revised set of Guidelines supersede the published Apr 2009 Guidelines. The Guidelines contained herein represent the latest evolution in our approach to mass casualty civilian based decontamination and continued refinement of decontamination doctrine for hazards (chemical, biological, radiological, unknown).

## 3.0 Objective

These Guidelines were developed for First Responders to provide information and suggested procedures for mass casualty decontamination following a hazardous material (HAZMAT)/WMD attack. Therefore, it is recommended that these Guidelines should be tailored for use based on individual resources. Also, while there is no perfect solution to mass casualty decontamination and there is no single process or method that can account for all variables (e.g., hazard, time, number of victims, environmental conditions, resource availability, etc.), the information presented in Volume I and II is presented as a means to help identify a simple, consistent mass casualty decontamination process that could be applied with reasonable effectiveness to any HAZMAT/WMD incident. In other words, ***use the fastest approach that will cause the least harm and do the most good for the majority of the people.***

**NOTE: Appendix F includes the high resolution graphics referenced in this Volume.**



## 4.0 Scope

The information presented is based on exposure to typical hazards and focus on immediate or rapid civilian mass casualty decontamination. Volumes I and II primarily focus on chemical, biological, and radiological (CBR) agents, but can be applied to Toxic Industrial Chemicals (TICs), Toxic Industrial Materials (TIMs), and toxins (collectively referred to in this document as HAZMAT/WMD). In addition, Volumes I and II do not cover each type of threat individually, however, the basic principles outlined are applicable to all HAZMAT/WMD situations that require immediate measures to decontaminate large civilian populations subjected to a no-notice or limited-notice event. The time requirements to decontaminate large numbers of civilian patients limits the countermeasures that would normally be taken if there were only a few patients. There may not be time to measure the effectiveness of decontamination on individual patients due to time constraints. Even small additional increments of time, when added to thousands of additional patients requiring decontamination, may have a significant impact on the patients at the end of the line.

This document addresses decontamination of an overwhelming number of victims (involving hundreds to thousands of victims) resulting from a HAZMAT/WMD incident in a large urban population center. Mass casualty decontamination requires a slightly different approach than the individual technical and equipment decontamination applied during typical or limited HAZMAT incidents. The information presented is designed for use during the first minutes of a mass casualty HAZMAT/WMD incident to reduce contamination and minimize casualties.

## 5.0 Guidelines Format

### 5.1 *Volume I – Quick Reference Field Guide*

Volume I is a quick reference book and designed to be a short, concise description of procedures to set up and execute mass decontamination. Volume I is designed to be separated and distributed to team members for training purposes and for use during a mass casualty HAZMAT/WMD incident. Note: Use of this Volume is to supplement pre-established planning efforts for known hazard scenarios in your particular community.

### 5.2 *Volume II - Supplemental Information*

Volume II is a more in-depth compendium of HAZMAT/WMD mass casualty decontamination and contains the reasoning behind the recommended procedures in Volume I, a review of the Guidelines development process, reference sources, potential best practices, additional considerations, and information concerning the working group that developed these Guidelines. Volume II also includes, by reference, the "*Patient Decontamination in a Mass Chemical Exposure Incident: National Planning Guidance for Communities*", which sets forth patient decontamination principles from a strategic standpoint, rather than a tactical one. Volume II is intended to be a planning guide, not to specify operational practices.

## **Appendix A**

### **Discussion on Mass Casualty Decontamination Operations**

Volume I of this document identified the six basic steps for the process of mass casualty decontamination (Refer to Appendix F, Figure F.1 of this Volume for the associated Mass Decontamination Process), which include:

1. Initial Situational Awareness / Identification
2. Victim Control and Decontamination Triage
3. Mass Casualty Decontamination Execution
4. Segregation for Observation
5. Secondary Decontamination / Medical Treatment
6. Post Decontamination

Additional discussion and reasoning for each Step is provided in this Appendix.

## A1.0 Step 1: Initial Situational Awareness / Identification

This Step should be performed IAW standard guidelines as contained in the latest printed edition Emergency Response Guidebook (ERG) and National Fire Protection Association (NFPA) Standard 472 for First Responders arriving at an incident scene. Additional reference material can be found in the National Incident Management System (NIMS); and the National Response Framework (NRF).

### A1.1 Sizing Up the Incident

Chemical and biological agents, as well as radioactive materials, can be dispersed in the air we breathe, the water we drink, or on surfaces we physically contact. Dispersion methods may be as simple as opening a container, using conventional (garden) spray devices, or as elaborate as detonating an improvised explosive device.

**Chemical Incidents** are characterized by the rapid onset of medical symptoms (minutes to hours) and easily observed signatures (colored residue, dead foliage, pungent odor, dead insects and animals).

Indicators	Description
Dead animals / birds / fish	Not just an occasional road kill, but numerous animals (wild and domestic) in the same area
Lack of insect life	Absence of normal insect activity
Unexplained odors	Smells that are out of character with its surroundings, including fruity, flower, sharp/pungent, garlic/horseradish, bitter almond, and newly mown hay.
Unusual numbers of mass casualties	Health problems including nausea, disorientation, difficulty breathing convulsing, reddening of eyes (irritation), reddening of skin, and death.
Pattern of casualties	Casualties consistent with wind patterns or ventilation.
Blisters / rashes	Numerous individuals experiencing unexplained blisters, bee sting like weals, and/or rashes.
Unusual liquid droplets	Numerous surface exhibits of oily droplets/film (especially when there has been no recent rain).
Low lying clouds	Fog or low lying clouds inconsistent with the surroundings.
Unusual metal debris	Unexplained shrapnel.

**Table A-1. Indicators of Possible Chemical Incident**

In the case of biological and radiological contamination, where there may not be immediate health effects. The amount of biological or radiological contamination that enters the body through inhalation, ingestion or broken skin will determine the severity of any associated illness.

If equipped, responders can also use detection devices to rapidly determine the presence of chemical, biological or radiological contamination. Biological detection devices can also be used if there is no delay in the decontamination process.

**Biological Incidents** are characterized by the onset of symptoms in hours to days. Typically, there will be no characteristic signatures because biological agents are usually odorless and colorless. Because of the delayed onset of symptoms in a biological incident, the area affected may be greater due to the movement of infected individuals.

Indicators	Description
Unusual number of sick or dying people animals	Delayed symptoms dependent on the agent used.
Abandoned spray devices at unscheduled times spraying	Outdoors, at night, in unusual areas.

**Table A-2. Indicators of Possible Biological Incident**

**Radiological Incidents** are characterized by the onset of symptoms, if any, in days to weeks or longer. Typically, there will be no characteristic signatures because radioactive materials are usually odorless and colorless. Specialized equipment is required to determine the size of the affected area, and whether the level of radioactivity presents an immediate or long term health hazard. Because radioactivity is not detectable without special equipment, the affected area may be greater due to the migration of contaminated individuals.

Indicators	Description
Radiation symbols	Containers may display a radiation symbol.
Unusual metal debris	Unexplained shrapnel.
Heat emitting materials	Material is hot or emits heat without any sign of a heat source.
Glowing material	Strongly radioactive material may emit or cause radio-luminescence.
Sick people / animals	Casualties may include skin reddening or vomiting depending on material and dose received.

**Table A-3. Indicators of Possible Radiological Incident**

For HAZMAT/WMD incidents, responders will look to identify signs and symptoms of exposure to determine whether mass decontamination is necessary. Observing for symptoms generally only applies to chemical incidents, not counting injuries sustained as the result of an explosive dissemination device or injuries suffered while evacuating the hazard area. Physical evidence of exposure includes victims covered with a liquid or solid, which can be the result of contamination from chemical, biological and radiological incidents. It is particularly important to identify victims exposed to liquid contamination, especially oily agents such as nerve and mustard, as liquids require the application of soap or other emulsifiers to most effectively remove the agent from the victims' hair and skin.

There are four typical routes of entry into the body, determined by the physical properties and characteristics of the agents released. These include:

1. Inhalation into the lungs - Chemical vapors, biological aerosols, or radioactive particles that can be inhaled into the lungs pose an inhalation hazard.
2. Absorption into the skin - Liquid and solid chemical, biological, or radiological agents that can be absorbed into the skin pose a contact hazard.
3. Injection - This could be the result of contaminated shrapnel from explosive or direct injection into the blood stream.
4. Ingestion - Chemical, biological, or radiological agents that can be ingested into the digestive / gastrointestinal system pose an internal hazard

Regardless of the material involved or the route of entry, when making your approach, move rapidly but cautiously, and observe your surroundings. Protect yourself and use a safe approach (minimize any exposure time, maximize the distance between you and the item that is likely to harm you, use cover as protection and wear appropriate personal protective equipment and respiratory protection). Look for vapor clouds, and listen for the sounds of high-pressure gas leaking and the creaking or popping of expanding and failing metal containers. As previous events have demonstrated, it is necessary for responders to check for secondary devices that may be placed near the incident scene. Since mass casualty decontamination results in the congregation of a large number of victims and responders, it is a natural target and the site(s) must be checked for secondary devices.

### *A1.2 Establishing Zones*

Isolate the area and secure the scene; potentially contaminated people should be isolated and decontaminated as soon as possible. To the extent possible, take measures to limit the spread of contamination. When HAZMAT/WMD exposure is suspected, responders first perform a scene safety assessment and ensure they properly protect themselves and do not rush into an unknown situation, this includes establishing the Initial Isolation and Protective Action Distances (aka "Hot", "Warm", "Cold" Zones).

The ERG offers the following definitions:

- The **Initial Isolation Zone** defines an area SURROUNDING the incident in which persons may be exposed to dangerous (upwind) and life threatening (downwind) concentrations of material.
- The **Protective Action Zone** defines an area DOWNWIND from the incident in which persons may become incapacitated and unable to take protective action and/or incur serious or irreversible health effects.

It is important to note that even though the term “zone” is used, they do not represent any actual area or pre-set distance. A key point to remember is that zone boundaries can change as a result of environmental conditions or re-classification and severity of the hazard. In all cases, establish distances deemed safe by the Incident Commander. Zones should be established IAW the Emergency Response Guidebook (ERG) 2012 and other applicable HAZMAT references (e.g., Federal Emergency Management Agency (FEMA), National Fire Protection Association (NFPA), Department of Health and Human Services (DHHS), National Institute for Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), etc.).

First Responders should also consider their own protection upon arrival at an incident scene. Personal Protective Equipment (PPE) should be selected IAW U.S. Department of Homeland Security’s “Guide for the Selection of Personal Protective Equipment for Emergency First Responders; Guide 102-06; Jan 2007, 2<sup>nd</sup> Edition.” Commercially available detection and disclosure equipment can be used to verify the hazard and can detect low levels of chemical warfare agents (CWAs) and toxic industrial chemicals (TICs) when visual determination cannot be made. When a chemical cannot be immediately identified, worst-case possibilities concerning toxicity must be assumed. The potential for severe local effects (e.g., irritation and burning) and severe systemic effects (e.g., organ damage) should be assumed when specific rescuer-protection equipment is selected. Therefore, the Level of Protection selected is critical. PPE is divided into four categories based on degree of protection afforded:

Level A = greatest level of skin, respiratory, and eye protection required (includes a fully encapsulating chemical-resistant suit (equivalent to an NFPA vapor-protective suit) and a pressure-demand self contained breathing apparatus (SCBA))

Level B = highest level of respiratory protection necessary, but lesser level of skin protection needed (includes a non-encapsulating chemical-resistant suit (equivalent to an NFPA splash-protective suit) and an SCBA)

Level C = used when concentration(s) and type(s) of airborne substance(s) is known and criteria for using air purifying respirators are met (includes a non-encapsulating chemical-resistant suit (equivalent to an NFPA splash-protective suit) and an air-purifying respirator)

Level D = work uniform providing minimal protection. Used for nuisance contamination only (consists of work clothes that do not provide any specific respiratory or skin protection)

### A1.3 Decontamination Setup (\*)

Since mass decontamination is resource intensive, determination of the need for decontamination during the initial assessment is an very important step. The environment needs to be considered when determining where and how to execute decontamination. Follow cold weather guidelines (especially during extreme cold weather where outdoor air temperatures are below 65 degrees Fahrenheit) when exposure to the cold and wet decontamination may generate a greater number of, or more severe, casualties than the HAZMAT/WMD hazard.

**(\*) It is important to note that precautionary measures should be taken, to the best extent possible, to contain decontamination runoff and prevent cross contamination to personnel and equipment. Whenever possible, the decontamination site should be setup uphill / upwind from the Hazard Area (Hot Zone) and have good drainage. In addition, contaminated PPE should be disposed of IAW established HAZMAT/WMD procedures.**

The Ladder Pipe Decontamination System (LDS) is the only system included in this discussion due to its simplicity and expected application in a broad range of responder communities. The LDS is one example of an expedient equipment set up for establishing high-volume, low-pressure decontamination. The LDS provides a large capacity, high-volume, low-pressure water shower (approximately 60 psi). Two engines, utilizing ladder pipes, deck guns, and fog nozzles can create a mass decontamination corridor of water spray if positioned strategically. The dimensions of the corridor should be approximately 20 feet in width (between fire trucks) and approximately 40 feet in length (Refer to Appendix F, Figure F.2, for an illustration of a sample LDS in application).

Utilize an immediately available water source. Warm water temperatures may aid in the rate of chemical evaporation. Use of cool water (i.e., less than 77 degrees Fahrenheit) should be avoided unless no other means of decontamination is available. The water will physically remove and dilute the hazard. The effectiveness of wet decontamination varies according to the volatility of the contaminating chemical. In most cases, the use of excessive amounts of water can cause an increase in the rate of chemical absorption into the skin. Shorter durations of showering should reduce this effect. Wash time should be at least 30 seconds (but not longer than 3 minutes). Prolonged skin contact with water during decontamination should be avoided.

**Note: Time is critical. Initial gross decontamination is priority! DO NOT DELAY in order to set up technical decontamination tents, shelter tents, or to add soap, etc.. Current recommendations for on scene rapid mass casualty decontamination range from 30 seconds to 3 minutes. Initial research supports this range of values based on minimal levels of effectiveness at the 30 second level and possible tissue damage with increased chemical absorption at 3 minutes. Actual times must be determined at the scene and take into consideration multiple factors including number of victims, environmental temperatures, index of suspicion, and clinical symptomatology.**

**Optimal water temperature should be between 60°F and 100°F if possible as the warmer water temperatures may aid in the rate of chemical evaporation. However, DO NOT DELAY the decontamination process to heat the water.**

Although the variations for setting up mass casualty decontamination systems are virtually limitless, many waste precious minutes to set up additional equipment (e.g., tents, tarps) and mix in additives. Time is critical for effective decontamination. For fast acting agents, such as nerve agents, many victims will sustain serious injury or die within minutes of exposure. Even for chemical agents with delayed symptoms, such as mustard agents, rapid decontamination is critical. Though the physical symptoms associated with mustard agent poisoning are delayed, mustard agent starts damaging cells immediately upon contact with skin. Failure to rapidly decontaminate following chemical agent exposure could lead to severe illness or death, even for victims able to evacuate themselves from the hazard area.

Multiple LDSs use more than one ladder pipe to increase the length of the decontamination corridor to accommodate larger groups of victims and can be established to provide decontamination for different groups, such as ambulatory and non-ambulatory victims or even to provide decontamination at hospitals. As previously discussed, in the case of biological and radiological contamination, where there are no immediate health effects, the amount of biological or radiological contamination that enters the body through inhalation, ingestion or broken skin will determine the severity of any associated illness. For these reasons, rapid application of the high-volume, low-pressure water shower is critical to the success of mass decontamination in limiting deaths and injuries, as well as reducing the spread of contamination, regardless of the type of hazard involved.

## **A2.0 Step 2: Victim Control and Decontamination Triage**

This Step involves gaining initial control of the victims so responders can provide victims with guidance and instruction, to include removal of clothing and prioritizing victims for decontamination.

Before a decontamination set-up is established, many exposed persons are likely to have departed the area for local hospitals (either self-evacuation or assisted by others). Thus, the incident commander must assume that contamination has spread outside of the incident scene and promptly notify nearby hospitals so that these facilities may take appropriate decontamination precautions

Gaining control of onsite victims is a difficult task, but rapidly gaining control is critical to getting victims to quickly perform the critical first step in mass casualty decontamination – removal of their clothing down to undergarments. In addition, gaining initial control of the victims is essential to prevent unauthorized dispersion or re-entry to the incident site. Responders are not only challenged with guiding and controlling victims while wearing protective clothing, but also must try to avoid being exposed to cross contamination. The use of communication devices such as public address systems, bull horns, and signs may prove effective. Illustrated signs (with or without text) may prove effective, especially in multi-lingual communities. The use of physical barriers may prove effective in gaining initial control of victims and preventing the spread of contamination. Victims should be evacuated from the hazard area as quickly as possible in an orderly manner. Those victims who were likely not exposed to the hazard should be directed to an area of safe refuge for observation. Those victims who were likely exposed to the hazard should be directed to the decontamination station where they should be instructed to begin the decontamination process, first by removing clothing and then by proceeding through the decontamination station.



“Decontamination Triage” is a prioritization mechanism used by a First Responder to determine whether victims emerging from HAZMAT/WMD incident scene should be directed to area(s) of safe refuge/observation area or to a mass casualty decontamination station. **This is not the same as “Medical Triage”, which is performed to determine who should receive medical treatment first.**

Rapid identification of victims who may not require decontamination can significantly reduce the time and resources needed to perform decontamination. Decontamination triage involves separating victims into prioritized groups. The term decontamination triage is not to be confused with medical triage and is used in these updated Guidelines as the term that is accepted and widely used in the response community.

Conducting decontamination triage, and determining the extent to which it is conducted, are decisions left to the discretion of responders at the incident scene, but should be conducted throughout the mass casualty decontamination process as a victim’s status could change. Based on time and resources, responders might reasonably elect to process all victims as rapidly as possible through mass decontamination rather than perform decontamination triage. If decontamination triage is performed, responders should look to identify signs and symptoms of exposure to determine whether mass decontamination is necessary or if observation would suffice. Observing for symptoms generally only applies to chemical, biological and radiological incidents. Medical triage for injuries sustained as the result of an explosive dissemination device or injuries suffered while evacuating the hazard area should also take place. Victims should be separated according to the following priorities:

1. Ambulatory and symptomatic (e.g., instruct victim to proceed to decontamination)
2. Non-ambulatory (e.g., assist victim through decontamination or transport direct to medical facility)
3. Ambulatory and non-symptomatic, but exposed to contaminant (e.g., instruct victim to proceed to decontamination)
4. Ambulatory and non-symptomatic, with no obvious exposure to contaminant (e.g., instruct victim to proceed to Safe Refuge/Observation Area)

The highest priority for decontamination is ambulatory victims who are symptomatic, yet can follow simple directions. They are easiest to decontaminate because they can walk themselves through the decontamination system. The next highest priority is those casualties who are non-ambulatory. Remember that some non-ambulatory victims should be extracted once responders can safely access the hot zone while wearing appropriate PPE. Based on operational conditions, decontaminating ambulatory victims may continue in decreasing order of priority until non-ambulatory casualties can be physically moved.

The next priority is casualties that are ambulatory, non-symptomatic, but have been exposed to the contaminant because of their location in relation to the release. The health of these victims could rapidly deteriorate due to their exposure to the contaminant. Depending upon the degree of exposure, the onset of symptoms could occur at any time during the decontamination process. Decontaminate these victims as soon as possible after higher priority casualties.

The last priority includes victims who are ambulatory, non-symptomatic, and who likely were not exposed to the hazard. The Mass Casualty Decontamination Research Team (MCDRT) from ECBC states that an Incident Commander (IC) should, "expect at least a 5:1 ratio of unaffected to affected victims." This group of unaffected victims may also be referred to as "worried well." Because they are usually the largest group presenting for assistance, they result in a large logistical hurdle. It is possible that these cases may not require decontamination. They may instead be sent to Safe Refuge/Observation Area to watch for delayed onset of symptoms. If the situation and resources allow, the IC may choose to decontaminate these cases to provide an additional degree of safety. Victims who are deemed deceased in the hot zone should be left in place as part of the crime scene (as evidence). Place those who die after entering the decontamination process or those who are deemed "expectant" into a morgue away from mass casualty decontamination operations.

