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Hospital Emergency Response Training
for Mass Casualty Incidents
Student Manual

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Update: December 2013
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Introduction

The Hospital Emergency Response Training for Mass Casualty Incident course prepares healthcare responders to utilize the Hospital Incident Command System (HICS)—integrating into the community emergency response network while operating an Emergency Treatment Area (ETA) as hospital first responders during a mass casualty incident (MCI) involving patient contamination. The healthcare responders will determine and use appropriate Personal Protective Equipment (PPE), and conduct triage followed by decontamination of ambulatory and nonambulatory patients as members of a Hospital Emergency Response Team (HERT).

Course Goal

At the end of the Hospital Emergency Response Training for Mass Casualty Incident course, the healthcare responder will be able to demonstrate the ability to form a HERT that will respond operationally to an MCI that is the result of a natural, accidental, or intentional disaster.

The Hospital Emergency Response Training for Mass Casualty Incident course provides healthcare responders the opportunity to demonstrate the ability to form a HERT that will respond operationally to an MCI that is the result of a natural, accidental, or intentional disaster.

Course Objectives

At the conclusion of this course, healthcare responders will be able to:

- Analyze the need, composition, and use of a HERT during an emergency, MCI, or disaster situation.

- Summarize the organization and operation of the HICS as it integrates with the Incident Command System (ICS) during response to an MCI.

- Differentiate the medical responses to a variety of illnesses and injuries that may result from an MCI.

- Select and use the appropriate level of PPE as hospital first receivers in response to a disaster involving patient contamination.

- Structure the healthcare facility ETA to support medical operations in response to an MCI.

- Establish a HERT which meets all safety requirements, provides security to the hospital, and efficiently handles patients for processing into the hospital facility for follow up treatment.
• Compare decontamination methods and procedures.

• Perform Simple Triage and Rapid Treatment© (START) and JumpSTART procedures within the ETA during a hospital response to a disaster involving contamination.

• Conduct operations in an ETA while wearing appropriate PPE in response to an MCI involving contamination.

• Conduct an effective medical response to an MCI using the HERT approach.

Scope of Course

The *Hospital Emergency Response Training for Mass Casualty Incident* course

• Is a three-day training course.

• Assists the healthcare responder in understanding the relationship between a HICS, ICS, and national response requirements during all types of emergencies; addresses PPE requirements; and presents guidance for HERT design, development, and training.

• Helps prepare facilities and agencies to conduct a safe and effective emergency medical response to an MCI.

• Culminates with the application of this training in small- and large-group, facilitated practical exercises.
Target Audience

Basic Characteristics

The target audience for the Hospital Emergency Response Training for Mass Casualty Incident course includes hospital staff members who comprise a HERT such as physicians, nurses, administrators, security personnel, environmental staff, and other hospital staff.

Prerequisites

To be eligible to attend the Hospital Emergency Response Training for Mass Casualty Incident course, a candidate must

- Have successfully completed awareness-level training for CBRNE response through AWR-160, Standardize Awareness Authorized Training Program or another certified awareness-level training program.

- Have successfully completed ICS (IS) 700 National Incident Management System (NIMS), An Introduction, ICS (IS) 100.HCb Introduction to the Incident Command System for Healthcare/Hospitals, and ICS (IS) 200.HCa Applying ICS to Healthcare Organizations training.

In addition, it is recommended candidates have successfully completed Chemical, Biological, Radiological, Nuclear, or Explosive (CBRNE) or hazardous materials (HAZMAT) training at the operations level as specified in 29 Code of Federal Regulations 1910.120(g)(6)(ii) at a minimum.

Completion of this course prior to enrollment in the Healthcare Leadership and Administrative Decision Making (MGT-901) course is encouraged.

Educational Credits

The Center for Domestic Preparedness (CDP) awards 2.4 Continuing Education Units (CEU) for successful completion of this course. The CDP has been approved by the International Association for Continuing Education & Training (IACET) as an authorized provider of CEU.