Physical evidence of exposure includes victims covered with a liquid or solid, which can be the result of contamination from chemical, biological and radiological incidents. It is particularly important to identify victims exposed to liquid contamination, especially oily agents such as nerve and mustard, as liquids require the application of soap or other emulsifiers to most effectively remove the agent from the victims' hair and skin. If equipped, responders can also use detection devices to rapidly determine the presence of chemical, biological or radiological contamination.

Initial decontamination triage should include identification of toxic syndromes, such as:

- Vital signs
- Mental status
- Pupil size
- Mucous membrane irritation
- Lung exam for wheezes or rales
- Skin for burns, moisture, and color
- Twitching eyes / muscles
- Coughing
- Wiping eyes / tearing
- Confusion
- Requiring aided mobility
- Itching
- Debilitation
- Miosis
- Vomiting
- Convulsions

A Decontamination Triage Decision Tree (Refer to Appendix F, Figure F-4) has been designed to aid responders in performing decontamination triage.

**Note: The Mass Casualty Decontamination Triage Decision Tree is meant to be a simple tool to help plan for and respond to HAZMAT/WMD incidents. If a contaminant / agent is known, follow the prescribed decontamination TTPs in the ERG.**

Toxic syndrome recognition is an important part of decontamination triage because it provides a tool for rapid identification of the suspected causes and can focus the differential diagnosis to consideration of only a few chemicals with similar toxic effects. By focusing on certain chemicals, specific decontamination techniques can be rendered based on identified evidence.

In addition, the decontamination triage can include:

- a) A quick questioning as to whether victims were in the vicinity of the hazard and
- b) Visually observing for signs and symptoms of exposure.

Those victims in the vicinity, or showing/indicating signs/symptoms of exposure, are sent to decontamination as previously discussed. Those likely not exposed and showing no signs of exposure are sent to a Safe Refuge/Observation Area.

**Note: For unknown contaminants or a combination of contaminants, unless liquid contamination can be eliminated as a source of the hazard, responders should follow guidelines for liquid decontamination, which includes application of soap during either initial or secondary decontamination.**

### **A3.0 Step 3: Mass Casualty Decontamination Conduct**

Step 3 outlines procedures for decontaminating a large number of victims including providing victim instructions for properly removing clothing and proceeding through a decontamination shower corridor. This Section includes instructions on proper clothing removal (ideally completed prior to establishing the water shower system), proper procedure for walking through the decontamination shower corridor, identification of decontaminated victims, and directing decontaminated victims to an observation area to monitor for delayed symptoms or the need for additional decontamination.

#### *A3.1 Clothing Removal*

Victims should be instructed to carefully remove clothes and place them in piles.

**Note: The effectiveness of disrobing prior to decontamination rapidly decreases with time following exposure.**

If possible, responders should provide a means to separate and collect personal items and clothes. Victims will likely want to maintain possession of purses and wallets. In many cases this will present minimal hazard. However, in situations where the personal items are visibly contaminated with a liquid or solid, these items pose a risk to the victims and others and must be collected. Removal of victims' clothing is the single most critical action for effective mass decontamination. Having a victim carefully remove their clothes prior to decontamination will significantly reduce risk in all cases. Victims should be encouraged to immediately remove as much clothing as possible – the more clothing removed the better. This is especially true when liquid contamination is present, due to the increased risk of agent rapidly penetrating clothing and contacting the skin.

At a minimum, victims should remove outer garments down to their underwear. Removal of clothes down to the underwear is considered the most expedient solution. Though removal of all clothing would be most effective, making this action a requirement may cause many citizens to become uncooperative and potentially delay the mass decontamination process.

**Note: If a victim refuses to remove their clothes prior to decontamination, DO NOT force the issue and try to send the victim through the water shower deluge with their clothes on. Refusal to remove clothing may stem from religious, cultural or simply, discomfort by people, particularly parents or legal guardians of young children. However, water decontamination should not stop with this challenge because there is significant evidence showing that the effective time window for decontaminating of toxic chemicals diminishes over time, from minutes to hours. If clothing removal is refused, responders can try to apply water underneath the clothing. In addition, DO NOT delay initial decontamination for other victims. The victim(s) must be quarantined until other decontamination methods can be employed.**

Removal of clothing down to the underwear is an effective compromise for all situations, with the exception of liquid contamination that has saturated outer clothing and contacted undergarments. This scenario is considered a fairly low probability.

If clothes must be lifted over the head, instruct victims to do so carefully by placing hands and arms on the inside of the garment and using the hands to pull the head opening away from the face and head as much as possible. These precautions will reduce the chance of exposing the head, face and eyes to contamination. Whenever possible, victims should unbutton or cut clothes away rather than lift them over their head (Refer to Appendix F, Figure A-5 for the Proper Removal of Clothing).

It is the opinion of the scientists, doctors, and responders that removal of clothing down to the undergarments may remove as much as 80-90% of contamination from the victims. When most of the victim's skin is covered with clothing, such as long pants and shirts, there is a greater likelihood of significant or total contamination removal. During warm weather when shorts and short-sleeve shirts are common, it is likely that a higher percentage of contamination will be directly on the skin of the victims. Studies have shown that disrobing is generally an order of magnitude more effective than water decontamination. Whereas, the combined task of disrobing and decontamination further decreases dermal absorption of contaminants.

### *A3.2 Water Shower Deluge*

Following removal of clothing, victims should be instructed to move rapidly to the water shower deluge corridor (LDS) and walk slowly through the corridor with their head back and arms and legs extended to expose the armpits and groin areas to the water shower. While victims are waiting to be decontaminated, keep adequate spacing between individuals to avoid secondary contamination and exposure to off-gassing. When moving through the decontamination shower, victims should tilt their heads back, raise their arms and spread their legs to expose the armpit and groin areas and taking extra precaution to prevent runoff from the head/hair getting into the eyes, nose or mouth (Refer to Appendix F, Figure F-6).

Victims should occasionally turn 90 degrees (1/4 turn) to expose their entire bodies to the water cross stream (Refer to Appendix F, Figure F-7). Refer to Appendix F, Figure F-8 for the complete illustrated decontamination technique in application.

Wash time should be at least 30 seconds (but not longer than 3 minutes). Prolonged skin contact with water during decontamination should be avoided. Thorough washing increases the effectiveness of decontamination, depending on the type of contamination, ambient environment, number of victims, and resources available. Use available water source. Warm water temperatures may aid in the rate of chemical evaporation. Use of cool water (i.e., less than 77 degrees Fahrenheit) should be avoided unless no other means of decontamination is available.

The hair on the head can collect vapor, liquid and solid contaminants. The tilting of the head is designed to prevent runoff from the head getting into the eyes or mouth of the victim. The armpits and groin areas must be exposed since they are particularly sensitive to chemical agent penetration. Victims should also be instructed to turn 90 degrees (1/4 turn) at least once to expose the front and back of the body to the cross stream.

Applying gentle friction can increase effectiveness of decontamination. The application of gentle friction is recommended when the contamination involves chemical vapor, fine aerosols, or particles of biological or radiological contamination. Gentle friction includes rubbing with the hands or a non-abrasive soft cotton flannel or microfiber cloth or sponges. Studies have shown friction aids in the physical removal of contamination from the body. The use of brushes or other items that could break or damage the skin should never be used when performing mass casualty decontamination.

In the above situations, the contaminant should be wiped away from the body, starting with the head and moving down to the feet. When the contamination involves liquid contamination, particularly oily agents such as mustard or nerve, more harm than good could be caused by applying friction, especially without the use of an emulsifier such as soap. Applying friction by using the hands – the simplest and most expedient method in a mass casualty decontamination situation – would transfer liquid contaminant to the hands and possibly result in the transfer of contamination to sensitive parts of the body such as the face, armpits and groin areas, thus increasing medical risk.

In most cases, the use of excessive amounts of water can cause an increase in the rate of chemical absorption into the skin. Shorter durations of showering should reduce this effect.

**Note: Time is critical. Initial gross decontamination is priority! DO NOT DELAY initial gross decontamination in order to set up technical decontamination tents, shelter tents, or to add soap, etc..**

After the Responders successfully perform mass casualty decontamination, a Responder should conduct a quick visual inspection of the victims as they exit and directs them to the areas(s) of safe refuge for observation where they can be monitored for delayed symptoms and the need for secondary decontamination, to medical facility for treatment, or to secondary decontamination. Deck guns can be positioned to provide additional water volume, if necessary.

When the contaminating material is known, especially when a conventional HAZMAT material is involved, responders should follow decontamination procedures as outlined in the Emergency Response Guide 2012, adapting the principals as outlined for mass decontamination as appropriate.

When the contaminant is a solid (such as radiological or biological particles) or vapor/gas, a water-only shower is satisfactory. Victims not exposed to the contaminant can be sent to an observation area or given lowest priority for decontamination.

When the contaminant involved is a liquid chemical agent, those exposed should be decontaminated at some point with soap and water. The decision tree shows application of water-only decontamination followed by a secondary soap and water decontamination. However, if adding soap to the initial water shower does not delay the start of decontamination, a single shower can be performed, followed by observation.

**Note: It is possible that the severity of conventional injuries may require certain victims receive elevated priority, regardless of whether they are showing obvious signs/symptoms of exposure. This determination would be made by medical personnel performing medical triage.**

In the case of biological and radiological contamination, where there will be no immediate health effects, the amount of biological or radiological contamination that enters the body through inhalation, ingestion or broken skin will determine the severity of any associated illness.

#### **A4.0 Step 4: Segregation for Observation & Monitoring**

Following successfully mass casualty decontamination, the Responder should conduct a quick visual inspection of the victims as they exit the decontamination corridor. Actions to be taken following completion of initial mass decontamination includes re-robing and observing victims for delayed symptoms and determining visual evidence of residual contamination (such as off-gassing); arranging for clothing/cover for decontaminated victims; recovering personal items (if possible); transporting victims to medical facilities for follow-on care; and performing secondary decontamination as necessary.

##### *A4.1 Providing Victims a Means of Clothing/Cover*

When resources are available, allow the decontaminated victim to dry themselves, particularly around the eyes, nose, and mouth. Whenever practical, decontaminated victims should be provided with a means of clothing or cover, both to restore modesty and to provide warmth. Common items employed by response agencies during response exercises include a wide variety commercial off the shelf items (e.g., disposable paper suits / gowns, socks, or slippers, foil rescue blankets, sheets, and/or large plastic garbage bags) that are designed to fit a wide range of patient sizes. Decontaminated victims should be encouraged to use put these items on away from the decontamination corridor to not slow down the decontamination process of those victims immediately behind them.

#### *A4.2 Tag Victims to Identify Decontamination Status*

When practical, decontaminated victims should also be tagged / identified to aid medical personnel and others in determining potential risk to themselves when treating or assisting victims. Identification should include a method that can account for both initial mass decontamination and secondary decontamination. Some examples include the use of colored rubber bands and specially developed triage tags.

#### *A4.3 Direct Victims to Treatment or Observation*

Following decontamination, victims without additional visible symptoms should be directed to the area(s) of safe refuge for observation where they can be monitored for delayed symptoms. Observation for effectiveness of decontamination should include self, buddy, or responder evaluation to looking for physical signs of residual contamination. Involvement of a colorless chemical would make this type of observation difficult. However, since many agents would not be colorless, especially if they contain impurities as experts expect is likely for a terrorist attack, physical inspection may be effective in identifying residual contamination and the need for additional decontamination.

Observation is considered necessary to allow delayed symptoms of fast acting chemical agents to manifest while medical treatment is nearby. Small amounts of chemical agents, especially liquid agent on the skin, could result in delayed symptoms due to a delay in absorption of the agent into the body. Typically, there may be a latent period of one to 30 minutes and then a sudden cascade of overwhelming effects. One reported case of nerve agent poisoning resulted in an 18 hour delay before symptoms occurred. It is not recommended that victims be observed for such an extended period, but a reasonable minimum observation period should be determined based on the advice of medical personnel.

#### **Case Study**

**Observation is critical.** On the day of the sarin attack on the Tokyo subway system, ambulances transported 688 patients and nearly five thousand people reached hospitals by other means. Hospitals saw 5,510 patients, seventeen of whom were deemed critical, 37 severe and 984 moderately ill with vision problems. Most of those reporting to hospitals were the concerned, but unaffected, who had to be distinguished from those who were ill. By mid-afternoon, the mildly affected victims had recovered from vision problems and were released from hospital. Most of the remaining patients were well enough to go home the following day, and within a week only a few critical patients remained in hospital. The death toll on the day of the attack was eight. Several of those affected by sarin went to work in spite of their symptoms, most of them not realizing that they had been exposed to sarin. Most of the victims sought medical treatment as the symptoms worsened and as they learned of the actual circumstances of the attacks via news broadcasts. Several of those affected were exposed to sarin only by helping those who had been directly exposed.

Observation of possible exposure to delay-acting chemical agents may be done at home by giving a set of instructions of what to observe and who to contact (e.g. 911) when those signs and symptoms manifests. Observation on-site for large numbers of patients on-

scene may not be practical from a resource capability perspective (after decontamination). In fact, domestically, patrons desiring to leave the scene after decontamination and brief verification that decontamination was effective cannot be detained by law. The observation period can also be used to disseminate information to victims on symptoms they should watch for after they are released (i.e., delayed symptoms) and guidance on seeking follow-up medical care. Visual evidence of residual contamination (such as off-gassing) should be verified by trained medical personnel (Refer to Appendix F, Figure F-9). Secondary decontamination should be performed, as necessary.

**NOTE: Symptomatic and ambulatory victims should proceed to Step 5 and undergo additional medical triage, treatment, and are transported to a medical facility/transfer station, if required for further medical treatment.**

#### *A4.4 Secondary Decontamination*

Secondary decontamination (\*) with an emulsifier (such as soap) may be necessary if an oily liquid hazard (e.g., sulfur mustard) is involved, whereas initial decontamination is performed with water only. While the use of a soap-water solution is best for physical removal of gross contamination for all hazards, it will likely be required for oily liquid agents in order to provide the most effective physical removal of the agent from the victims' skin. Rubbing without the aid of soap is not recommended, as it may increase spread of the agent over a larger surface area of the body, resulting in increased medical risk.

**(\*) Use this method only if responders are capable of immediately applying a soap and water solution as this method represents the best solution for all HAZMAT/WMD mass casualty decontamination situations. In the absence of soap, application of water via the LDS is the preferred primary method of decontamination.**

The need for secondary decontamination is most likely if an oily liquid based hazard (e.g., sulfur mustard) is involved and initial decontamination was performed with water only (Refer to Appendix F, Figure F-10 for identification of Oily Agent Residue Following Decontamination). Though soapy water is ideal for all mass decontamination operations, it will likely be required for oily liquid agents in particular in order to provide the most effective physical removal of the agent from the victims' skin.

In addition, medical facilities may often require secondary decontamination before allowing contaminated victims inside the facility as an added precaution to protect medical staff and prevent the medical facility from being contaminated.

**NOTE: Secondary Decontamination should only be used if responders are capable of immediately applying a soap and water solution as this method represents the best solution for all HAZMAT/WMD mass casualty decontamination situations. In the absence of soap, re-application of water via the LDS is the preferred primary method of secondary decontamination.**



## **A5.0 Step 5: Segregation for Medical Treatment**

For those victims in immediate need of additional medical treatment, transportation should be arranged to a medical facility. "Medical Triage" should be conducted at this point on victims to determine the order in which they receive medical care. Many medical triage systems are in routine practice. The most commonly used system in the United States is the Simple Triage and Rapid Treatment (START) system. START was developed in 1983 by Hoag Hospital and the Newport Beach (California) Fire and Marine Department. It is a system by which casualties are triaged as, "Immediate", "Delayed", "Minor", or "Deceased" based on the severity of illness and/or injury.

A special medical triage algorithm has been developed called START (developed by the Newport Beach Hoag Hospital and the Newport Beach Fire Department; info@start-triage.com). Using the START algorithm, children that cannot walk under their own power are evaluated first and uses the color-coding system, as described below:

- Deceased (Black Triage Tag). Casualty unlikely to survive given severity of injuries, level of available care, or both. Palliative care and pain relief should be provided.
- Immediate (Red Triage Tag). Casualty can be helped by immediate intervention and transport. Requires medical attention within minutes for survival (up to 60). Casualty's airway, breathing, and circulation have been compromised.
- Delayed (Yellow Triage Tag). Casualty's transport can be delayed. Has serious and potentially life-threatening injuries, but status not expected to deteriorate significantly over several hours.
- Minor (Green Triage Tag). Casualty has relatively minor injuries. Status unlikely to deteriorate over days. May be able to assist in own care. Walking wounded.

To identify casualties in the different triage categories, affix a commercially available triage tag to each casualty. They are perforated for easy ripping. The bottom-most color of the tag indicates the triage category of the casualty. Some tags may also have bar-coded strips that can be detached and included in a bag of personal effects or retained by the Triage Officer. The barcodes make tracking, documentation, and accountability processes easier for casualty management. To separate the Medical Triage Staging Area within the mass casualty decontamination corridor, lay colored tarps on the ground or place small colored flags in an area. Direct or place the casualties accordingly. The colors of the tarps and/or flags should correlate to the triage categories of Red, Yellow, Green, and Black.

## **A6.0 Step 6: Release of Victims**

Once the Incident Commander has consulted with the Safety Officer, Medical Team, Technical Specialists, and other appropriate response personnel, and deems that the incident scene to be safe and secure, the victims can be released from the safe/refuge observation area. Upon release, additional information related to delayed symptoms that should be watched for and guidance on seeking follow-up medical care, should be disseminated to the victims. Visual evidence of residual contamination (such as off-gassing) should be verified by trained medical personnel prior to release. Additionally, the victims sent to a medical facility/transfer station will be released as directed by medical personnel.

## **Appendix B**

### **Discussion on Mass Decontamination**

This Appendix provides a more detailed discussion of mass casualty decontamination methods and procedures than is contained in Volume I and supports both the information contained in Volume I, as well as the discussion in Volume II; Appendix A: Discussion of Mass Casualty Decontamination Operations.

The methods and procedures described in this Appendix are the result of:

- 1) Empirical evidence and lessons learned from recent international research,
- 2) Subject Matter Expert (SME) reporting from ECBC, the U.S. Army Medical Research Institute for Chemical Defense (USAMRICD), the CBRN School, and Geisel School of Medicine,
- 3) The experience of responders from local communities and the U.S. Army's Aberdeen Proving Ground Fire Department, and
- 4) Recommendations submitted by the Department of Health and Human Services, Office of the Assistant Secretary for Preparedness & Response (ASPR) and the Department of Homeland Security (DHS), Office of Health Affairs, Mass Casualty Decontamination Integrated Project Team (IPT).

## B1.0 Basic Decontamination Discussion

This Appendix includes recently obtained empirical data, technical information, and scientific testing that has been conducted to validate the mass casualty decontamination methods and procedures outlined in the original printing of Volume I & II in 2009.

### B1.1 Definition of Decontamination

Decontamination refers to means that reduce the hazard of a contaminant. There are two basic methods of decontamination, physical removal and neutralization:

- Physical removal involves mechanical action with techniques such as gentle friction with a soft (cotton flannel or microfiber) cloth or sponge, blotting, and washing (Note: Washing aids may accumulate contaminants and could represent a substantial hazard itself). Rapid physical removal of agent from the victim is the single most important action associated with effective decontamination. Physical removal includes disrobing, wiping, scraping or blotting visible agent from the skin, along with flushing or showering with water. If physical assets are limited, one possible method of secondary decontamination is to recycle victims through the initial decontamination site, but at a slower and more deliberate pace that emphasizes thorough cleaning and removal of all residual agent. Equipment such as decontamination tents and the use of additives (such as soap) are best implemented at the secondary decontamination site. Liquid soap, if available, should be distributed for victims' use during this secondary decontamination.
- Neutralization involves methods and/or materials to counteract the harmful effects of the contaminant. If neutralization is deemed necessary, it should be performed by trained individuals.