Course Contents

- Module 1: National Emergency Response and the Hospital Emergency Response Team
- Module 2: Hospital Incident Command System
- Module 3: Health Effects of CBRNE
Module 4: Personal Protective Equipment

Module 5: Emergency Treatment Area

Module 6: Hospital Emergency Response Team Exercise

Module 7: Hospital Decontamination Procedures

Module 8: Triage

Module 9: Lanes Training

Module 10: Final Exercise

Testing and Evaluation Strategy

Kirkpatrick’s four-level model for evaluation of training includes two levels applicable to the evaluation strategy for the Hospital Emergency Response Training for Mass Casualty Incident course.

- Reaction—Responders have an opportunity to provide feedback on the course, course materials, and instructors through end-of-course critiques and U.S. Department of Homeland Security’s (DHS) Level 1 Evaluations. This information is used to continually improve CDP services and training.

- Learning—Knowledge and skills acquired or improved due to training provided at the CDP are measured through testing and performance checklists. Responders are administered pre- and post-tests, including questions primarily from lecture material, to assess the knowledge level of responders both prior to and following the course, thus providing an additional measure of learning. Responders must pass the post-test with a score of 70% or better to complete the course and receive a certificate of completion. If a responder does not pass the post-test on the first attempt, a retest will be offered. If the responder does not pass the retest with a score of 70% or better, a certificate of attendance is issued.
Administrative Overview

Hospital Emergency Response Training for Mass Casualty Incidents

Administration

Please note the following locations:

- Restrooms and break areas
- Dining area for lunch
- Emergency evacuation directions
- Lanes training areas
- Smoking areas
- Medical area
National Emergency Response and the Hospital Emergency Response Team

Hospital Emergency Response Training for Mass Casualty Incidents

Update: December 2013
Lesson Administrative Page

Summary: This module provides a brief introduction to the national emergency response system’s National Response Framework (NRF) and National Incident Management System (NIMS). It continues with a comprehensive discussion concerning the requirements and composition of a Hospital Emergency Response Team (HERT) used by hospitals during response to a Mass Casualty Incident (MCI) that may involve contamination from various sources to include local hazards.

Terminal Learning Objective:

At the conclusion of this module, the healthcare responder will be able to determine the need, composition, and use of a HERT during an emergency, MCI, or disaster situation.

Enabling Objectives:

At the conclusion of this module, the healthcare responder will be able to:

1-1 Recognize the general components of the national emergency response system to include the NRF and NIMS

1-2 Identify the relationship of the hospital’s Emergency Operations Plan (EOP) to the regulatory requirements of national and hospital standard-setting agencies

1-3 Determine the necessity of establishing a HERT capability within a hospital based on a given local hazard assessment and knowledge of the HERT mission

1-4 Identify the roles and responsibilities of the various HERT groups and teams required to perform operations during an MCI

1-5 Identify in order the procedures for activation of the HERT in response to an MCI involving contamination

Risk Assessment: Low

Duration: 1.0 Hour

Method of Instruction: Facilitated seminar in a classroom environment

Instructor Ratio: 1:40
Introduction

Throughout the history of the United States, the federal government has attempted to provide assistance to state and local governments when a disaster has occurred. This assistance has been provided via many different approaches. The priorities of Federal assistance are influenced by incident type.

Enabling Objective 1-1: Recognize the general components of the national emergency response system to include the NRF and NIMS

National Emergency Response System

Response to various terrorist attacks, most notably that of September 11, 2001, revealed many problems associated with incident operations, communications, personnel qualifications, resource and information management, and supporting technology. Though the Incident Command System (ICS) was already being used by some agencies, it was not mandated for use throughout the response network. It was clear that a national system of standards for responding to disaster was necessary. Recognizing the importance of an effective, coordinated management system for incident response, President George W. Bush issued Homeland Security Presidential Directive-5 (HSPD-5), which directed the Secretary of Homeland Security to develop an all-hazards template. This template would be applicable across federal, state, local, and tribal governments as well as to private organizations to improve preparedness, response, and recovery coordination and cooperation. The result of this directive was the National Response Plan (NRP), which was ultimately superseded by the NRF.

The NRF, along with NIMS, provides a structure that integrates response capabilities and resources into a unified, coordinated, national approach to incident management. Regarding response, the NRF explains what to do during operations, as NIMS explains how to conduct those operations.

National Response Framework

The NRF is an outline of plans, scenarios, and educational and planning tools to support those responding to an incident or a disaster. The NRF consists of the following components:

Notes
Base Document—Explains federal agency roles and responsibilities, response actions, incident management, and usefulness of the *NRF*. It establishes how the framework will be used.

Support Annexes—Eight annexes describing how the federal government will respond for specific functions involved in an incident response.

*Emergency Support Function (ESF) Annexes*—Fifteen annexes, each containing function-specific response information. Each annex details the federal agency in charge of that ESF along with coordinating and cooperating agencies responsible for emergency support and the actions they perform during an incident.

Incident Annexes—Addresses seven potential threats (Department of Homeland Security [DHS], 2007). Each incident annex describes the policies, situations, concept of operations, and responsibilities pertinent to the type of incident in question. Incident annexes are currently in the form of response plans.

Learning Resource Center—Interactive learning center website to aid emergency management organizations in increasing the usefulness of the framework and assisting emergency management organizations in planning.

The *NRF* is the federal guide for managing all-hazards incidents. It establishes the following protocols:

- Save lives and protect the health and safety of the public, responders, and recovery workers.
- Ensure security of the homeland.
- Prevent imminent incidents from occurring.
- Protect and restore critical infrastructure and key resources.
- Conduct law enforcement investigations to resolve the incident, apprehend perpetrators, and collect and preserve evidence for prosecution and/or attribution.
• Protect property and mitigate the impact of damages to individuals, communities, and the environment.

• Facilitate recovery of individuals, families, businesses, governments, and the environment.

**NOTE:** The NRF base plan and its individual components can be downloaded from http://www.fema.gov/national-response-framework.

**National Incident Management System**

*NIMS* consists of a group of systems enabling federal, state, local, and tribal governments, and private entities to work together efficiently and effectively while responding and recovering from disasters. The system is applicable to all disasters regardless of cause, size, or complexity.

*HSPD-5* mandated the use of *NIMS* by all federal agencies and, through the use of federal funds and grant access, required its use by lower level governments and private organizations. Though mandated for use by all federal agencies as of October 1, 2004, it has been difficult to implement all components of the system. All agencies and organizations had to learn and understand what *NIMS* compliance meant. For hospitals and healthcare agencies, compliance requires changes to procedures and methods.

*NIMS* provides a consistent template for government, private sector, and nongovernmental organizational cooperation during an incident by promoting interoperability and coordination through a flexible framework. *NIMS* is useful through all phases of an incident.

*NIMS* provides a core set of concepts, principles, terminology, and technologies through its five major components as follows:

• Preparedness—Involves a combination of planning, training, exercises, personnel qualification and certification standards, equipment acquisition, and publication management processes.

• Communications and Information Management—Provides a standardized framework for communications and information management and sharing. Ensures communication between government agencies and lower levels of government.

Notes
- Resource Management—Provides standardized procedures and establishes requirements to inventory, track, dispatch, and recover assets. Provides methods to put a Multiagency Coordination System (MACS) into operation.

- Command and Management—The NIMS incident command structure is based on three organizational systems as follows:
  - ICS—Adopted from FEMA, it defines operating characteristics, management components, and incident management structure for an incident. Hospitals integrate with ICS through the adoption of the Hospital Incident Command System (HICS).
  - MACS—This system defines the integration of support entities and how they will provide assistance. MACS is a resource system that ensures the availability of equipment, supplies, and personnel. At its highest level, it integrates all resources from the federal to the local level ensuring that all resources are available when and where needed.
  - Public information system—Processes and procedures for communicating timely and accurate information to the public during an emergency. The public information system is integrated through the Joint Information System (JIS) and the Joint Information Center (JIC). The JIC is the physical location for Public Information Officer (PIO) to work and support the information needs of the public and responders. The JIS and JIC ensure one timely, accurate message is provided rather than every agency communicating different, and sometimes conflicting, information.