Physical removal and neutralization techniques may be used together to create an effective decontamination method. However, the primary focus of mass casualty decontamination should be on physical removal of the contaminant using water. Use of cool water (i.e., less than 77°F) should be avoided unless no other means of decontamination is available (30 seconds to 3 minutes, at ~50 to 60 psi). The additional step of adding neutralizing agents, such as household bleach (2-6% sodium hypochlorite in water), is likely to delay the conduct of mass casualty decontamination and create potential additional hazards and safety issues when decontaminating large numbers of personnel. The use of household bleach to decontaminate victims creates three potential problems:

- **Delays administering the initial water shower.** Time is critical. Mixing diluted bleach or another neutralizing agent into the water shower, or providing it in buckets, could delay the start of the decontamination process.
- **Creates additional hazards.** Neutralizing agents applied during a mass decontamination water shower could get into the eyes, mouths or open wounds of victims, creating additional health hazards (Note, studies have shown that application of some haemostatic products as a topical decontaminant can arrest blood flow and neutralize some CW agents within contaminated open wounds. In general, powders provide more efficacy than liquids, primarily attributable to their absorptive mode of action. However, there is no single effective treatment.)

- **Increases agent penetration.** Neutralizing agents such as bleach can irritate and weaken or damage the skin, increasing the chemical agent's skin penetration.

### *B1.2 Purposes of Decontamination*

The three most important reasons for decontaminating exposed victims are:

- Remove the agent from the victim's skin and clothing, thereby reducing further potential agent exposure and further effects among victims. ***Immediate disrobing is considered the single most critical step for victims. This simple step may remove 80-90% or more of the contamination.***
- Protect emergency responders, medical personnel and others from secondary transfer exposures.
- Prevent victims from spreading contamination over additional areas.

For instance, after a chemical agent vapor or aerosol attack, toxic levels of agent may be trapped in victims clothes and hair, representing a continued threat to the victims themselves, fellow victims, First Responders and medical personnel, and the public if victims are released without being decontaminated. This effect was demonstrated during the Tokyo sarin nerve agent attacks in 1995 where no decontamination of victims was performed. Numerous responders and medical personnel were affected by secondary exposure to the agent while treating victims.

Although medical staff in Tokyo suffered only minor effects from their secondary exposure to the contamination, it can take months to recover from a "minor" effect such as miosis (pupil constriction). Removal of clothes alone may have significantly reduced secondary agent exposure. Application of a high-volume, low-pressure water shower could have eliminated residual hazard remaining in the victims' hair.

### *B1.3 Treatment Versus Decontamination*

Most medical treatment is delivered in the cold zone, after decontamination has occurred and been verified. However, in some cases, advanced-level skills are needed in the warm or hot zone before or during decontamination activities. In such a situation, the need for life-saving care should be weighed against the need to remove the contaminant and protecting the responders. Before giving medical care, consider the nature and severity of the incident, the medical resources available, the resource requirements of providing such treatment, and the need to perform decontamination. A casualty's chance of survival increases exponentially if he/she reaches medical care within the first 60 minutes after the injury, sometimes referred to as the "golden hour."

The medical treatment of those who have been exposed to a radioactive material, in the absence of any other contamination, should take priority over all other activities, including decontamination. Life safety of the responder is the most important aspect of the mass casualty decontamination situation. Any emergency medical service (EMS) personnel operating in such situations should be trained under NFPA 473 and meet PPE requirements under NFPA 472 and 29 CFR 1910.120.41,43,49.

Casualties with open wounds may need special attention because bandages could trap the contaminant against the wound. Only properly trained medical personnel should remove contaminated bandages and splints. If the casualty arrives for decontamination with a bandage, remove the bandage and decontaminate the wound. Examine the wound and remove any visible foreign objects, if they can be removed without aggravating the wound. If bleeding persists, place a fresh bandage over the cleaned wound.

The priorities for treatment compared to decontamination in a situation in which other significant injuries exist should be based on the information listed below:

Contamination Level	Priority Based on Conditions		
	Critical (A)	Unstable (B)	Stable (C)
Heavily contaminated with highly toxic substance	II	III	III
Heavily contaminated with low-toxicity substance	I	II	II
Low-level contamination with highly toxic substance	II	III	III
Low-level contamination with low-toxicity substance	I	I	II
Chemical in eyes: decontaminate eyes immediately and thoroughly			

**Table B-1. Contamination Levels & Priorities**

A casualty's condition can be determined by the following criteria:

- (A) - **Critical condition.** Airway compromised, serious signs or symptoms of shock, life-threatening trauma, or burns.
- (B) - **Unstable condition.** Shortness of breath, unstable vital signs, altered level of consciousness, significant trauma, or burns.
- (C) - **Stable condition.** Stable vital signs, no altered level of consciousness, no significant trauma or burns.

A casualty's priority can be determined by the following criteria:

**Priority I - Medical Care First.** For these casualties, medical care is more important than thorough decontamination. They should be processed through emergency decontamination before treatment and/or transport. If serious or critical medical conditions are present, start life-saving measures while gross decontamination is being performed.

**Priority II - Combined Priorities.** Medical care needs and decontamination needs are equal. These casualties' injuries are usually unrelated to the agent. However, they are still contaminated, and responders must wear appropriate PPE. Focus on maintaining the casualty's airway, breathing, and circulation processes while decontamination is performed.

**Priority III - Decontaminate First.** Medical care is less important than decontamination.

## B2.0 Methods of Mass Decontamination

Decontamination must be conducted as soon as possible to save lives, limit injuries and reduce the spread of contamination. This Guideline recommends that responders use resources that are immediately available and start decontamination as soon as possible. The most expedient approach, following removal of victims clothing, is to use currently available equipment to immediately apply an emergency deluge of high volume, low-pressure (approximately 60 pounds per square inch (psi)) water shower. The following represent the forms of water-based decontamination:

- **Water alone.** Flushing or showering uses gravity and dilution to physically remove contamination from skin and hair. A water only shower is considered satisfactory for incidents involving chemical agent vapors, aerosols, radiological particles and biological particles.
- **Soap and water.** Adding soap can improve results by achieving ionic degradation of a chemical agent. Soap (or another emulsifier) aids in dissolving oily substances like blister and nerve agents. Liquid soaps are quicker to use than solids, and may reduce the need for gentle friction, however when rubbing with a sponge or cloth victims should be careful not to break or damage the skin. A soap and water deluge is best, in terms of effectiveness, for all HAZMAT/WMD incidents. *However, the removal of clothes and application of a water shower should never be delayed so that soap can be included in the initial water shower.*
- **Bleach and water.** Bleach (sodium hypochlorite) and water solutions remove, break down, and neutralize most chemical agents. However, as indicated above, this approach is not recommended in a mass decontamination situation where speed is the paramount consideration and the victims are not trained in decontamination procedures.
  - Commercial bleach must be diluted and applied with equipment that may not be available to all responders.
  - Extensive skin contact time (up to 30 minutes) is required for effectiveness. This would also require additional steps to apply the bleach and then rinse the victims following the minimum contact time, resulting in delays in decontaminating large numbers of victims.
  - Laboratory studies suggest that bleach solutions at the 0.5% level may not be more effective than flushing with water alone.<sup>A, B</sup>
  - Medically, bleach solutions are not recommended for use near eyes or mucous membranes, or for those with abdominal, thoracic or neural wounds.<sup>C</sup>

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A Hypochlorite Solution as a Decontaminant in Sulfur Mustard Contaminated Skin Defects in the Euthymic Hairless Guinea Pig; 1994; Gold, M.B., Woodard, Jr., C.L., Bongiovanni, R., Schraf, B.A., and Gresham, V.C.; Drug and Chemical Toxicology 17(4), 499-527.

B Evaluation of the Effects of Hypochlorite Solutions in the Decontamination of Wounds Exposed to Either the Organophosphonate Chemical Surety Material VX or to the Vesicant Chemical Surety Material HD (1992); Hobson, D.W. and Snider, T.H.; Final Report for Contract DAMD17-89-C-9050, Task 89-04; Battelle.

C Decontamination, Chapter 15 in Medical Aspects of Chemical and Biological Warfare; 1997; Hurst, Charles G.; in Textbook of Military Medicine, Part 1: Warfare, Weaponry, and the Casualty; Specialty editors: Sidell, F.R., Takafugi, E.T., and Franz, D.R.

In summary, the issues associated with the use of soap or bleach solutions include time delay, dilution, specialized application, and medical contraindications. Given the satisfactory nature of water alone for all incidents except liquid chemical agent contamination, the rapid application of a water shower as described in Volume I provides an expedient, effective and broadly applicable method for mass casualty decontamination.

This method represent the better solution for all HAZMAT/WMD mass casualty decontamination situations, only If responders are capable of immediately applying a soap and water solution.

### **B3.0 Mass Decontamination for Specific Hazards**

This section describes mass decontamination for specific incidents, further explaining the reasoning behind the recommended procedures contained in these Guidelines.

#### *B3.1 Chemical Incident*

Chemical agent incidents can include gross liquid, aerosol and vapor hazards. The threat of a chemical agent comes from direct absorption of the chemical through the skin, as well as inhalation of aerosols and vapors produced by the off-gassing of the chemical agents. In most cases, effects from chemical agents are immediate and observable and range from spasms and vomiting to dizziness, disorientation and death. Because effects are determined by dosage and proximity to the hazard, the effects may not be immediately apparent. In the case of mustard agents, though cell destruction begins upon contact, there will be no immediately visible effects or symptoms.

Therefore, do not assume that if a victim is walking and talking that he or she will not need decontamination. In the case of immediate acting chemical agents (e.g., nerve and blood agents, arsenicals), ambulatory victims may be of lower risk but should be encouraged to decontaminate. Decontamination is recommended as soon as possible to lessen chemical contamination effects. Immediate clothes removal and high-volume, low-pressure water are the recommended solutions. The more thorough the shower the better, though the addition of gentle friction will decrease throughputs and the length of the wash will depend on the responders' resources and the number of victims requiring decontamination. The recommended shower time is between 30 seconds to three minutes.

For vapor or aerosol contamination, the water only shower, combined with gentle rubbing with the hands, should effectively remove contamination from the skin and hair.

For gross liquid contamination with oily based chemical agents (e.g., VX nerve agent, sulfur mustard blister agent), mass decontamination with a water only shower may not remove all contamination from a victim's skin.

At some point, application of soap and water to more effectively remove the contamination will probably be necessary. If a soap and water shower can be applied without delaying the decontamination process, then this is the preferred method. However, if application of soap will delay initial decontamination, then a water only shower should be applied immediately to remove gross contamination. In this situation an additional, more thorough secondary decontamination with soap and water should be applied as soon as possible to more effectively remove the oily agent.

In the case of oily agents, also it is recommended that victims not rub the skin during a water only shower. This recommendation is based on the potential for victims to spread the oily agent over a greater body surface area, increasing medical risk. For instance, mustard agent, which creates blisters on the skin, creates a hazard similar to thermal burns – i.e., the higher the percentage of the body covered in blisters, the greater the medical risk.

Mustard agent presents a particular problem when it comes to the application of friction. Mustard agent exposure results in both localized effects, such as blistering, and systemic effects. A large amount of agent left on the skin to absorb over time could increase systemic effects. However, just as with thermal burns, the higher the percentage of the body containing blisters from a mustard agent exposure, the greater the medical risk. As with thermal burns, blisters on 50-60% of the body can prove fatal. Since mustard agent is an oily substance, applying gentle friction, especially without soap, could cause victims to spread the agent over a larger percentage of their body and increase medical risk.

During application of soap and water to remove residual oily agent, if rubbing is necessary to completely remove the agent, it should be done carefully and localized as much as possible. Care must be taken to not break or damage the skin. Studies with animals have shown that damaging skin during decontamination may actually increase the absorption of contaminant into the body.

### *B3.2 Biological Incident*

Effects and symptoms of a biological attack will be delayed. In a biological incident, there likely will be no overt signs of a biological agent release and, therefore, no on-site decontamination. Treatment will likely occur at the hospital on an individual basis as symptoms arise in victims. In this scenario, hospitals and medical centers will be the center of the consequence management effort.

An overt biological release is most likely to involve a biological powder or slurry, or direct witness observation of a release of a biological aerosol. In the event of an overt biological release, just as with a chemical agent incident, immediate clothes removal and high-volume, low-pressure water are still the recommended solutions to reduce exposure and the spread of contamination.



A high-volume, low-pressure shower that includes a soap-water solution is ideal for all situations, however, a water only shower combined with gentle friction, such as rubbing with the hands, is considered satisfactory for biological agents. Unlike chemical agents, biological agents will not penetrate unbroken skin, so there is no increased medical risk from applying gentle friction to more effectively remove biological particles from the hair and skin. In the event victims have open wounds, care should be taken not to spread contamination into open wounds while rubbing.

Since biological agents do not produce immediate symptoms, once the presence of a biological hazard is confirmed victims can be released following decontamination and receipt of information on symptoms the victims should monitor for in themselves, family members, and others they may come in contact with, as well as follow-on care victims should seek should symptoms present themselves. This information can be disseminated at the observation area.

### *B3.3 Radiological Incident (\*)*

Radiological contamination would likely consist of radioactive particles following an attack with a radiological dispersal device. Of all the HAZMAT/WMD hazards, radioactive contamination is easiest to detect with devices. Generally, radiological dispersal devices present a limited health hazard and do not cause immediate health effects. Therefore, if an incident is clearly identified as a radiological hazard only, responders should treat wounds first if equipped to do so, then decontaminate. The greatest risk during a radiological incident is inhalation of radioactive particles, so while the standard decontamination method is still beneficial, extra care should be taken to reduce forcing radioactive particles into the air. Victims should carefully follow the clothing removal process outlined in Volumes I and II.

A high-volume, low-pressure shower that includes a soap-water solution is best, but rapid decontamination using a water-only shower is satisfactory since radiological particles can not penetrate unbroken skin.

**(\*) NOTE: Subsequent evaluation indicates that the risk of re-aerosolization is minimal and that removal of clothes prior to decontamination with a water shower is still the most expedient means of decontamination.**

Acute radiation syndrome (ARS), also known as radiation poisoning, radiation sickness or radiation toxicity, is a constellation of health effects which present within 24 hours of exposure to high amounts of ionizing radiation. The onset and type of symptoms depends on the radiation exposure. Relatively smaller doses result in gastrointestinal effects such as nausea and vomiting and symptoms related to falling blood counts such as infection and bleeding. Relatively larger doses can result in neurological effects and rapid death. Treatment of acute radiation syndrome is generally supportive with blood transfusions and antibiotics.

Classically acute radiation syndrome is divided into three main presentations: hematopoietic, gastrointestinal and neurological/vascular. These symptoms may or may not be preceded by a prodrome. The speed of onset of symptoms is related to radiation exposure, with greater doses resulting in a shorter delay in symptom onset. These presentations presume whole-body exposure and many of them are markers which are not valid if the entire body has not been exposed. Each syndrome requires that the tissue showing the syndrome itself be exposed. The hematopoietic syndrome requires exposure of the areas of bone marrow actively forming blood elements (i.e., the pelvis and sternum in adults). The neurovascular symptoms require exposure of the brain. The gastrointestinal syndrome is not seen if the stomach and intestines are not exposed to radiation.

**Hematopoietic.** This syndrome is marked by a drop in the number of blood cells, called aplastic anemia. This may result in infections due to low white blood cells, bleeding due to low platelets, and anemia due to low red blood cells. These changes can be detected by blood tests after receiving a whole-body acute dose as low as 0.25 Gy, though they might never be felt by the patient if the dose is below 1 Gy. Conventional trauma and burns resulting from a bomb blast are complicated by the poor wound healing caused by hematopoietic syndrome, increasing mortality.

**Gastrointestinal.** This syndrome often follows absorbed doses of 6–30 Gy (600–3000 rad). Nausea, vomiting, loss of appetite, and abdominal pain are usually seen within two hours. Vomiting in this time-frame is a marker for whole body exposures that are in the fatal range above 4 Gy. Without exotic treatment such as bone marrow transplant, death with this dose is common. The death is generally more due to infection than gastrointestinal dysfunction.

**Neurovascular.** This syndrome typically occurs at absorbed doses greater than 30 Gy (3000 rad), though it may occur at 10 Gy (1000 rad). It presents with neurological symptoms such as dizziness, headache, or decreased level of consciousness, occurring within minutes to a few hours, and with an absence of vomiting. It is invariably fatal.

The prodrome (early symptoms) of ARS typically includes nausea and vomiting, headaches, fatigue, fever and short period of skin reddening. These symptoms may occur at radiation doses as low as 35 rad (0.35 Gy). These symptoms are common to many illnesses and may not, by themselves, indicate acute radiation sickness.

Phase	Symptom	Whole-body absorbed dose (Gy)				
		1–2Gy	2–6Gy	6–8Gy	8–30Gy	Greater Than 30Gy
Immediate	Nausea and vomiting	5–50%	50–100%	75–100%	90–100%	100%
	<i>Time of onset</i>	2–6h	1–2h	10–60 min	< 10 min	Minutes
	<i>Duration</i>	< 24h	24–48h	< 48h	< 48h	N/A (patients die in < 48h)
	Diarrhea	None	None to mild (<10%)	Heavy (>10%)	Heavy (>95%)	Heavy (100%)
	<i>Time of onset</i>	—	3–8h	1–3h	< 1h	< 1h
	Headache	Slight	Mild to moderate (50%)	Moderate (80%)	Severe (80–90%)	Severe (100%)
	<i>Time of onset</i>	—	4–24h	3–4h	1–2h	< 1h
	Fever	None	Moderate increase (10–100%)	Moderate to severe (100%)	Severe (100%)	Severe (100%)
	<i>Time of onset</i>	—	1–3h	< 1h	< 1h	< 1h
	CNS function	No impairment	Cognitive impairment 6–20 h	Cognitive impairment > 24h	Rapid incapacitation	Seizures, Tremor, Ataxia, Lethargy
Latent period		28–31 days	7–28 days	< 7 days	none	none
Illness		Mild to moderate Leukopenia Fatigue Weakness	Moderate to severe Leukopenia Purpura Hemorrhage Infections Epilation after 3 Gy	Severe leukopenia High fever Diarrhea Vomiting Dizziness and disorientation Hypotension Electrolyte disturbance	Nausea Vomiting Severe diarrhea High fever Electrolyte disturbance Shock	N/A (patients die in < 48h)
Mortality	Without care	0–5%	5–100%	95–100%	100%	100%
	With care	0–5%	5–50%	50–100%	100%	100%
	Death	6–8 wks	4–6 wks	2–4 wks	2 days–2 wks	1–2 days

**Table B-2. Radiation Phases, Symptoms, and Dosages**

### B3.4 Cold Weather Mass Decontamination (<65 °F)

#### B3.4.1 Discussion of Cold Weather Decontamination Methods

Cold weather presents some additional challenges to performing mass decontamination. Victims may be less inclined to disrobe and the chances of cold weather injury are increased. Still, even in cold weather, it is generally most practical to conduct decontamination outdoors. The healthy human body can withstand very low temperatures for a brief amount of time. *Regardless of the ambient air temperature, people who have been exposed to hazardous contamination should disrobe, undergo decontamination and be sheltered as soon as possible.*

The recommended basic methods of decontamination (immediate clothes removal and high-volume, low-pressure shower) still apply for air temperatures between 64°F and 36°F. Once the victims are decontaminated, they should be provided a means of clothing/cover and moved to a heated facility.

If decontamination triage is performed, an additional step can be taken to give a higher priority to the very young and elderly, as they are more likely to be affected by the cold weather. Within each mass decontamination priority category, all other criteria being equal (such as injuries/agent effects), additional priority can be given to the very young and elderly. For example, within the Ambulatory, Non-Symptomatic, Exposed category, the very young and elderly could be processed first to reduce the amount of time they are exposed to the cold weather.