- Ongoing Management and Maintenance—Provides strategic oversight for review and revision of NIMS. This area is supported by the National Integration Center (NIC) formerly known as the NIMS Integration Center (NIC).

**NIMS Implementation Requirements for Hospitals and Healthcare**

To assist jurisdictions and private organizations in the implementation of NIMS, the Secretary of Homeland Security established the NIC. The NIC supports routine maintenance and continuous refinement of the system while helping organizations by providing guidance and support. It also develops compliance criteria and implementation activities for all levels. The NIC develops NIMS materials, national standards, guidelines, and protocols for incident management training and exercises. It also collaborates with the Emergency Management
June 10, 2008, the Incident Management Systems Integration (IMSI) Division, formerly the NIC, issued NIMS Alert 07-08. This alert, titled FY 2008 and 2009 NIMS Implementation Objectives for Healthcare Organizations, reduced the mandated compliance items to 14 and changed the titles of the major groupings. NIMS Alert 07-08 replaced the FY 2007, 17 NIMS implementation objectives. A FEMA explanation letter going along with the NIMS Alert states “the remaining objectives from FY 2007 will be addressed in FY10 and out years.” The document can be accessed through the NIC at: http://www.fema.gov/national-incident-management-system-alerts. The 14 implementation objectives for FY 2008–FY 2009 are as follows:

- Adoption
  - Adoption of NIMS
  - Federal preparedness awards
- Preparedness Planning
  - Revise and update plans
  - MAA
- Preparedness Training and Exercises
  - IS 700.a NIMS, ICS 100.b, and ICS 200.b
  - IS 800.b NRF (not required by those who have already completed IS 800A NRP)
  - Training and exercises
- Communication and Information Management
  - Interoperability incorporated into acquisition programs

Notes
National Emergency Response and the Hospital Emergency Response Team

Hospital Emergency Response Training for Mass Casualty Incidents

- Standard and consistent terminology
- Collect and distribute information

- Command and Management
  - ICS
  - Include incident action planning and common communications plans
  - Adopt public information principles
  - Public information can be gathered, verified, coordinated, and disseminated

Enabling Objective 1-2: Identify the relationship of the hospital’s EOP to the regulatory requirements of national and hospital standard-setting agencies

Emergency Operations Plan

The EOP, or the Emergency Management Plan (EMP), is the equivalent of the NRF for governments and organizations below the federal level. It is the planning document established as an operations plan that explains how the organization will respond in the event of a disaster. The plan attempts to address all possibilities using generalities and not specific actions. The EOP must comply with the NRF, NIMS, and numerous other regulatory requirements.

Regulatory and Standards Agencies

In addition to the NIC and Health Resources and Services Administration (HRSA), there are several other governmental agencies and organizations that provide guidance concerning NIMS and ICS, and how these systems should be utilized in a hospital environment during emergencies. While healthcare facilities are licensed and regulated by state and local authorities, there is a role for federal oversight of their disaster preparedness and response capabilities through standards developed by the Occupational Safety and Health Administration (OSHA) and

Notes
The Joint Commission, as well as through Conditions of Participation (COP) for Medicare and Medicaid.

- Centers for Medicare and Medicaid Services (CMS) and United States Department of Health and Human Services (HHS)—Numerous references are made in Condition of Participation for Hospitals: Physical Environment (Basic Care), 42 Code of Federal Regulations (C.F.R.) § 482.41, Condition of Participation: Physical Environment (Intermediate Care Facilities), 42 C.F.R. § 483.470, and Condition of Participation: Physical Environment (Comprehensive Outpatient Rehabilitation Facilities), 42 C.F.R. § 485.62 (regulations that govern COP). These references concern the need for evacuation plans and drills. Additionally, Condition of Participation: Disaster Procedures, 42 C.F.R. § 485.64 and Condition of Participation: Disaster Preparedness, 42 C.F.R. § 485.727 require facilities to have comprehensive disaster plans, which are to include evacuation components.