Air temperatures of 35°F and below present a special case, since at extreme low temperatures, the risk of mass cold weather injuries could exceed the risk presented by the HAZMAT/WMD hazard. At extremely low temperatures, the effectiveness of many chemical hazards is reduced, in some cases significantly. The risk from off-gassing from chemical agents is also significantly reduced. In addition, when air temperatures reach 32°F or lower, water can no longer be used effectively.

Therefore, mass decontamination for chemical agents in extreme cold weather presents a dichotomy: The extreme cold presents a significant health hazard if victims face prolonged exposure and water deluge is no longer an effective decontamination technique. On the other hand, victims may be “safer” from the effects of the chemical hazard while outdoors. Moving victims indoors while fully clothed could significantly increase the danger from off-gassing as a result of the warmer indoor temperature and reduced gas dispersion from being in an enclosed space.

Biological agents are generally less affected by cold temperatures and radiological materials are not affected at all by the cold. Unlike chemical agents, neither biological nor radiological materials are subject to off-gassing. The mechanics of being infected by biological agent via inhalation/ingestion or subjected to radiological poisoning via inhalation/ingestion are likewise not impacted by cold weather.

To perform dry decontamination, use a soft rag, paper towel or towelette to “blot” up any visible areas of liquid contamination. For solid contamination, use the soft rag, towel, or towelette and wipe downwards away from the body (Refer to Appendix F, Figure F-11).

Therefore, the consensus for extreme cold weather is to remove clothing outside and move victims inside as rapidly as possible. For biological and radiological hazards, and chemical vapor exposure, movement indoors after clothing removal, followed by a water shower is the recommended procedure.

In the unlikely event of a liquid chemical hazard in extreme cold weather, for victims with evidence of liquid contamination on their skin the Working Group recommends using a dry decontamination method after clothing removal, followed by movement indoors for a water shower.

Dry contamination should consist of using a paper towel or soft cloth to blot liquid contamination as shown in Figure B-2. Given the likelihood that victims would be wearing multiple layers of clothing in an extreme cold weather situation, inner layers of clothing may be used to blot the contamination. If inner layers of clothing are used to expedite decontamination, clothing should be quickly inspected for evidence of contamination.

**Note: In an extremely cold (<36°F) mass casualty decontamination situation, outdoor decontamination with water could create a greater hazard and result in more cold weather induced casualties (such as hypothermia) than caused by the initial WMD hazard.**

Cold can kill, maim, and disable without any help from a HAZMAT/WMD. Having said that, it is important to understand that chemical agents react differently at extremely low temperatures. For example, at 32°F (0°C), HD, CX and HT become solids. As the temperature drops to minus 15°F (minus 25°C), AC, CK, HN-3, and PD become solids. Although frozen agents do not present a significant problem in solid state, they become hazards when they warm up. Appendix F, Figure F-12 provides a simple guide that indicates appropriate all weather decontamination procedures.

#### B3.4.2 Cold Weather Hazard Information

This section contains information that may be useful in assessing the on-scene situation in a cold environment.

- **Cold Shock.** Cold shock refers to the sudden onset of physical responses, such as an increase in blood pressure, triggered by cold-water exposure. This can result in sudden death in susceptible individuals. Cold shock occurs almost immediately and must be anticipated by the responder community. The risk of serious health implications from cold shock is greater for those with pre-existing medical conditions, such as heart disease, and among the elderly. There is tremendous variability in individual physical responses at specific temperatures. Cold shock is more likely to cause serious medical problems than hypothermia during mass decontamination operations. Cold shock can be minimized by inquiring about pre-existing medical conditions before decontamination, if the on-scene situation permits, and by encouraging people to gradually get wet, rather than being instantaneously deluged in cold water. This information on cold shock is presented to help responders make informed decisions at the scene based on the competing risks of chemical exposure versus the decontamination process.

- **Hypothermia.** Although a genuine threat to inadequately protected individuals in some outdoor exposure situations, hypothermia is not a significant risk for most people undergoing mass decontamination in cold weather. Hypothermia is a condition of deep body cooling that usually takes longer to develop than one would normally encounter in a mass decontamination situation. Most individuals can tolerate 55°F water, and although they would shiver severely and experience great discomfort, they would not be in an immediate life-threatening situation due to hypothermia. For a wet individual in a cold environment, shivering is a sign that the body is trying to warm itself and is not necessarily of significant concern. If an individual is cold and wet and is not shivering, prompt medical attention should be sought since some people are not able to shiver and are at greater risk of developing hypothermia.
  
- **Cold Weather Physiology.** Humans must keep a near-constant body temperature regardless of environmental temperature. Humans can distinguish slight temperature differences of 0.5°F, are negatively impacted at a 2°F difference, and cannot function effectively at 7°F from their normal core temperature of 98.6°F (37°C). Because of this, humans must maintain their core temperatures within a narrow range. Since human bodies constantly produce heat, there are four highly developed mechanisms for releasing heat to the environment:
  - Evaporation - transition of a liquid to vapor with resultant heat loss
  - Conduction - heat exchange between two objects in direct contact
  - Convection - heat gain or loss to air or water moving over the body surface
  - Radiation - heat exchange between two objects not in direct contact

Most people are unaware of all four heat transfer mechanisms. Evaporation occurs during processes such as perspiration and respiration. The evaporation of water during respiration allows people to “see” their breath when the environment is cold. Conductive heat loss occurs, for example, when a warm hand is placed on a cold object, and eventually the hand becomes cold. Convective heat loss occurs when, for example, a breeze passes a warm face, replacing the layer of warm air next to the skin with cold air. Radiative heat loss occurs when the environment is colder than the uncovered surface of the body. In these transfer mechanisms, it is the difference in temperature between the body and the environment that results in heat gain or loss.

Conversely, the human body has three physiological ways of maintaining and producing heat: resting (quiescent body state) metabolism, exercise, and shivering (the involuntary contraction of muscles). Resting metabolism (conversion of food stores to energy) produces heat as a by-product during rest. Exercise is an obvious voluntary method of producing heat; to warm up, a person might do jumping jacks, run in place, or walk around for short periods of time. However, if individuals have no means of sustaining exercise, shivering becomes the main source of heat for people who are exposed to cold for long periods of time. Shivering can potentially generate five times the amount of heat normally produced by the resting metabolic rate. Shivering, increased activity, and behavioral responses such as adding clothing are simple ways for an individual to maintain body temperature. More complex, physiological responses are vasoconstriction (decreased blood flow) and vasodilation (increased blood flow) when the body is cooled or warmed, respectively. Because the blood from a person’s core is cooled as it flows through the periphery (hands, feet, arms, and legs), vasoconstriction minimizes this avenue of heat loss and helps the body to conserve heat in a cold environment.

**Mild** hypothermia is characterized by normal shivering, and the person is likely to report the sensation of being cold. Goosebumps may appear on the surface of the skin, and some people may be unable to perform simple or complex tasks with their hands, such as fastening a button. People suffering from **moderate** hypothermia may be ill-tempered and/or slow moving. They may stumble when on their feet, fumble with their hands, mumble, slur their speech, and shiver more intensely. Shivering stops at about 86°F (30°C) core temperature. A person with moderate hypothermia will have difficulty with higher cognitive functioning, may be more difficult to manage in a group setting, and may act inappropriately. **Severe** hypothermia is characterized by a lack of shivering, unresponsiveness, pupil dilation, and cloudy consciousness. The person may be unable to walk or move his/her arms and legs and may curl up into a fetal position. If untreated, a healthy adult with severe hypothermia can progress to respiratory failure, cardiac arrest, and death.

Stage	Core Temperature		Physiological Changes
	°F	°C	
Normothermia	98.6	37.0	
Mild Hypothermia	95.0	35.0	Maximal shivering, increased blood pressure
	93.2	34.0	Amnesia; dysarthria (trouble speaking); poor judgment; behavior change
	91.4	33.0	Ataxia (lack of coordination); apathy
Moderate Hypothermia	89.6	32.0	Stupor
	87.8	31.0	Shivering ceases; pupils dilate
	85.2	30.0	Cardiac arrhythmias; decreased cardiac output
	84.2	29.0	Unconsciousness
Severe Hypothermia	82.4	28.0	Ventricular fibrillation likely; hypoventilation
	80.6	27.0	Loss of reflexes and voluntary motion
	78.8	26.0	Acid-based disturbances; no response to pain
	77.0	25.0	Reduced cerebral blood flow
	75.2	24.0	Hypotension (low blood pressure); bradycardia (low heart rate); pulmonary edema
	73.4	23.0	No corneal reflexes; areflexia (lack of neurologic reflexes)
	66.2	19.0	Electroencephalographic silence
	64.4	18.0	Asystole (no cardiac electrical activity)
	59.2	15.2	Lowest infant survival from accidental hypothermia
56.7	13.7	Lowest adult survival from accidental hypothermia	

**Table B-3. Stages and Symptoms of Hypothermia**

Suspected hypothermic patient must be carefully assessed for coexisting injuries and illnesses (e.g., diabetic seizure). First Responders should be aware of these physiological and mental symptoms when monitoring victims with suspected cold injury. Most of the guidelines offered in this Guideline are based on core temperatures; however, it may not be practical to measure the core temperature of chemical agent victims. The simplest assessment a First Responder might perform to determine a potential cold stress injury in a decontaminated individual is to place an ungloved hand on the skin of the patient's chest or back. If the skin feels warm, then hypothermia is unlikely. This method of assessment can be used if responders are not able to take the victim's temperature with a thermometer. A hypothermia assessment thermometer should read as low as 70°F in order to accurately measure low core temperatures. Table B-3 lists stages and symptoms of hypothermia.

### 3.4.3 Wind Chill

A wind chill estimate or temperature is an attempt to quantify the effect of moving a cold air stream over a warm body. In effect, this air movement displaces the warm air at the body surface and replaces it with a layer of air at ambient temperature. The amount of heat loss is therefore a function of both air temperature and wind speed. If the body surface is wet, then heat loss is magnified by evaporation. People who already may be wet from decontamination will experience greater discomfort during cold exposure and their body temperature will cool faster than an individual with dry skin. For the purposes of cold weather mass decontamination, responders should be aware of an increased risk of cold shock and hypothermia when wind is present. Appendix F, Figure F-13 illustrates the wind speeds, temperatures, and associated wind chills that can result in frostbite risks and times as they relate to hypothermia that can occur due to exposure.



## **Appendix C**

### **Chemical, Biological, Radiological Information**

The Appendix briefly discussed the properties, symptoms and behaviors of CBR warfare agents. It is intended to be a quick technical reference guide.

## **C1.0 Chemical Agents**

### *C1.1 Properties*

- Chemicals are usually found in liquid form, producing both a contact hazard with the skin and toxic vapors.
- Most existing chemical weapons are either nerve or blister agent weapons and terrorist organizations have attempted to either manufacture or acquire these agents.
- Nerve agents attack the nervous system through skin contact, inhalation or ingestion.
- Blister agents cause skin blisters, as well as systemic effects.
- Symptoms can be caused by contact with the liquid or, in very high concentrations, from vapors and from inhalation of vapors.

### *C1.2 Symptoms:*

- Symptoms of a chemical attack may be almost immediate (nerve agents), or they may be delayed for hours to days (mustard agents).
- Nerve agents:
  - Miosis: Contracting of the pupils. Rapid effect that becomes more acute over time
  - Headache
  - Twitching of eyelids
  - Blurred vision
  - Runny nose
  - Vomiting
  - Weakness
  - Muscle twitches
  - Tightness in chest
  - Convulsions
  - Loss of consciousness
  - Death will usually occur in less than 15 minutes after a lethal exposure to a nerve agent
- Blister agents:
  - May have significantly delayed symptoms, with latent periods for hours after exposure, especially in the case of mustard agents burns.
  - Irritation of the skin, which may lead to severe pain.
  - Formation of blisters, which are very sensitive to infection.
  - Irritation of the throat, which may lead to pain and blisters.
  - Cough.
  - Death can occur within a few days from either asphyxia, pulmonary edema, or bacterial infection.

Agent	VX (nerve)	GD (nerve)	HD (blister)
Health Hazard Data	<ul style="list-style-type: none"> <li>• &gt;25-30 mg-min/m<sup>3</sup> of vapor is lethal.</li> <li>• &gt;10mg of liquid is lethal.</li> </ul>	<ul style="list-style-type: none"> <li>• &gt;70 mg-min/m<sup>3</sup> of vapor is lethal.</li> <li>• &gt;0.35g of liquid is lethal.</li> </ul>	<ul style="list-style-type: none"> <li>• Median dose is 2000 mg-min/m<sup>3</sup> of vapor on skin.</li> <li>• Median dose is 1500 mg-min/m<sup>3</sup> of inhalation.</li> </ul>
Special Protection and Precautions	<ul style="list-style-type: none"> <li>• Protective suit with SCBA.</li> </ul>	<ul style="list-style-type: none"> <li>• Protective suit with SCBA.</li> </ul>	<ul style="list-style-type: none"> <li>• Protective suit with SCBA.</li> </ul>
Spill Procedures / Waste Disposal	<ul style="list-style-type: none"> <li>• Alcoholic HTH is neutralizing agent.</li> </ul>	<ul style="list-style-type: none"> <li>• Sodium hydroxide is neutralizing agent.</li> </ul>	<ul style="list-style-type: none"> <li>• 5.25% sodium hypochlorite is neutralizing agent.</li> </ul>
Reactivity Data	<ul style="list-style-type: none"> <li>• Relatively stable at room temperature.</li> <li>• Hydrolysis creates EA2192, a weaker poison.</li> </ul>	<ul style="list-style-type: none"> <li>• Stable storage in steel.</li> </ul>	<ul style="list-style-type: none"> <li>• Stable at ambient temperature.</li> <li>• Hydrolysis creates HCL and thiodiglycol.</li> </ul>
Physical Data	<ul style="list-style-type: none"> <li>• Liquid at -50°C to 298°C.</li> <li>• Colorless to straw colored.</li> </ul>	<ul style="list-style-type: none"> <li>• Liquid at -42°C to 198°C.</li> <li>• Colorless to dark brown with fruity odor.</li> </ul>	<ul style="list-style-type: none"> <li>• Colorless to dark yellow.</li> <li>• Garlicky odor.</li> <li>• Liquid at room temperature.</li> </ul>

**Table C-1 Chemical Agent Technical Information**

**Note:** Appendix A of 6 CFR Part 27 “The Chemical Facility Anti-Terrorism Standards Final Rule Federal Register / Vol. 72 , No. 223; U.S. Department of Homeland Security; 20 Nov 07,” has a list of chemicals of interest, or COI. There were 325 chemicals on this list at the time of this publication. In developing the list, the DHS looked to existing expert sources of information including other federal regulations related to chemicals. In addition, the DHS has also identified three security issues related to chemicals:

**Release**—Toxic, flammable, or explosive chemicals or materials that, if released from a facility, have the potential for significant adverse consequences for human life or health.

**Theft or Diversion**—Chemicals or materials that, if stolen or diverted, have the potential to be misused as weapons or easily converted into weapons using simple chemistry, equipment or techniques, in order to create significant adverse consequences for human life or health.

**Sabotage or Contamination** —Chemicals or materials that, if mixed with readily available materials, have the potential to create significant adverse consequences for human life or health.

## C2.0 Biological Agents:

### C2.1 Properties:

- Biological weapons can be disseminated in many ways, but the most common and likely way is to aerosolize them.
- Biological weapons may cause illness that is contagious or non-contagious.
- The intent of biological weapons may vary, from causing illness of a small group of people to causing death on a large scale.
- Biological weapons are usually bacteria or viruses found in nature.

### C2.2 Symptoms:

- Symptoms from a biological attack are not usually immediate, taking days to become observable or severe. However, some toxins may produce effects within a much shorter period of time.
- Symptoms are unique for different biological agents. However, typical initial symptoms include cold- and flu-like symptoms, making it difficult to quickly diagnose.

<b>Agent</b>	<b>Anthrax</b>
Disinfection	<ul style="list-style-type: none"><li>• Survives in many conditions and resistant to disinfectant.</li><li>• Glutaraldehyde to disinfect.</li></ul>
Transmission	<ul style="list-style-type: none"><li>• Inhalation.</li><li>• Skin contact.</li><li>• Ingestion.</li></ul>
Treatment	<ul style="list-style-type: none"><li>• Susceptible to penicillin.</li></ul>
Health Hazards	<ul style="list-style-type: none"><li>• 8,000 to 50,000 organisms to be infectious.</li><li>• Higher fatality rate for inhalation.</li></ul>
Protection and Precautions	<ul style="list-style-type: none"><li>• Protective equipment with respirator.</li></ul>
Communicability	<ul style="list-style-type: none"><li>• Person to person transmission is very rare.</li></ul>

**Table C-2 Biological Agent Technical Information**

### **C3.0 Radiological Agents:**

#### *C3.1 Properties:*

- Radiological weapons would typically be radiological dispersal devices (RDDs) or “dirty bombs,” such as radiological material from medical equipment or waste dispersed by a conventional explosion.
- The greatest danger from radiological weapons is posed by inhalation of radioactive particles.

#### *C3.2 Symptoms:*

- Symptoms are delayed for hours, days, or longer depending on the dose.
- Symptoms appear in several stages. There is an initial stage of illness, followed by a latent period, then a final stage of illness.
- The initial stage is characterized by nausea and vomiting, though this is not seen in all cases, even when contamination has been significant.
- Symptoms of the final stage vary with degree of contamination, but include low white blood cell count, hair loss, diarrhea, fever, and death.
- Final symptoms do not present until days to weeks after exposure

## **Appendix D**

### **Supplemental Tools for Consideration**

This Appendix provides additional information and describes equipment beyond the basic set of solutions to enhance decontamination capability and effectiveness. These ideas require more manpower, pre-planning and resources and may not be applicable to all organizations and localities. These ideas should not supplant the basic solution of clothes removal and high-volume, low-pressure water shower.

## **D1.0 Preparing for Response and Mass Casualty Decontamination for a HAZMAT/WMD Incident**

### *D1.1 Training*

Given that very few terrorist events or naturally occurring events have required mass casualty decontamination, very little real-world experience has been accumulated. For example, mass decontamination was not performed following the sarin nerve agent attacks in Tokyo. Although the objective of this Guideline is to develop a simple, repeatable process, successful conduct of mass decontamination requires individual training to master individual tasks; team training to master each of the five decontamination steps; and integrated, collective training to ensure a fast, effective, coordinated response and mass decontamination operation.

A key element of preparedness is training. Components from the National Incident Management System (NIMS), such as the use of Incident Command System (ICS), should be incorporated into all exercises. Many preparedness organizations, such as Local Emergency Planning Committees (LEPCs) and either county or state EMAs, already plan and conduct all-hazard exercises that incorporate NIMS. It is worthwhile for utilities to reach out to these preparedness organizations and to take part in the exercises they conduct. This will ensure that a utility's ERP coincides with other local Emergency Operations Plans (EOPs). In addition, this participation allows utility staff to take part in professionally facilitated exercises with minimal utility resource expenditure, and, it also allows utility personnel to develop working relationships with other local First Responders before an emergency occurs.

Utilities with more resources may wish to consider conducting their own exercises and inviting other First Responders to attend. Exercises need to be designed and conducted in accord with the Homeland Security Exercise and Evaluation Program (HSEEP) guidance.

### *D1.2 Community Outreach*

Managing HAZMAT/WMD Incident training is a complex task. The challenge is to conduct training with limited resources and still meet the public sector response training requirements of OSHA 1910.120(q) and EPA (Environmental Protection Agency) 40 CFR 311 (EPA 311). This challenge is compounded by the additional responsibility to ensure that all public sector employees involved in planning and prevention must be properly trained to perform their roles. The tasks the public sector should perform to meet these training responsibilities include:

- Ensuring that proper hazard and vulnerability analyses are conducted to determine response and planning needs
- Conducting training needs assessments to establish and prioritize employee needs for competency and refresher training;
- Conduct decontamination training for local security forces, such as mall or stadium security.
- Train 911 operators on basic HAZMAT/WMD decontamination techniques.
- Post basic decontamination steps on community websites to increase public awareness.

### *D1.3 Community & Private Partnerships*

Establish mutual aid agreement among local emergency responders to lend assistance across jurisdictional boundaries. This may be required due to an emergency response that exceeds local resources. Mutual aid agreements may be *ad hoc*, requested only when such an emergency occurs or it may also be a formal standing agreement for cooperative emergency management on a continuing basis. Mutual aid may also extend beyond local response. Several states have statewide mutual aid systems.

Coordination of activities above the field level and prioritization of the incident demands for critical or competing resources, thereby assisting the coordination of the operations in the field is critical in the Multi-Agency Coordination System (MACS). MACS consists of a combination of elements: personnel, procedures, protocols, business practices, and communications integrated into a common system. For the purpose of coordinating resources and support between multiple jurisdictions, MACS can be implemented from a fixed facility (such as an Emergency Operations Center or "EOC") or by other arrangements outlined within the system. Utilities should learn the location of and how to contact the EOC that serves their community. The EOC, in addition to the Water/Wastewater Agency Response Network (WARN), can help a utility to obtain resources needed during an incident.

### *D1.4 Target Assessment*

Identify at least four areas at high risk for HAZMAT/WMD attack in your region or jurisdiction (e.g., sports arenas, shopping malls, mass transit facilities, commercial and private transportation, major utilities, military installations, etc.). Determine feasible support from other jurisdictions for these areas. For high risk targets, determine potential sites for conducting mass decontamination, setting up observation areas, and establishing a secondary decontamination site should it be needed.

### *D1.5 Route Assessment*

Determine routes to and from potential incident sites to assist in determining the flow of resources to possible decontamination sites. Consider traffic patterns and potential congestion points and inform local responders and resources of the most efficient routes in advance.

### *D1.6 Medical Facilities*

Identify local hospitals' and medical facilities' capacity to handle mass casualty situations. Identify medical facilities (e.g., hospitals, clinics) near likely targets so they can be quickly informed and supported during an actual incident. Determine if local and mutual aid medical facilities will require victims to undergo secondary decontamination prior to allowing them to the facility. If so, determine whether the medical facility will perform the secondary decontamination themselves or whether they will require support to perform the secondary decontamination.



## **D2.0 Technology, Techniques, and Equipment**

### *D2.1 Secondary Decontamination*

Secondary decontamination refers to the set up of an additional site(s) to conduct further decontamination, typically with soap or another emulsifier.

Equipment such as decontamination tents, showers and the use of additives such as soap, are best implemented at the secondary decontamination site. If physical assets are limited, one possible method of secondary decontamination is re-running victims through the initial decontamination site, but at a slower and more deliberate pace that emphasizes thorough cleaning and removal of all residual agents. Liquid soap, if available, should be distributed for victims' use.

Many medical facilities will require a more thorough, secondary decontamination prior to treating victims and/or allowing them inside the medical facility for treatment (Volume I; Figure 6-1; Station 5). Many medical facilities take this added precaution to reduce the risk to medical staff, as well as to avoid contaminating the medical facility itself, which could impact both the emergency response effort as well as non-emergency medical facility operations.

### *D2.2 Reactive Skin Decontamination Lotion (\*)*

Reactive skin decontamination lotion (RSDL) is a new, commercially-available, personnel decontamination lotion, that is highly effective against chemical agents. RSDL is a broad-spectrum liquid CW agent decontaminant that will remove and destroy chemical agents on contact. After CW agent destruction, RSDL leaves a nontoxic residue that may be washed off with water. While it does not need to be removed immediately, the lotion should be applied within 1 minute of contamination, making it impractical for use in mass casualty decontamination scenarios. The lotion is effective against cutaneous nerve and blister agents, such as mustard, GB, and VX. RSDL is safe for use on all intact skin surfaces. RSDL reacts rapidly, providing the full removal and destruction of CW agents within 2 minutes, enabling efficient decontamination of casualties. It is relatively expensive when compared to the cost of soap and may be difficult to use with a large number of victims. If RSDL is to be used, provide it as soon as possible for spot decontamination of visible contamination. Blot the RSDL on the agent droplet to begin agent neutralization start reaction and removal.

**(\*) This is not an endorsement by ECBC for any particular commercial off the shelf (COTS) item.**

### *D2.3 Bleach (sodium hypochlorite)*

As previously noted, the use of bleach (sodium hypochlorite) is not recommended in a mass decontamination situation where speed is the paramount consideration and victims are not trained in decontamination procedures.

## *D2.4 Soap*

Adding soap to the water for decontamination is slightly more effective for removing contamination from a victim's skin, particularly if the contamination is oily. Do not delay decontamination to incorporate soap if it is not readily available, pre-mixed or easily implemented. When using soap, a liquid form that can be quickly and easily incorporated into the process is recommended.

## *D2.5 Sanitizing Wipes*

If readily available, sanitizing wipes can be used to remove residual contamination, such as liquid and solid contamination from the skin. Sanitizing wipes can be particularly effective for use during secondary decontamination or for cold weather decontamination.

## *D2.6 Decontamination Tents*

While sometimes useful as a secondary decontamination site, or as a means to provide some privacy for victims, most mass casualty decontamination situations cannot afford the time required to set up tents, even for secondary decontamination. Although tents provide the benefit of modesty protection, they do so at the expense of valuable time. In addition, most commercial decontamination tents do not provide either sufficient volume or pressure to effectively remove contamination from a victim's skin.

## **D3.0 Crowd Control/Comfort**

### *D3.1 Personal Items*

Returning personal items is a laudable goal, but should not obstruct performing immediate mass decontamination to save lives and limit casualties. Plastic bags can be used to store personal effects. Instructing victims to place/tag their own items in bags will help prevent cross-contamination and aid responders. Do not return belongings to victims until the belongings have been decontaminated or deemed safe.

### *D3.2 Crowd Control*

Exercises have demonstrated that effective crowd control is critical to initiating rapid mass decontamination. The use of public address systems or other means of voice amplification, as well as universal signage to direct victims can be effective means of communication with victims following a HAZMAT/WMD incident.

### *D3.3 Emergency Responder Protection*

Law enforcement will maintain order and prevent disruptions to emergency operations. They should be aware of and look for secondary devices and other suspicious activities. Law enforcement can also help maintain crowd control around the decontamination site/response area. Law enforcement personnel without appropriate protective equipment must perform their responsibilities from the cold zone.

### *D3.4 Modesty Clothing*

Modesty clothing/cover should be provided if available. Do not delay decontamination to acquire clothing. Those who do not wish to disrobe and who display no symptoms should be separated and placed in quarantine for observation. However, they should be made aware that liquid chemical agent contamination will eventually penetrate their clothing and that immediate removal of clothing and decontamination is the safest alternative. They should also be made aware that their clothes and hair may have trapped solid, aerosol or vapor contaminants and that they eventually may be affected by the contaminant if they are not decontaminated.

### *D3.5 Contaminated Animals*

If possible, animals should be secured in an area within the warm zone and decontaminated after humans in order to prevent further spread of contamination. Since an animal's typical reaction to a water shower is to shake violently to remove the excess water, animals should be decontaminated in the warm zone to prevent the possibility of spraying contamination on victims, responders or other animals.

## **D4.0 Alternate Sites**

### *D4.1 Alternate Sites Definition*

Alternate sites refer to decontamination outside the incident zone, such as secondary decontamination established at medical facilities.

### *D4.2 Time Factor*

Consider the time and resources required to move victims to an alternate site. Time should be the number one factor when determining whether to establish an alternate site. Rapid decontamination at the incident site should not be sacrificed to move victims to an alternate site.

### *D4.3 Alternate Site Selection*

Alternate sites should have a readily available water supply, such as a sprinkler system, shower, swimming pool, or support from local/mutual aid response organizations.

## D5.0 Environmental Concerns

The Environmental Protection Agency (EPA) addressed the issues of acceptable levels of contamination in runoff and First Responder liability for the spread of contamination caused by efforts to save lives.

### D5.1 Liability

The EPA's interpretation of The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, 42 U.S.C § 9601 et seq. (2006) indicates that:

*“no person shall be liable...for costs or damages as a result of actions taken or omitted in the course of rendering care, assistance or advice in accordance with the National Contingency Plan (NCP) or at the direction of an On-Scene Coordinator appointed under such plan...”*

### D5.2 Runoff

Containment of runoff must be considered at every mass casualty decontamination incident. However, the speed of decontamination, especially in the case of chemically contaminated victims, is of paramount importance.

On the subject of accepted runoff, the EPA recognizes that any level of contamination represents a threat to the environment. The threat is also dependent on many variables, including the chemicals involved, their concentrations, and the runoff watershed. However, life and health considerations are paramount.

*“First Responders should undertake any necessary emergency actions to save lives and protect the public and themselves. Once any imminent threats to human health and lives are addressed, First Responders should immediately take all reasonable efforts to contain the contamination and avoid or mitigate environmental consequences.”*

The EPA allows that the highest priority be given to responder actions taken to save lives and preserve health during a chemical terrorist incident. The EPA indicates that, when taking federally recommended actions in response to a chemical terrorist incident, responders are protected under the law. While it is recognized that there are environmental issues associated with the run-off and containment of any flushing fluid that becomes contaminated when treating a victim, such procedures should be established in consultation with authorities and applicable local, state and federal regulations.

Several published resources are available:

- *NFPA Supplement 10, Guidelines for Decontamination of Fire Fighters and Their Equipment Following Hazardous Materials Incidents* Pg.14, National Fire Protection Association, 1997
- US EPA Waiver 550-F-00-009; Provides for limitations on the environmental liability for wastewater run-off occurring during mass casualty decontamination operations conducted first responders when life safety is at risk.

### *D5.3 Secondary Contamination*

The potential for secondary contamination of responders is well discussed in the literature and best-practices guides. Nevertheless, First Responders must be cognizant of the potential risk of secondary contamination to both themselves and other citizens. Secondary contamination of responders was well documented following the sarin attacks in Japan and from HAZMAT incidents in the U.S.. Typically, the greatest risk of secondary contamination is during transportation of contaminated victims, however, the potential of exposure remains a high likelihood, particularly with self-evacuating patients.

### **D6.0 Legal Concerns**

Lawsuits have been filed against responders and communities following decontamination operations where privacy was not provided during decontamination. Although these lawsuits did not involve mass decontamination, it is impossible to rule out the possibility of lawsuits following a mass decontamination operation. Lawsuits can be filed for any number of reasons related to mass decontamination, to include lack of privacy, unnecessary decontamination, loss of personal property, and inadequate decontamination. Ultimately, each jurisdiction must base their policies on local interpretation of applicable regulations, statutes, laws and historical legal precedence

## Appendix E

# Planning Guidance for Mass Casualty Decontamination Incidents

This Appendix provides additional information on the planning aspects for mass casualty decontamination incidents. This guidance was established at the request of the National Security Staff and, lead by the Department of Health and Human Services (DHHS), Office of the Assistant Secretary for Preparedness and Response (ASPR) and the Department of Homeland Security (DHS), Office of Health Affairs (OHA).<sup>D</sup>

The intended audience for this information is Senior Leaders, planners, Incident Commanders, emergency management personnel (e.g., fire, EMS, law enforcement, first responders, etc.) and trainers of response organizations. Though the guidance was developed for planning purposes; it may be of value to other audiences, including First Responders and First Receivers, community leaders, and others from the response and emergency management fields. The recommendations presented are designed to assist in developing or improving current plans and training for patient decontamination in a mass casualty decontamination incident. Proper planning could influence how responders approach mass casualty decontamination incidents.

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<sup>D</sup> Patient Decontamination in a Mass Chemical Exposure Incident: National Planning Guidance for Communities, U.S. Department of Homeland Security & Department of Health and Human Services, July 2012 (Unpublished Draft)

Effective management of such incidents is dependant on a fully integrated approach and should be based upon robust intelligence and training.

### **Guiding Principles**

Each day hazardous chemicals are produced, transported, stored, and used for industrial and household purposes. During each of these activities, there is risk that these chemicals could be released due to an accident or intention to cause harm. In addition, terrorist activities could exploit vulnerabilities related to these activities and/or target high risk assets for HAZMAT/WMD attack in your region or jurisdiction (e.g., sports arenas, shopping malls, mass transit facilities, commercial and private transportation, major utilities, military installations, etc.). Because of this, First Responders, must be prepared to respond to incidents involving the release of chemical agents.

Mass casualty decontamination limits the duration of patient exposure and the toxicity that follows chemical exposure, as well as protects responders in the field and in the health care facilities from secondary contamination. The mass casualty decontamination process is also an essential first step in the medical response of patients exposed to a chemical agent. As such, decontamination of humans is a medical countermeasure.

Life safety is always the highest priority. Decontamination operations benefit the health of individual patients by minimizing exposure, which minimizes absorption; decreases morbidity and mortality; prevents secondary contamination; and reduces the strain on the First Responders and community based health care infrastructure. These benefits clearly define a medical countermeasure. Decontamination directly impacts the flow of patients at all levels of a mass exposure chemical incidents, thus decisions about decontamination impact the entire emergency response.

### **Decontamination is a Community Issue**

The response to a chemical release, regardless of circumstances, requires a concerted effort from multiple organizations, including First Responders (e.g., fire, hazmat responders, and emergency medical services), first receivers (e.g., health care facilities and other clinical personnel), emergency management, public health, poison centers, and law enforcement and even members of the public who may have been exposed. Response to and recovery from these incidents can require action from the private sector (e.g., emergency medical services providers, health care facilities, chemical companies, railroads) as well as from multiple governmental levels and may necessitate requesting resources from surrounding jurisdictions.

As previously noted in Appendix E of this Volume, managing HAZMAT/WMD Incident training is a complex task. The challenge is to conduct training with limited resources and still meet the public sector response training requirements of OSHA 1910.120(q) and EPA (Environmental Protection Agency) 40 CFR 311 (EPA 311). This challenge is compounded by the additional responsibility to ensure that all public sector employees involved in planning and prevention must be properly trained to perform their roles.

Establish mutual aid agreement among local emergency responders to lend assistance across jurisdictional boundaries. This may be required due to an emergency response that exceeds local resources. Mutual aid agreements may be *ad hoc*, requested only when such an emergency occurs or it may also be a formal standing agreement for cooperative emergency management on a continuing basis. Mutual aid may also extend beyond local response. Several states have statewide mutual aid systems, which can also be utilized.

Coordination of activities above the field level and prioritization of the incident demands for critical or competing resources, thereby assisting the coordination of the operations in the field is critical in the Multi-Agency Coordination System (MACS). MACS consists of a combination of elements: personnel, procedures, protocols, business practices, and communications integrated into a common system. For the purpose of coordinating resources and support between multiple jurisdictions, MACS can be implemented from a fixed facility (such as an Emergency Operations Center or “EOC”) or by other arrangements outlined within the system. Utilities should learn the location of and how to contact the EOC that serves their community. The EOC, in addition to the Water/Wastewater Agency Response Network (WARN), can help a utility to obtain resources needed during an incident. WARNs are being formed to enable public and private utilities to share personnel, resources, and equipment during emergencies. WARN reduces the response gap between local and statewide mutual aid.

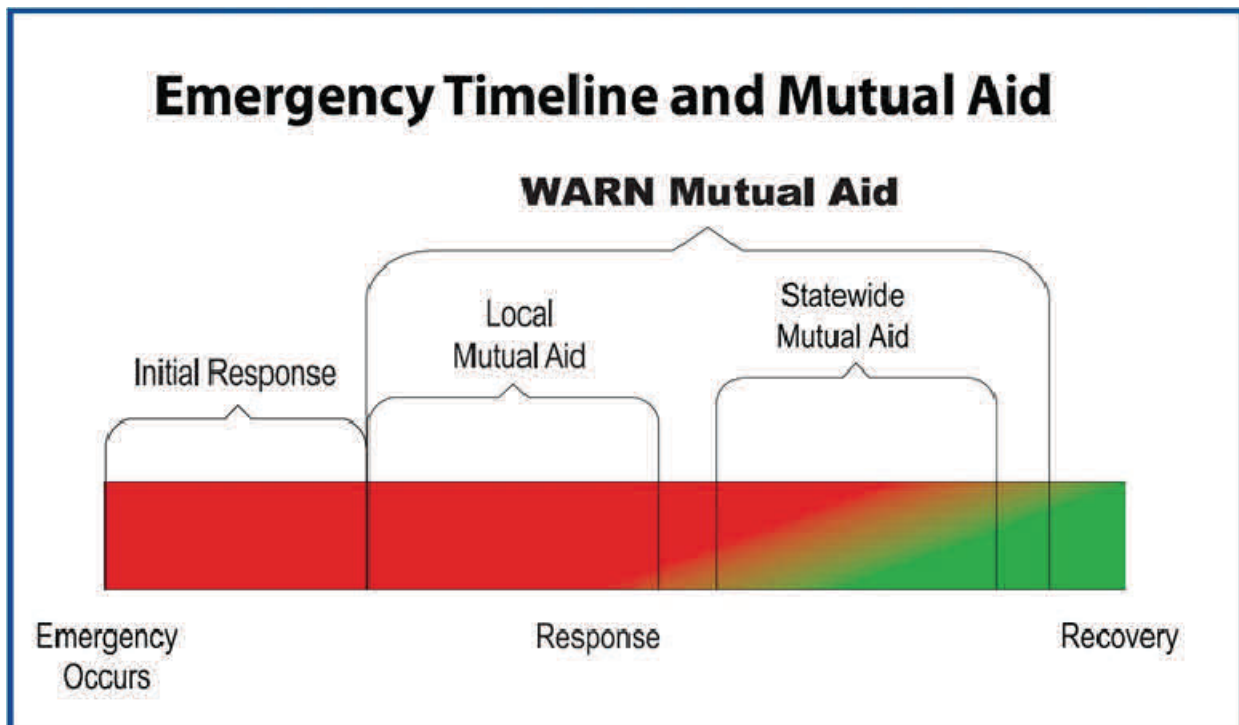


Figure E-1. Emergency Timeline and Mutual Aid



WARN works because it:

- Expedites arrival of aid and access to specialized resources
- Improves planning and coordination
- Can be activated prior to emergency declaration
- Is a single agreement that links all statewide utilities together
- Agreement addresses member indemnification, Worker's comp, and reimbursement
- Membership includes private and public utilities
- Participation is voluntary and there is no cost
- Members utilities can recall their resources as needed
- Meets federal reimbursement requirements to have a pre-disaster agreement in place
- Consistent with National Incident Management System (NIMS)

There are 10 basic steps to developing a WARN:

1. Identify interest in starting a program
2. Form an initial leadership team
3. Prepare a kickoff session
4. Establish a Steering Committee
5. Identify a mission for the program and goals for the Steering Committee
6. Determine need to use your state's regions
7. Identify mutual aid and assistance activation criteria
8. Draft an agreement (include information on steps 4, 6, and 7)
9. Create facilitation tools
10. Maintain the program

### **Resource Planning**

Patient decontamination plans and procedures have evolved over time with only limited guidance based on scientific evidence; many basic questions about decontamination have not yet been addressed by research. Evidence-based planning and best practices are thus limited. For example, attempting to fully decontaminate every person in the vicinity of a chemical release will slow the transport of seriously ill patients from the scene to hospitals. In this case, inappropriate decontamination protocols might hamper, rather than contribute to, medical mitigation of morbidity and mortality. In addition, past chemical events demonstrate that scene perimeters will not be established quickly enough after the release to prevent a large number of people from leaving the scene. These potentially exposed people will show up at hospitals or other facilities without being decontaminated. Health care facility chemical event response plans should address such scenarios. The recent closure of two St. Louis hospital emergency departments due to suspected secondary contamination of the facility from exposed patients illustrates the need for scrutinizing the patient decontamination process.

Homeland Security Presidential Directive-22, Domestic Chemical Defense, calls for the Federal government to support the development of State and local plans and protocols for the decontamination of persons. In order to best accomplish this task, the Federal government, through the Mass Chemical Decontamination Working Group, will attempt to ensure that those State and local plans and protocols reflect current best practices. The working group will also identify decontamination issues in need of research and draft a strategic plan for addressing such research gaps.