- OSHA—The mission of OSHA is to prevent work-related injuries, illnesses, and deaths by issuing and enforcing rules (called standards) for workplace safety and health. OSHA publishes multiple “Best Practices” documents that provide regulations and guidance for healthcare responders. These documents can be accessed at the OSHA website. The OSHA document Best Practices for Hospital-Based First Receivers of Victims from Mass Casualty Incidents involving the Release of Hazardous Substances, dated January 2005, is emphasized in this course. It is located within the course reference folder and can be accessed at https://www.osha.gov/dts/osta/bestpractices/html/hospital_firstreceivers.html.

- OSHA’s Best Practices For Hospital-Based First Receivers Of Victims From Mass Casualty Incidents Involving the Release Of Hazardous Materials—Paragraph 1.2.1 Applicable Standards specifies:

  Organizations, such as OSHA, those states operating OSHA-approved State Plans, The Joint Commission, the National Fire Protection Association (NFPA®), and other state or local government agencies, establish standards that govern employee preparation, particularly regarding employee training and medical evaluations. OSHA standards, or the parallel State Plan standards, relevant to the training of first receivers include the HAZWOPER, Personal Protective Equipment (PPE), Respiratory Protection, and Hazard Communication Standards. Hospitals with decontamination facilities should comply with the requirement for medical evaluations contained in the HAZWOPER and Respiratory Protection Standards.

Notes
The Joint Commission (2004) requires an orientation and education program for all personnel, including licensed independent practitioners, who participate in implementing the EMP. When plans involve management of chemical hazards, OSHA’s HAZWOPER and hazard communication (HAZCOM) Standards complement The Joint Commission requirements by providing specific topics that should be addressed during training. Other requirements of these standards might also apply (e.g., training duration, demonstration of skills, and retraining), depending on whether the Hazardous Waste Operations and Emergency Response (HAZWOPER) (hospital decontamination zone) or HAZCOM (hospital postdecontamination zone) standard is in effect. Competencies for Incident Commanders (IC) and others responding to hazardous materials incidents are listed in 53 NFPA (2002) (Department of Labor, OSHA, 2005).

Paragraph 1.2.7 Information Dissemination during an Incident specifies:

Hospitals need to work with local emergency service organizations to provide clear, accurate information during large-scale emergencies. To avoid disseminating conflicting information, hospitals that use a NIMS-compatible ICS, such as HEICS (HICS), provide for an individual who will coordinate with other response groups and communicate with the media and other outside organizations (OSHA, 2005).

HAZWOPER, 29 C.F.R. § 1910.120(q); Personal Protective Equipment, 29 C.F.R. § 1910.132; Respiratory Protection, 29 C.F.R. § 1910.134; Hazard Communication, 29 C.F.R. § 1910.1200(h) are referenced throughout OSHA’s Best Practices For Hospital-Based First Receivers Of Victims From Mass Casualty Incidents Involving The Release of Hazardous Materials. Occupational Safety and Health Standards, 29 C.F.R. § 1910 requires operations to be managed by the ICS.

Appendix G of OSHA’s Best Practices For Hospital-Based First Receivers Of Victims From Mass Casualty Incidents Involving The Release Of Hazardous Materials provides an orientation to HICS (HEICS III, which was current at the publishing date)

• 29 C.F.R.—Standards regulations—HAZWOPER, 29 C.F.R. § 1910.120: This is OSHA’s hazardous materials standard, addressing the ICS in a number of sections/paragraphs. Paragraph HAZWOPER, 29 C.F.R. § 1910.120(q)(3)(i) of this
regulation identifies who will be the IC and how other responding personnel and agencies will interface with the IC.