Mass Casualty Decontamination planning should consider the following consumable items, which can include, but may not be limited to:

- Display/Directional signs
- Multi-lingual instructional signs
- Detection equipment
- Dry decontamination consumables (e.g., paper towel or soft cloth)
- Zone tape/signs
- Triage tags
- Post decontamination “Modesty” garments (e.g., disposable paper suits / gowns, socks, or slippers, foil rescue blankets, sheets, and/or large plastic garbage bags)
- Reactive skin decontamination lotion (RSDL), Bleach (sodium hypochlorite), Soap, Sanitizing Wipes
- Training to identify signs and symptoms of contamination when determining need for decontamination

**Note:**

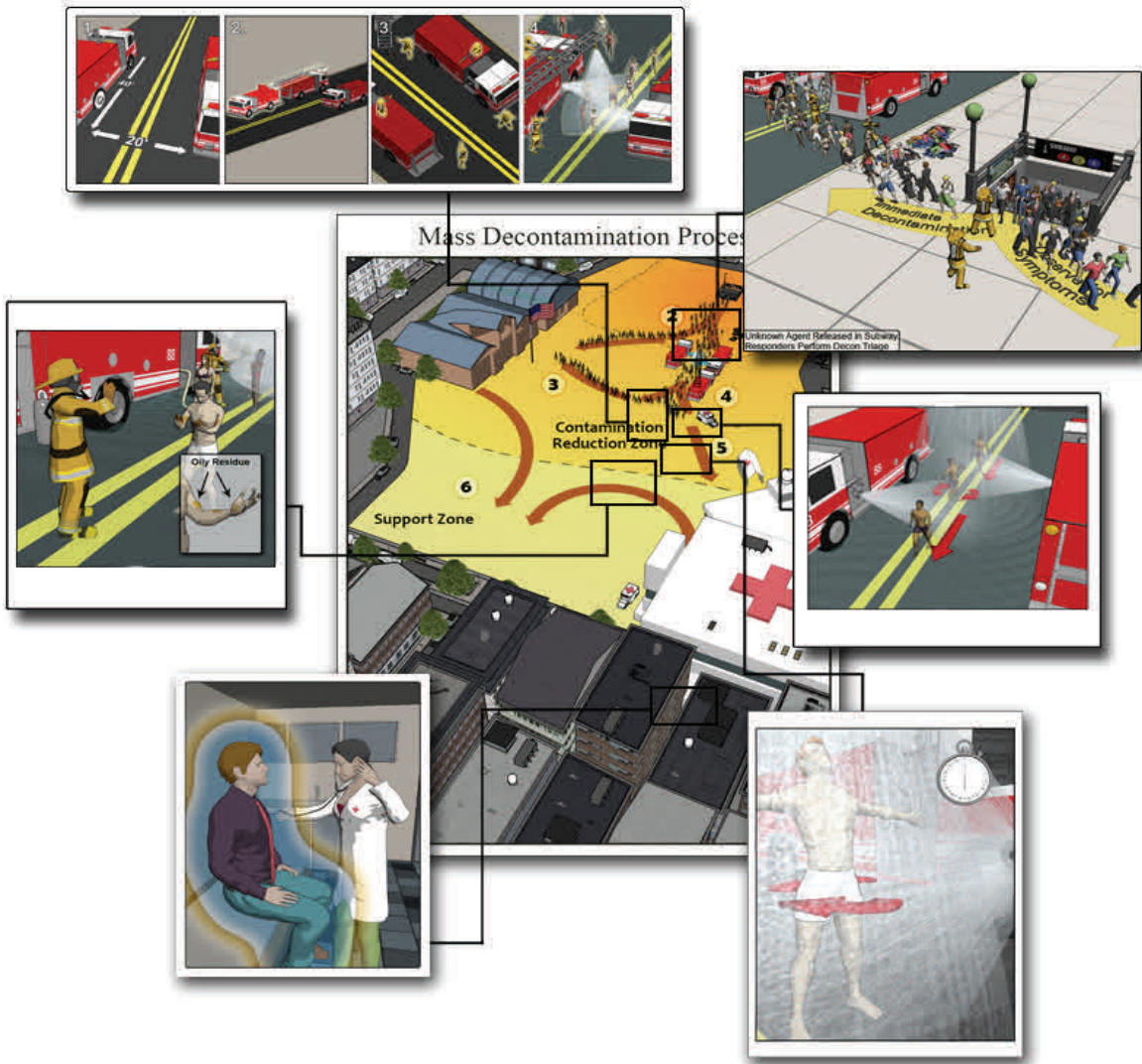
- **One of the fundamental principles of responding to mass casualty incidents is to do the best you can for the most people with the resources you have.**
- **Be careful to discard soiled clothing and decontamination equipment in a safe area to avoid cross contamination.**
- **Rinse exposed areas as thoroughly as possible before leaving the contaminated area.**
- **Avoid inhalation when in close contact with mucosa.**

# Appendix F

## Drawings and Diagrams

This Appendix contains large scale versions of all the mass decontamination drawings and diagrams referenced in Volume II.

### Pieces of the Puzzle: An Overview of Mass Decontamination



# Mass Decontamination Process

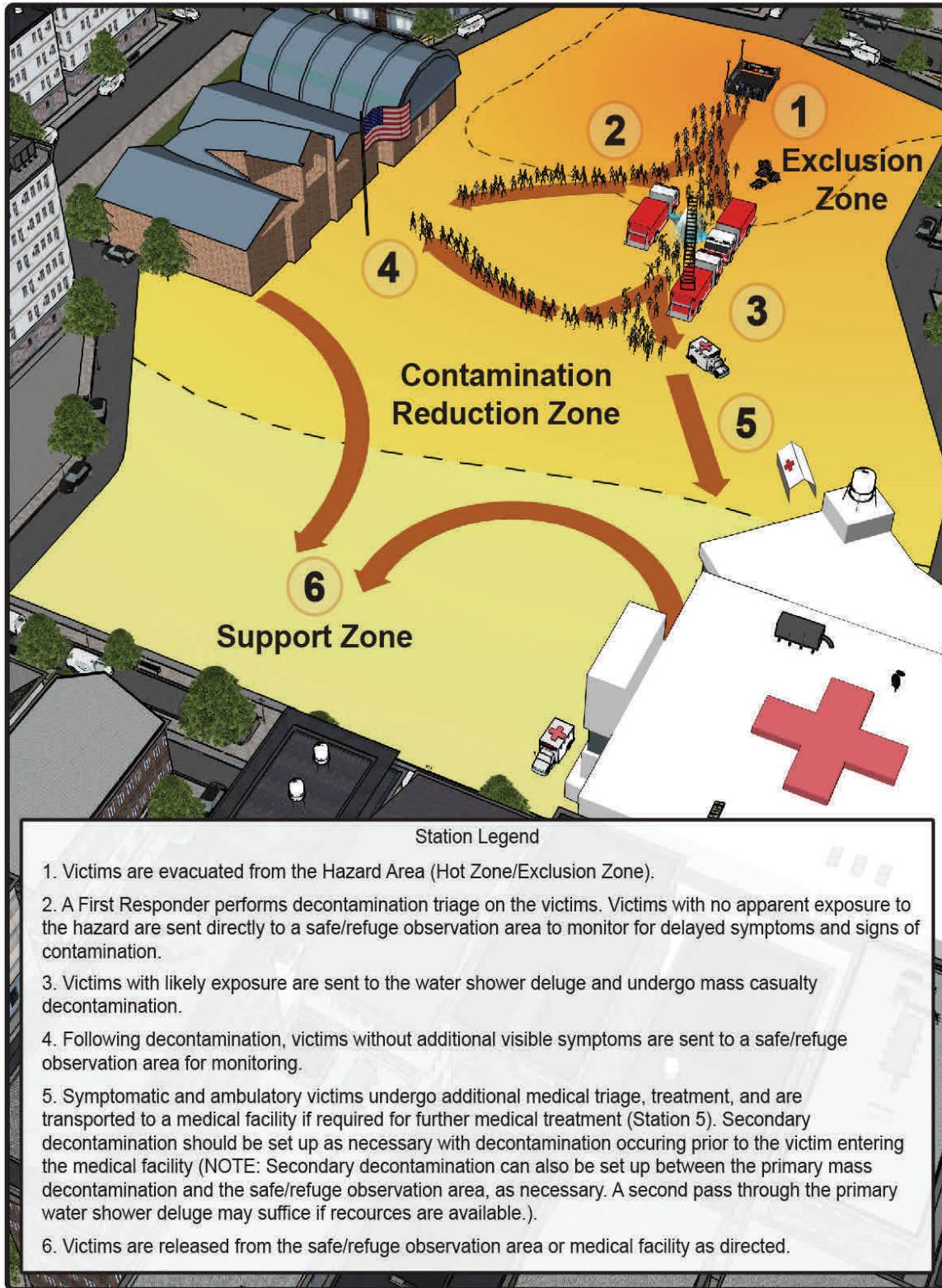


Figure F-1. Mass Decontamination Process

## Ladder Pipe Decontamination System Method

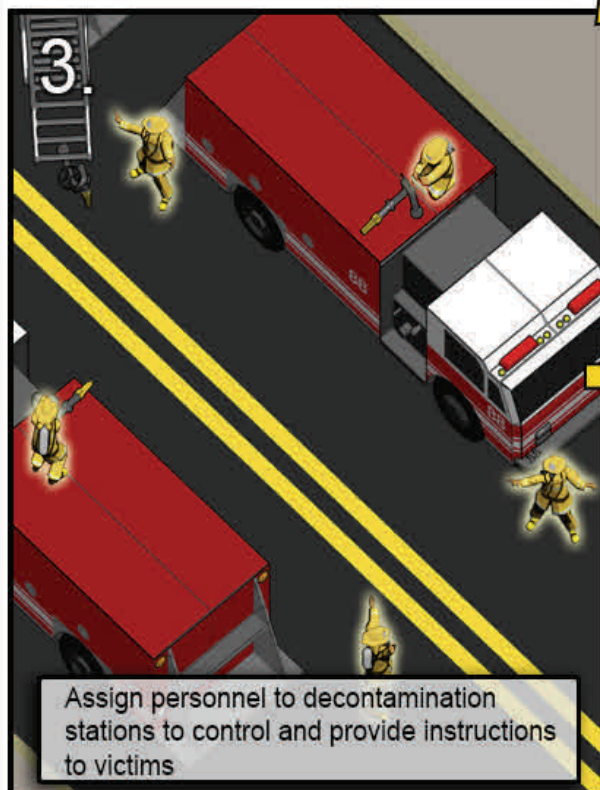
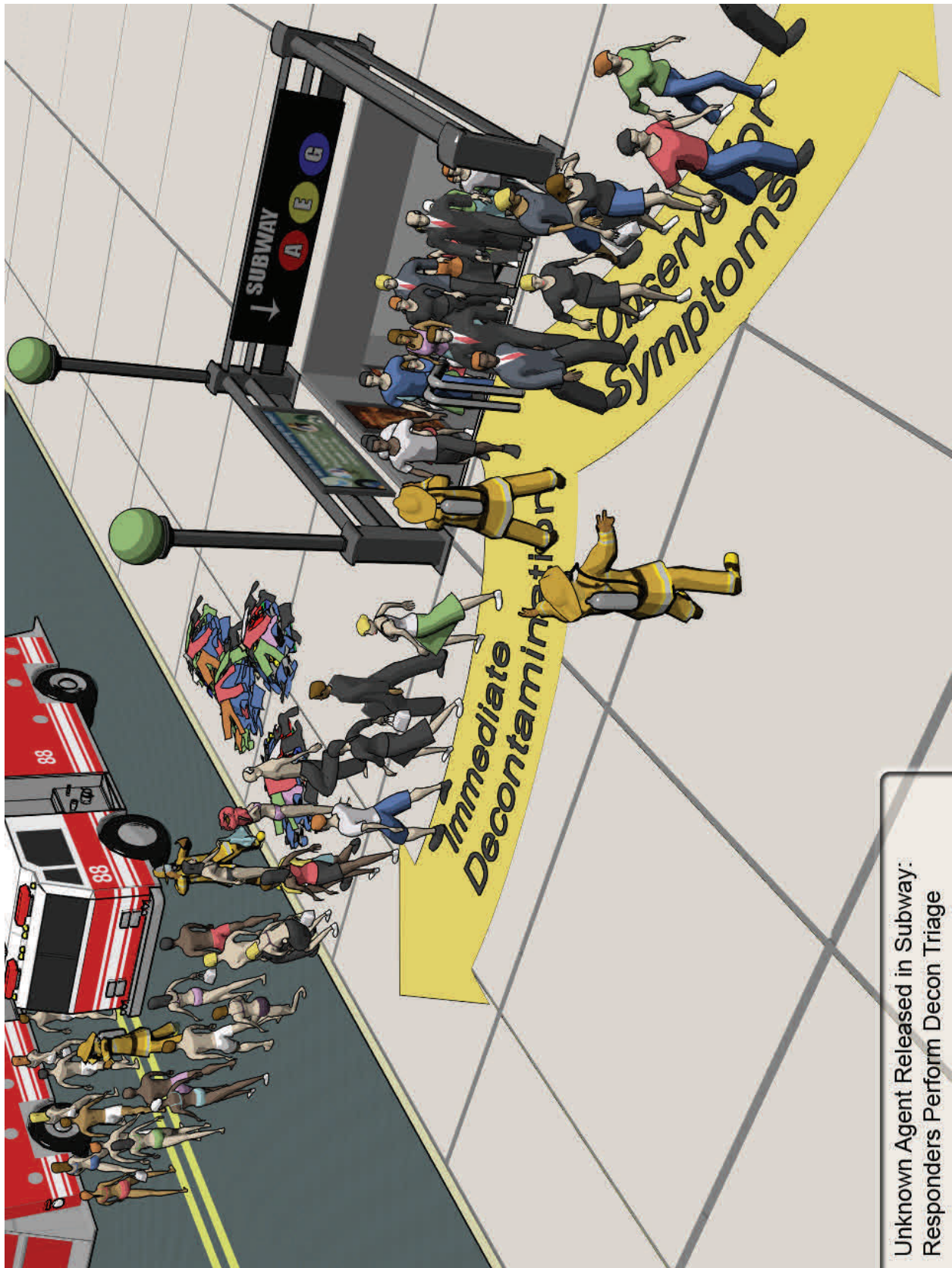


Figure F-2. Ladder Pipe Decontamination System (LDS)



Unknown Agent Released in Subway:  
Responders Perform Decon Triage

Figure F-3. Victim Control and Decontamination Triage

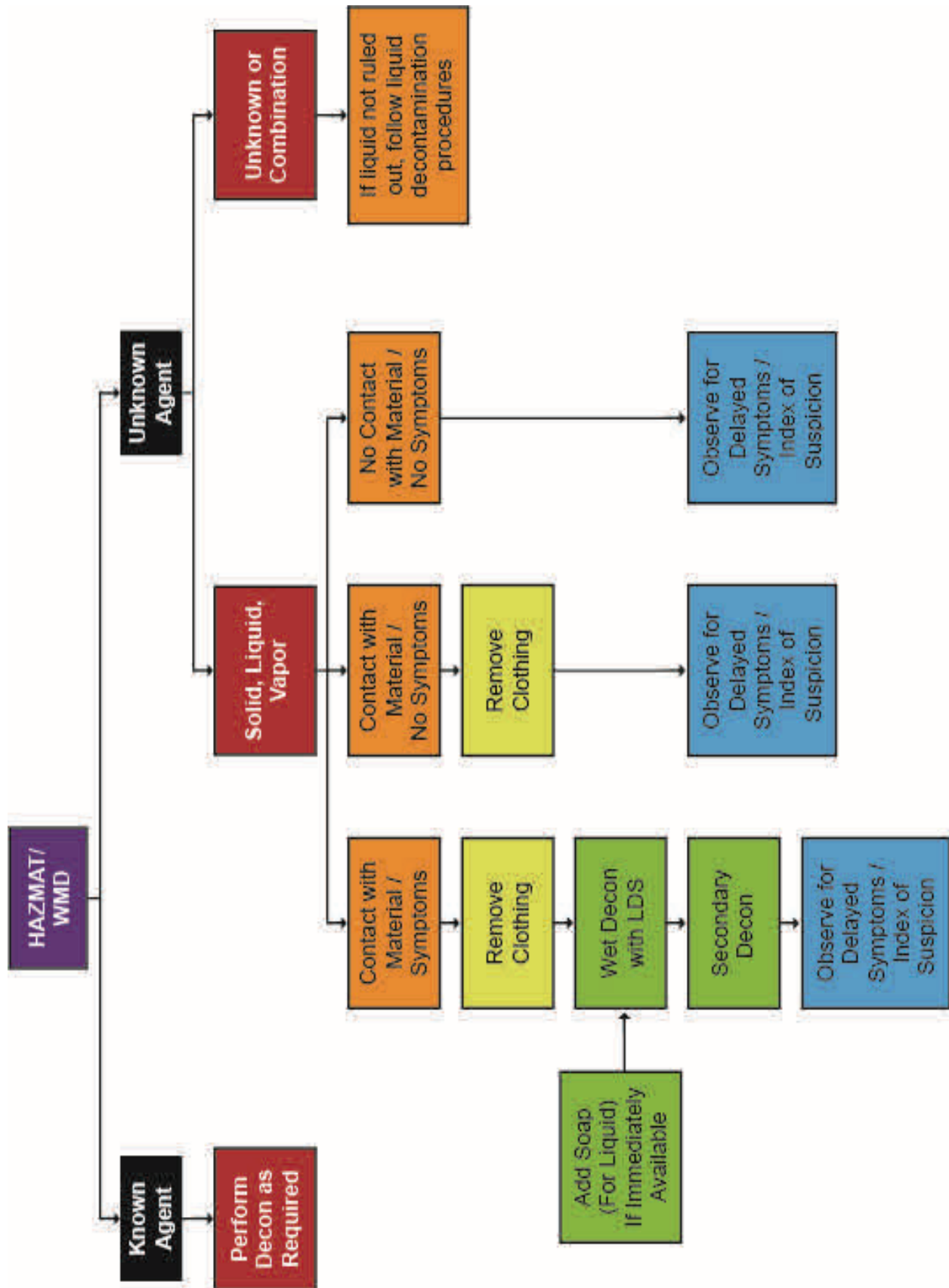
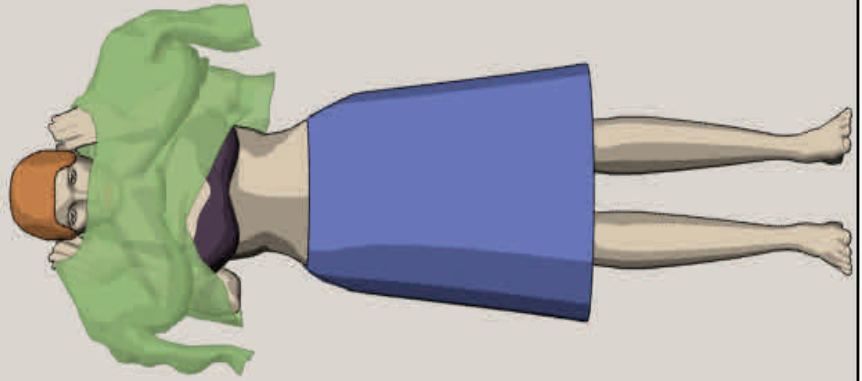


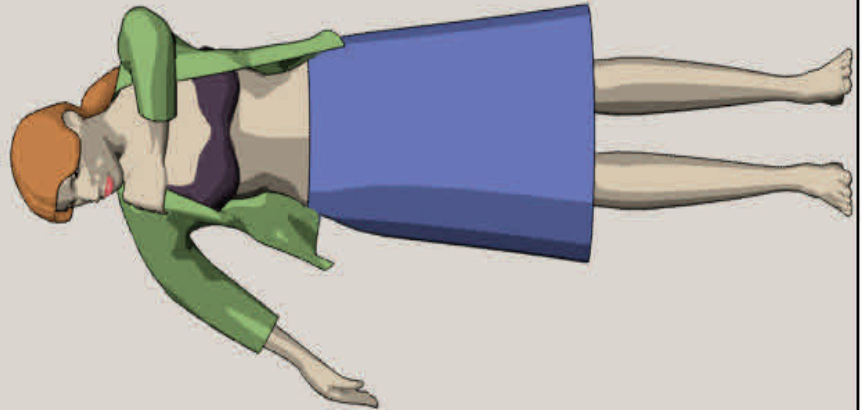
Figure F-4. Mass Casualty Decontamination Triage Decision Tree



Using Arms to Shield Clothing from Contact with Face



Cutting or Unbuttoning



Pulling Clothing Directly Overhead

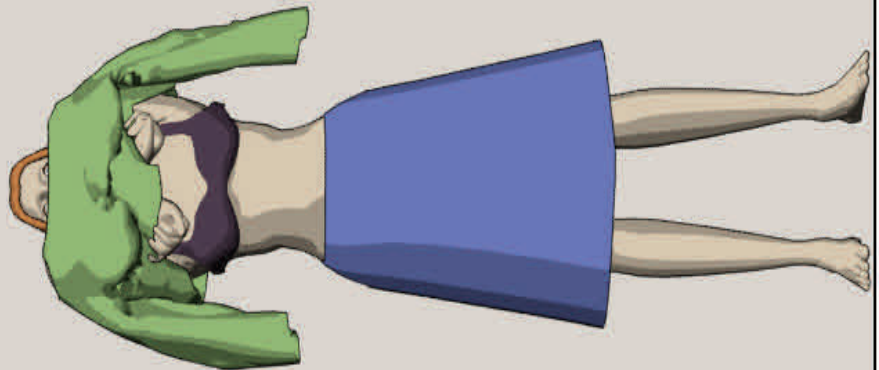
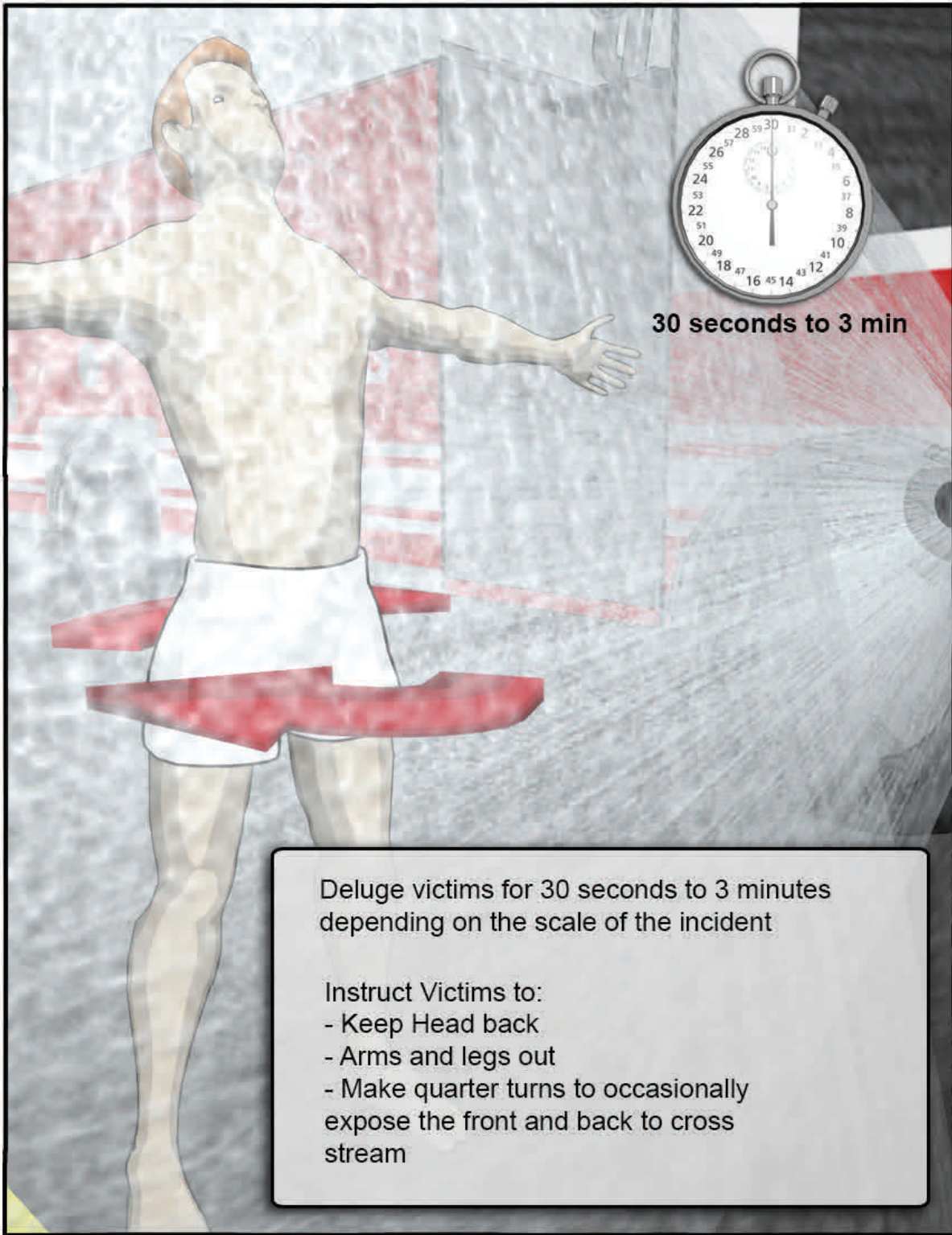


Figure F-5. Proper Removal of Clothing





Deluge victims for 30 seconds to 3 minutes depending on the scale of the incident

Instruct Victims to:

- Keep Head back
- Arms and legs out
- Make quarter turns to occasionally expose the front and back to cross stream

**Figure F-6. Proper Body Positioning for Mass Decontamination**



**Figure F-7. Proper Decontamination Corridor Procedure**

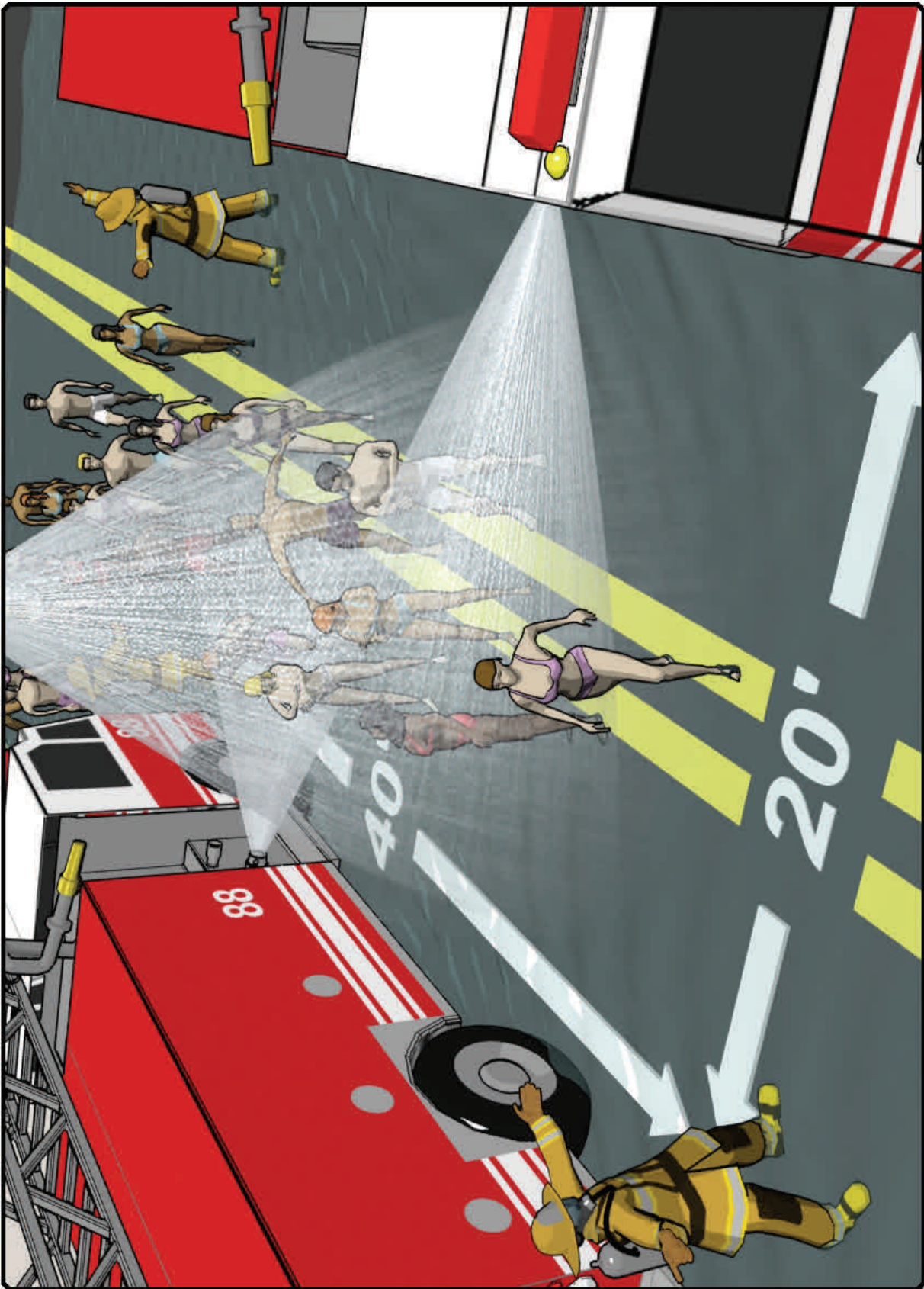


Figure F-8. Mass Decontamination Corridor

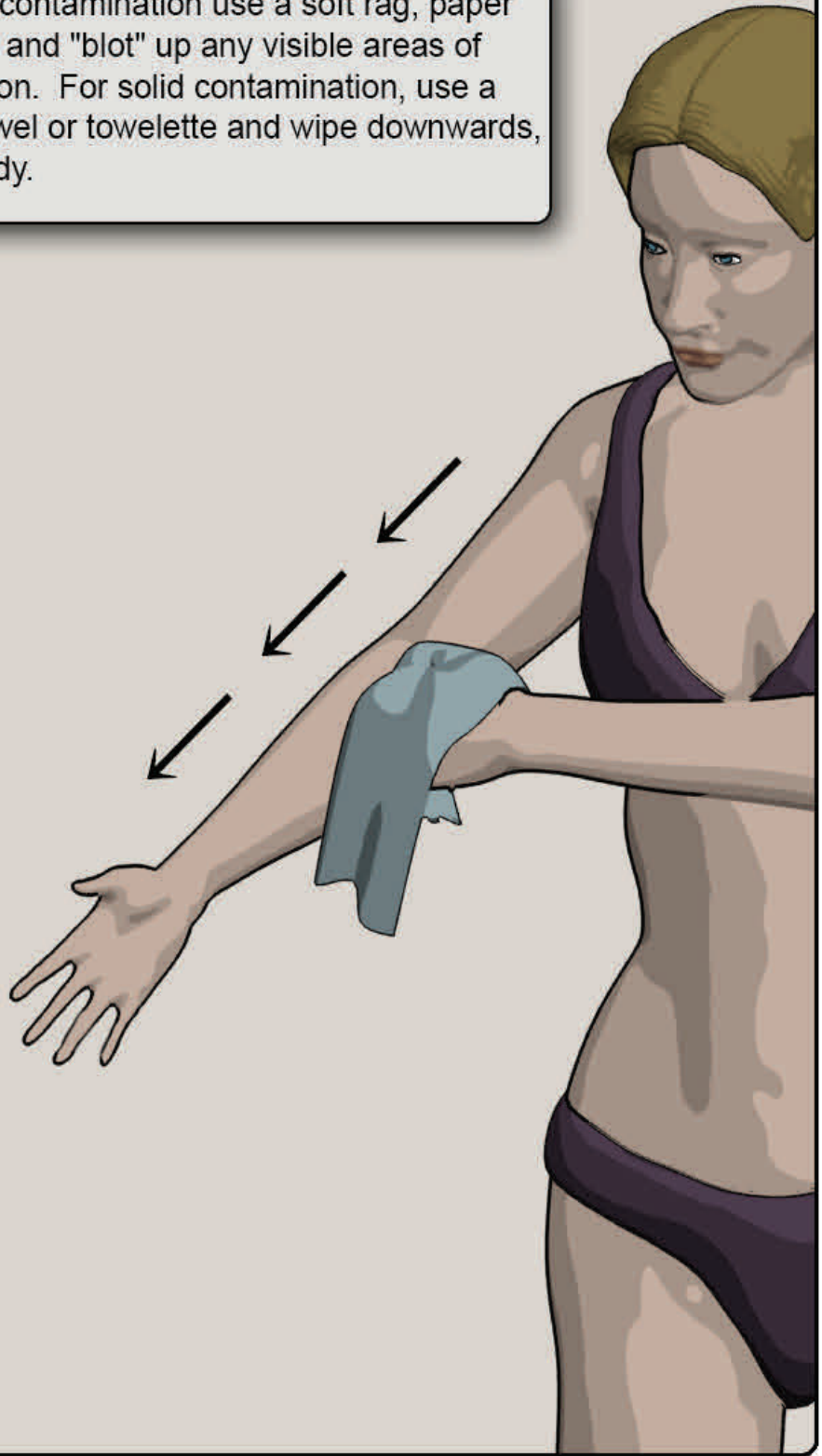


**Figure F-9. Off Gassing Hazard**



Figure F-10. Oily Agent Residue Following Decontamination

To perform dry decontamination use a soft rag, paper towel or towelette and "blot" up any visible areas of liquid contamination. For solid contamination, use a soft rag, paper towel or towelette and wipe downwards, away from the body.



**Figure F-11. Dry Decontamination Technique**

# Temperature Decontamination Guide

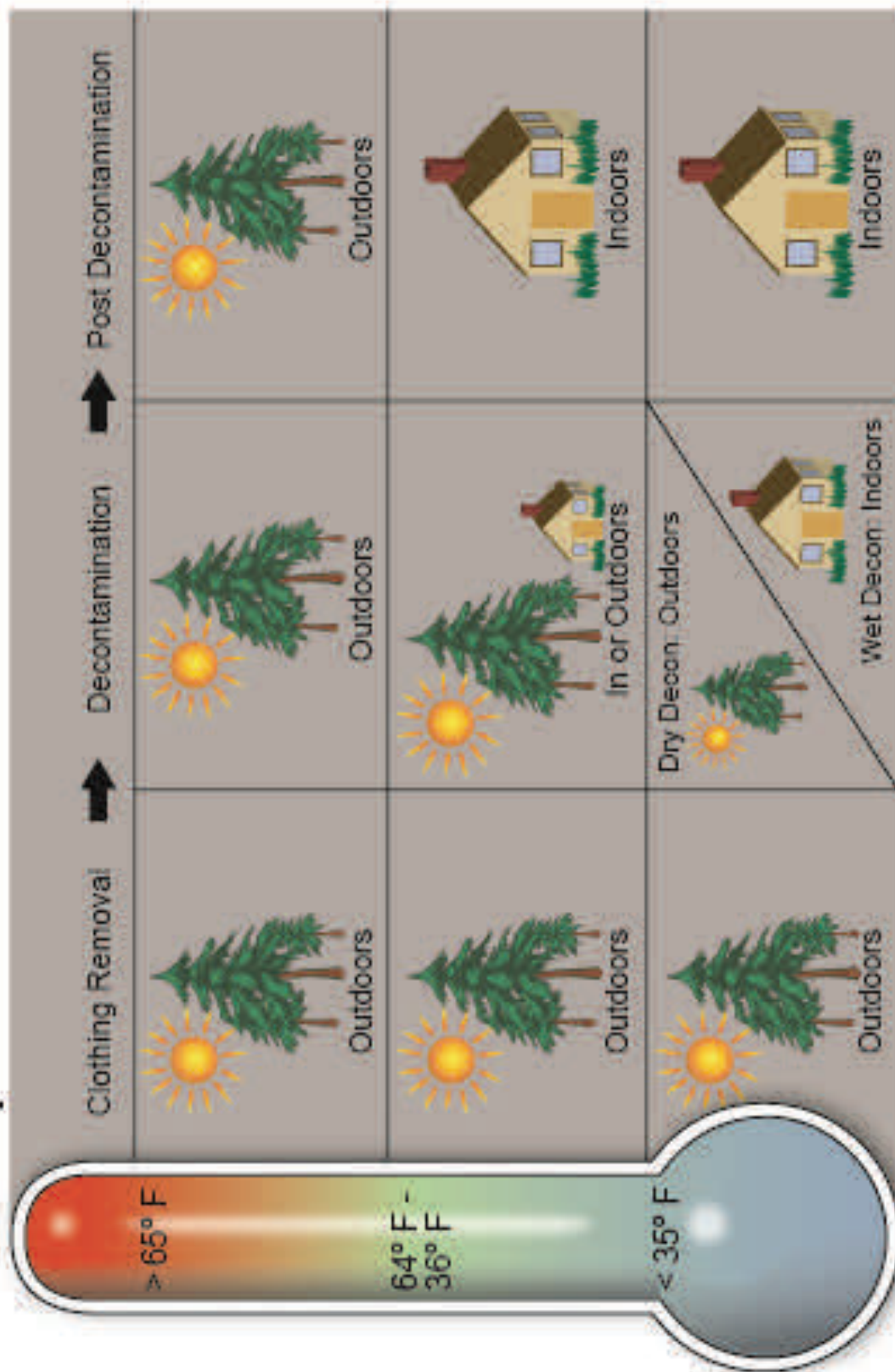


Figure F-12. Cold Weather Decontamination Guide

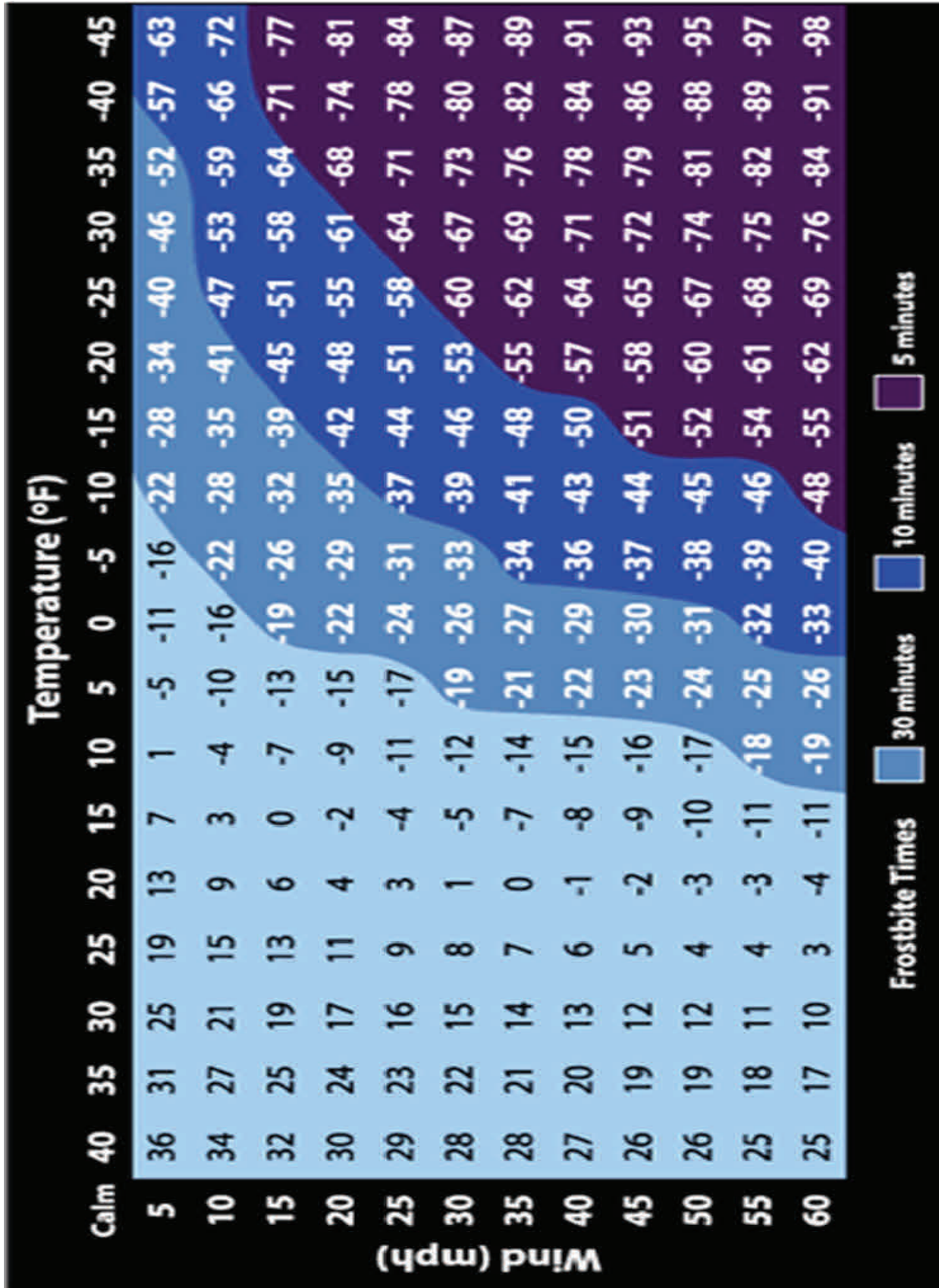


Figure F-13. Frostbite Risk by Temperature



## **Appendix G**

### **Sources and Citations**

This Appendix provides a summary listing of all sources and citations used throughout Volumes I and II.