- The Joint Commission—Evaluates and accredits nearly 15,000 healthcare organizations and programs in the United States. An independent, nonprofit organization, The Joint Commission is the nation’s pre-eminent standard-setting and accrediting body in healthcare. The CMS, HHS, utilizes The Joint Commission findings to determine if a facility is eligible to participate in Medicare/Medicaid programs. Compliance with standards in the emergency management chapter of The Joint Commission accreditation manuals is mandatory for hospital accreditation.

- NFPA—An independent, voluntary-membership, nonprofit (tax-exempt) organization. Its mission is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating scientifically based consensus codes and standards, research, training, and education. DHS has adopted several of the NFPA standards, including NFPA 1600, Standard on Disaster/Emergency Management and Business Continuity Programs. This code has relevance to hospital emergency management because it provides ICS, and therefore, HICS guidance.

**Hospital Emergency Operations Plan**

A hospital develops an EOP to prepare for disaster-related events of all sizes that are outside the normal hospital routine. The plan is created so patient care can be continued effectively in the event of a disaster. The plan should address the types of disasters likely to be encountered by the facility. Whether an event is internal, external, or combined, the same guidelines can be used to aid in initial response and continued operations. The plan should specifically address situations where large numbers of patients will be triaged, decontaminated, isolated, diagnosed, and treated. Narrowly defining an incident based upon casualty numbers is the most frequent mistake. Many situations generate few or no patients but still have potential to significantly affect a healthcare system’s normal operations. The isolated loss of critical systems could severely impact the healthcare system’s continuity of normal operations. For planning purposes, any event with significant potential to impact day-to-day operations should be considered a hazard.
Requirements for the Plan

The following organizations have established regulations and recommendations concerning disaster response and planning:

- **OSHA**—*OSHA Best Practices for Hospital-Based First Receivers of Victims from Mass Casualty Incidents Involving the Release of Hazardous Substances*. This document includes PPE, training, response and recovery of a Chemical, Biological, Radiological, Nuclear, or Explosives (CBRNE) event.

- The Joint Commission—2006 Hospital Accreditation Standards—This document provides hospitals and healthcare institutions with appropriate guidance for accreditation and emergency management standards.

- **NIMS**—FEMA—*NIMS Alert 07-08 NIMS Implementation Activities for Hospitals and Healthcare Systems*. Designed to assist hospitals and healthcare systems with implementation of NIMS.

Additionally, the EOP must take into consideration fire codes and sanitation ordinances, state and federal regulations, local EOPs, and community emergency preparedness plans. Hospitals and healthcare facilities should take an active role in the development of local plans to avoid conflicts and facilitate integration with those plans.

Coordination

There is a natural organizational disparity within healthcare systems. Even within a single organization, components may not easily interface for the purpose of emergency response. These components include multiple departments within a hospital, multiple facilities within a single healthcare organization, and multiple response agencies (e.g., public health, Emergency Medical Services [EMS], nursing homes, medical clinics, pharmacies, independent laboratories, etc.) within a jurisdiction that must coordinate closely with the hospital response.

A major EOP component is acceptance and implementation of the HICS or another incident management system. By embracing the concepts and incident command design outlined in HICS, a hospital is positioned to be consistent with NIMS and participate in a system that promotes greater national standardization in terminology, response concepts, and procedures.
Use of ICS promotes continuity of operations in developing and executing contingency plans during a significant event.

A well-developed EOP increases hospital awareness of capabilities of first responders and other hospitals, as well as the expectations of the local professional and response community. Coordinated plans encourage communication and can increase the safety of both patients and healthcare workers. It is important to know representatives from other organizations and the details of their plans. Multiorganizational drills test the way organizations interact under adverse conditions. Drills also test interorganizational communication systems and are a valuable tool for continuously improving an EOP.

Plan Contents

An effective EOP addresses the four phases of emergency management: mitigation, preparedness, response, and recovery. It includes continuity planning activities to ensure that critical patient care, ancillary, and support functions will continue with little or no interruption. An EOP must also describe the organization’s position and role within the community response. The NRF provides a template for divisions of the EOP. The Joint Commission’s 2006 Hospital Accreditation Standards for Emergency Management Planning offers a more detailed template for design of an EOP. The standard plan is divided into the following five sections:

- Base Plan—Addresses the administrative goals and objectives, policies and authorities, and concepts of operation following a standardized format, such as The Joint Commission 2006 Hospital Accreditation Standards for Emergency Management Planning.