1. An Integrated Civilian Medical Response to Mass Casualty Incidents; May 2005; Banu Onaral; Drexel University, Philadelphia PA.
2. Best Practices for Hospital-Based First Receivers (of Victims from Mass Casualty Incidents Involving the Release of Hazardous Substances); 2005. OSHA U.S. Dept. of Labor.
3. Biological Incident Operations: A Guide for Law Enforcement; Sep 2004; Edge-wood Chemical Biological Center, Aberdeen Proving Ground, MD.
4. Chemical Weapons Improved Response Program (CWIRP) Playbook. Guidelines for Responding to and Managing a Chemical Weapons of Mass Destruction Terrorist Event; Dec 2003; Army Soldier And Biological Chemical Command, Aberdeen Proving Ground, MD Domestic Preparedness.
5. Chemical, Biological, Radiological, Nuclear, and High-Yield Explosives Consequences Management; Oct 2006; Joint Chiefs Of Staff Washington DC.
6. Chemical-Biological Weapons of Mass Destruction: Understanding the Problem; Aug 2002; Bruce Bowman; Jerry Glasow; Military Operations Research Society Alexandria VA.
7. Combined Injury: Radiation in Combination with Trauma, Infectious Disease, or Chemical Exposures; 2005; T. C. Pellmar; G. D. Ledney; Armed Forces Radiobiology Research Inst. Bethesda, MD.
8. Considering the Effects of a Catastrophic Terrorist Attack; Charles Meade, Roger C. Molander - RAND Center for Terrorism Risk Management Policy (CTRMP).
9. CWIRP Playbook, Guidelines for Responding to and Managing a Chemical Weapons of Mass Destruction Terrorist Event; December 2003; SBCCOM.
10. Decontamination Guidance For Emergency Response; Aug 2005; PEMA.
11. Decontamination of Mass Casualties - Re-evaluating Existing Dogma in Prehospital and Disaster Medicine, Vol. 18, No. 3 pages 200-207; Mar 2004; Howard W. Levitin FACEP, Henry J. Siegelson FACEP, Stanley Dickinson EMT, Pinchas Halpern, Yoshikura Haraguchi, Anthony Nocera FACEM, David Turineck.
12. Decontamination of Warfare Agents: The History of Biological Warfare; 2008. Friedrich Frischknecht; Andre Richards and Marc-Michael Blum.
13. Diagnosis of Exposure to Chemical Warfare Agents: A Comprehensive Literature Survey 1990-2005; Jan 2006; D. Noort; TNO Defense Security And Safety, Rijswijk (Netherlands).
14. Environmental Protection Agency Radiological Emergency Response Plan. Jan 2005; <[www.EPA.gov](http://www.EPA.gov)>.

15. Fire Department Operations In Chemical Agent Areas Standard Operating Procedure No. 420-108; Mar 2004; Directorate of Safety, Health & Environment U.S. Army Aberdeen Proving Ground, MD.
16. FM 3-11.5, Multi-Service Tactics, Techniques, And Procedures For Chemical, Biological, Radiological, And Nuclear Decontamination; US Department of Defense.
17. Guidelines for Responding to a Chemical Weapons Incident; Aug 2003; US Army Soldier And Biological Chemical Command, Aberdeen Proving Ground, MD Domestic Preparedness.
18. Interim Report on Lessons Learned from Decontamination Experiences; 2003; Department of Energy (DOE).
19. Mass Decontamination Standard Operating Procedure No. 420-331; Sep 2004; Directorate of Safety, Health & Environment Fire & Emergency Services Division US Army Garrison, Aberdeen Proving Ground, MD.
20. Mass Decontamination: Anchorage, Alaska Fire Department's Initial Emergency Response Actions; May 2007.
21. Mass Decontamination: Connecticut Capitol Region Metropolitan Medical Response System's Cold Weather Protocols; Feb 2007.
22. Mass Decontamination: Connecticut Capitol Region Metropolitan Medical Response System's Guidelines for Hospital-Based Directed Self-Decontamination; Apr 2007.
23. Mass Decontamination: Scanning Victims for the Successful Removal of Contaminants; Aug 2007.
24. Material Safety Data Sheets (MSDS) For Infectious Substances; 2001; Public Health Agency of Canada.
25. Medical Management of Radiological Casualties, Second Edition, Handbook; Apr 2003; Armed Forces Radiobiology Research Inst, Bethesda, MD.
26. Multi-Casualty Mass Decontamination Guidance Document for First Responders; Aug 2007; California OES.
27. National Incident Management System; Mar 2004; Department of Homeland Security.
28. NFPA 472 Standard for Competence of Responders to Hazardous Materials/ Weapons of Mass Destruction Incidents; Jun 2008/2012.
29. Orange County, California's Chemical Incident Operations and Mass Decontamination Program; Aug 2004.

30. PEMA Circular: Decontamination Guidance for Emergency Response; Aug 2005; Pennsylvania Emergency Management Agency (PEMA).
31. Performing Mass Victim Decontamination During A Cold Weather Hazardous Material Emergency Incident; Mar 2007; Fire Chief Magazine.
32. Radiation Incident Mass Casualty Decontamination; Canadian Nuclear Safety Commission.
33. Rapid Access Mass Decontamination Protocol; Aug 2006; Capitol Region Council of Governments.
34. Simple Triage and Rapid Decontamination of Mass Casualties with Colored Clothes Pegs (STARDOM-CCP) System against Chemical Releases; Tetsu Okumura, MD;1,2 Hisayoshi Kondo, MD;1,3 Hitomi Nagayama, MD;1,4,5. Toshiro Makino, MD;1,6 Toshiharu Yoshioka, MD;7,8 Yasuhiro Yamamoto, MD.
35. Task 0008: Phase I & II Canadian Reactive Skin Decontamination Lotion (RSDL); Aug 2004; Battelle/U.S. Army Medical Materiel Development Activity.
36. Strip and Shower: The Duck and Cover for the 21st Century; Annals of Emergency Medicine, September 2003, 42:391-394, Kristi L. Koenig, MD.
37. Weapons of Mass Destruction Events With Contaminated Casualties, Effective Planning for Health Care Facilities; JAMA, January 2000, Volume 283, No 2, Anthony G. Macintyre, MD; LtCol George W. Christopher, USAF, MC; COL Edward Eitzen Jr, MC, USA; LTC Robert Gum, MC, USA; Scott Weir, MD; Craig DeAtley, PA-C; CDR Kevin Tonat, DRPH, MPH, USPHS; Joseph A. Barbera, MD.
38. Emergency Response Guidebook 2008/2012.
39. Guidelines for Mass Casualty Decontamination During a Terrorist Chemical Agent Incident, U.S. Army Soldier and Biological Chemical Command, Jan 2000; Lake, William A; Fedele, Paul D; Marshall, Stephen M.
40. Guidelines for Cold Weather Mass Casualty Decontamination During a Terrorist Chemical Agent Incident, U.S. Army Soldier and Biological Chemical Command, August 2003.
41. 29 CFR 1910.120; OSHA Hazardous Waste Operations and Emergency Response.
42. Guide for the Selection of Personal Protective Equipment for Emergency First Responders; Guide 102-06; Jan 2007, 2<sup>nd</sup> Edition; U.S. Department of Homeland Security.
43. 6 CFR Part 27, Appendix A of the Chemical Facility Anti-Terrorism Standards Final Rule Federal Register / Vol. 72 , No. 223; U.S. Department of Homeland Security; 20 Nov 07.

44. Chilcott, R.P., Compilation of Empirical Data and Research Efforts - "Development Programme on Decontamination."
45. Gougelet. R., Regional Response System - A Regional Response for All-Hazards Catastrophic Emergencies, Planning Guide - December 2010.
46. NFPA 473 Standard for Competence of EMS Response Personnel to Hazardous Materials/Weapons of Mass Destruction Incidents; Jun 18, 2012.
47. Patient Decontamination in a Mass Chemical Exposure Incident: National Planning Guidance for Communities, U.S. Department of Homeland Security & Department of Health and Human Services, July 2012 (Pre-Decisional Draft).
48. NFPA Supplement 10, Guidelines for Decontamination of Fire Fighters and Their Equipment Following Hazardous Materials Incidents Pg.14, National Fire Protection Association, 1997.
49. Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C § 9601 et seq. (2006).
50. U.S. Environmental Protection Agency. (2000, July). *First Responders' Environmental Liability Due to Mass Decontamination Runoff* (EPA-550-F-00-009). Office of Solid Waste and Emergency Response. Washington, DC.

## **Appendix H**

### **Glossary of Terms**

This Appendix provides a summary listing of all terms and associated definitions used throughout Volumes I and II.

**Ambulatory**

Victims able to understand directions, talk, and walk unassisted.

**Blister Agents (Persistent)**

Mustard (H), Distilled Mustard (HD), Nitrogen Mustard (HN), Lewisite (L).

**Casualty**

Person(s) who may or may not be contaminated, but have sustained physical injuries.

**Chemical, biological, radiological, nuclear, or high-yield explosives (CBRNE) incident**

An emergency resulting from the deliberate or unintentional release of nuclear, biological, radiological, or toxic or poisonous chemical materials, or the detonation of a high-yield explosive.

**Cold Zone**

Uncontaminated area of a HAZMAT incident site (located upwind from the contaminated or Hot Zone) established around the warm zone where emergency operations can be directed and supported. Also referred to as the clean zone, green zone or support zone.

**Deck gun**

Aimable, controllable, high-capacity water jet cannon used for firefighting and/or decontamination.

**Decontamination**

The process of making any person, object, or area safe by absorbing, destroying, neutralizing, making harmless, or removing chemical or biological agents, or by removing radioactive material clinging to or around it.

**Decontamination Triage**

Prioritization of victims for decontamination based evidence of contamination and/or exposure to the hazard.

**Emergency Responders**

Firefighters/HAZMAT, law enforcement/security personnel, emergency medical services, EM and operations personnel, Explosive Ordnance Disposal (EOD) personnel, physicians, nurses, medical treatment providers at medical treatment facilities, disaster preparedness officers, public health officers, bioenvironmental engineers, and mortuary affairs personnel.

**First Responder**

Firefighters/HAZMAT, law enforcement and/or security personnel, emergency medical services, and EOD personnel (for suspected explosive CBRNE events) that provide the initial, immediate response to an emergency.

**Fog nozzle**

Firefighting hose spray nozzle that separates a water stream into small droplets. By doing so, its stream achieves a greater surface area,

**Hazard**

Something that is potentially dangerous or harmful.

**Hazardous Material (HAZMAT)**

Any item or agent with potential to cause harm to humans and animals.

**Hoseline**

A thick, high-pressure hose used to carry water or other fire retardant to a fire to extinguish it. Outdoors, it is attached either to a fire engine or a fire hydrant.

**Hot Zone**

The contaminated area immediately surrounding a HAZMAT incident site, that extends far enough to minimize adverse health effects from hazardous material releases to personnel outside the zone, which must be isolated and requires suitable protective equipment to enter and decontamination upon exit. Also referred to as exclusion zone, red zone or restricted zone.

**Incident Commander (IC)**

The person responsible for all decisions relating to the management of the incident. The incident commander is in charge of the incident scene. This term is equivalent to the on-scene incident commander.

**Incident Command System (ICS)**

A standardized, on-scene, all-hazard incident management concept which allows its users to adopt an integrated organizational structure to match the complexities and demands of single or multiple incidents. The ICS can grow or shrink to meet different needs. The ICS consists of procedures for controlling personnel, facilities, equipment, and communications.

**Initial Isolation Zone**

An area surrounding the incident in which persons may be exposed to dangerous (upwind) and life threatening (downwind) concentrations of material.

**Ladder pipe**

Nozzle attached to aerial ladder and used to direct a heavy stream of water.

**Ladder Pipe Decontamination System (LDS)**

A decontamination corridor using fire trucks (approximately 20 feet in width between fire trucks and approximately 40 feet in length). The LDS provides a large capacity, high-volume, low-pressure water shower (approximately 60 psi). Ladder pipes, deck guns, and fog nozzles are positioned strategically to create a mass decontamination corridor.

**Level of Protection**

Personal Protective Equipment (PPE) is divided into four categories based on degree of protection afforded:

Level A = greatest level of skin, respiratory, and eye protection required;

Level B = highest level of respiratory protection necessary but lesser level of skin protection needed;



### ***Level of Protection (Continued)***

Level C = used when concentration(s) and type(s) of airborne substance(s) is known and criteria for using air purifying respirators are met;

Level D = work uniform providing minimal protection. Used for nuisance contamination only.

### ***Mass Casualty***

Any large number of casualties produced in a relatively short period of time, usually as the result of a single incident.

### ***Mass Decontamination***

Decontamination of large numbers of people, in the event of contamination by a harmful substance.

### ***Medical Triage***

Prioritization of victims for medical treatment.

### ***National Incident Management System (NIMS)***

A system mandated by Homeland Security Presidential Directive 5 (HSPD-5) that provides consistent nationwide approach for federal, state, local, and tribal governments; the private sector; and nongovernmental organizations to work effectively and efficiently together to prepare for, respond to, and recover from domestic incidents, regardless of the cause, size, or complexity. To provide for interoperability and compatibility among federal, state, local, and tribal capabilities, the NIMS includes core set of concepts, principles, and terminology. HSPD-5 identifies these as the Incident Command System (ICS); multiagency coordination systems; training; identification and management of resources (including system for classifying types of resources); qualifications and certification; and the collection, tracking, and reporting of incident information and incident resources.

### ***Neutralization***

Counteraction of the effects of a hazardous substance.

### ***Nerve Agents; G Series (Non-persistent)***

Tabun (GA), Sarin (GB), Soman (GD), Cyclosarin (GF)

### ***Nerve Agents (Persistent)***

O-ethyl-diisopropylaminomethyl methylphosphonothiolate (VX)

### ***Non-ambulatory***

Victims who are unconscious, unresponsive, or unable to move without assistance.

### ***Non-symptomatic***

Not exhibiting the signs or characteristics of exposure to a hazardous substance.

### ***Personal Protective Equipment (PPE)***

equipment worn to minimize exposure to a variety of hazards.

**Protective Action Zone**

an area DOWNWIND from the incident in which persons may become incapacitated and unable to take protective action and/or incur serious or irreversible health effects.

**Sarin**

An extremely toxic nerve agent; also known as GB.

**Self Presenter**

Members of the public who present themselves at a medical facility..

**Symptomatic**

Exhibiting the signs or characteristics of exposure to a hazardous substance.

**Tepid Water**

Water that is 60 to 100 degrees Fahrenheit per ANSI Z358.1-2009 and ANSI/ISEA 113-2008.

**Toxic Industrial Chemical (TIC)**

Chemical compounds used or produced in industrial processes that are toxic to humans.

**Toxic Industrial Material (TIM)**

Toxic radioactive compounds used or stored by industry.

**Triage**

Evaluation of exposed individuals based on type and seriousness of injury for the purpose of decontamination prioritization.

**Victim**

Any person (ambulatory and non-ambulatory) who are contaminated or partially contaminated with a HAZMAT/WMD substance.

**Warm Zone**

Also referred to as the contamination reduction zone, the warm zone is usually established around the hot zone to provide a buffer between the hot and cold zones. Decontamination often takes place in the warm zone. Also referred to as the contamination reduction zone (CRZ), yellow zone or limited access zone.

**Weapon of Mass Destruction (WMD)**

Weapons capable of a high order of destruction and/or of being used in such a manner as to destroy large numbers of people. WMD can be high explosives or CBRN weapons but exclude the means of transporting or propelling the weapon when such means is a separable and divisible part of the weapon.

**Wind Chill**

A wind chill estimate or temperature is an attempt to quantify the effect of moving a cold air stream over a warm body. In effect, this air movement displaces the warm air at the body surface (which has been heated by conduction) and replaces it with a layer of air at ambient temperature.

# **Appendix I**

## **Acronym List**

This Appendix provides a summary listing of all acronyms used throughout Volumes I and II.

**AAR** – After Action Report

**a.k.a.** – also known as

**ASAP** – as soon as possible

**ASPR** – Office of the Assistant Secretary Preparedness & Response

**CERCLA** – Comprehensive Environmental Response, Compensation, and Liability Act

**CBR** – Chemical, biological, radiological

**CBRN** – Chemical, biological, radiological, nuclear

**CBRNE** – Chemical, biological, radiological, nuclear, high-yield explosive

**CFR** – Code of Federal Regulations

**COI** – Chemical of Interest

**CWA** – Chemical Warfare Agent

**DHHS** – Department of Health & Human Services

**DHS** – Department of Homeland Security

**DoD** – Department of Defense

**DoT** – Department of Transportation

**ECBC** – Edgewood Chemical Biological Center

**EMA** – Emergency Management Agency

**EMS** – Emergency Medical Services

**EOC** – Emergency Operations Center

**EOP** – Emergency Operations Plan

**EPA** – Environmental Protection Agency

**ERG** – Emergency Response Guidebook

**ERP** – Emergency Response Program

**EPA** – Environmental Protection Agency

**FEMA** – Federal Emergency Management Agency

**gpm** – gallons per minute

**HAZMAT** – Hazardous Material

**HSEEP** – Homeland Security Exercise and Evaluation Program

**IAW** – in accordance with

**IC** – Incident Commander

**ICS** – Incident Command System

**IPT** – Integrated Project Team

**LDS** – Ladder-Pipe Decontamination System

**LEPC** – Local Emergency Planning Committee

**LLIS** – Lessons Learned Information System

**NIMS** – National Incident Management System

**MACS** – Multi Agency Coordination System

**MCDRT** – Mass Casualty Decontamination Research Team

**MOA** – Memorandum of Agreement

**MOU** – Memorandum of Understanding

**NCP** – National Contingency Plan

**NFPA** – National Fire Protection Association

**NIMS** – National Incident Management System

**NRF** – National Response Framework

**OHA** – Office of Health Affairs

**OSHA** – Occupational Safety and Health Administration

**PPE** – Personal Protective Equipment

**PSI** – pounds per square inch

**RDD** – Radiological Dispersal Device

**RSDL** – Reactive Skin Decontamination Lotion

**SBCCOM** – US Army Soldier and Biological Chemical Command

**SCBA** – Self-contained Breathing Apparatus

**SME** – Subject Matter Expert

**START** – Simple Triage and Rapid Treatment

**TIC** – Toxic Industrial Chemical

**TIM** – Toxic Industrial Material

**USAMRICD** – US Army Medical Research Institute of Chemical Defense

**WARN** – Wastewater Agency Response Network

**WMD** – Weapon of Mass Destruction

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