- Functional Annexes—Describes the roles, responsibilities, command considerations, functional guidelines, and checklists.

- Supporting Annexes—Describes specific processes and procedures (e.g., Continuity of Operations Plan [COOP], media procedures, resource ordering, financial management, and credentialing of volunteers and mutual aid personnel).

- Incident Annexes—Provides guidance for specific hazards identified in the Hazard Vulnerability Analysis (HVA).

- Appendixes—Addresses additional subjects relevant to guidance during the response and recovery phases.

Notes
Enabling Objective 1-3: Determine the necessity in establishing a HERT capability within a hospital based on a given local hazard assessment and knowledge of the HERT mission

HERT Capabilities

All levels of government are tasked with analyzing hazards and the response to them in order to protect the public, property, and environment. Healthcare organizations must also analyze hazards that could cause patients to require additional medical attention. One hazard that is presented to almost every community is the possibility of a disaster or incident that results in some form of contamination.

Sources of contamination include: hazardous chemicals stored in a local business, trains, and trucks transporting dangerous chemicals through the community, aircraft engines containing volatile liquids, and the intentional use of CBRNE by terrorists. These hazards, which are typically small-scale incidents, can evolve into large-scale disasters by the spread of contamination from patient to patient. Contaminated patients create a hazard wherever they are. These patients present a significant hazard to a hospital as they arrive looking for treatment for actual and imagined wounds. Contaminated patients arriving at the hospital may introduce that contamination into the hospital system where it can continue to spread creating an even larger problem. Should this occur the hospital becomes part of the disaster rather than a response agency treating patients.

Response to multicasualty events can test the capabilities of emergency response teams at every level. Hospitals face significant challenges in responding to patients with possible contamination. Hospitals must receive these patients with the goal of protecting both the patients and the hospital.

A HERT is the hospital’s primary defense against introduction of contamination into the patient care environment. The HERT is an organization comprised of many different groups, teams, and functional areas required to establish an operation outside the facility building. It is strictly an organization of the hospital that activates during times of emergency. When activated, the HERT is a team under the Operations Section of the facility HICS.
The HERT mission is to protect the hospital while transferring patients into the facility for medical treatment. This mission is accomplished by securing the hospital grounds, identifying patients, separating and prioritizing patients by needs, decontaminating those patients, and protecting caregivers from becoming victims.

Consequences of not having an organized and coordinated internal HERT could include secondary contamination of medical personnel, internal structural contamination of the hospital (e.g., Emergency Department [ED]), contamination of the hospital ventilation system with possible exposure to compromised medical patients, and closing the hospital due to contamination.

No regulation details specific requirements for a HERT or how a HERT should be established. OSHA provides practical information concerning hospital response to events involving contamination within its *Best Practices for Hospital-Based First Receivers of Victims from Mass Casualty Incidents Involving Hazardous Substances*. The Joint Commission provides emergency preparedness guidelines for hospitals and requires an all-hazards approach for responding to emergencies of all types. These documents along with NFPA and National Institute for Occupational Safety and Health (NIOSH) requirements clearly define the need for articulated hospital response capabilities. Formation of a HERT along with other hospital emergency response capabilities meets this goal. An effective and capable HERT successfully protects healthcare responders and delivers professional medical care to those in need.

**Enabling Objective 1-4:** Identify the roles and responsibilities of the various HERT groups and teams that would be required to perform operations during an MCI

**Roles and Responsibilities of the HERT**

A HERT typically consists of selected individuals from the Medical Care Branch, Hazardous Material Branch, and Security Branch that perform specified functions that together add up to the process of security for the hospital facility and grounds, registration, triage, decontamination, monitoring, and movement of patients into the facility or on to other definitive medical care. An example might include members from the Casualty Care Unit, Victim Decontamination Unit, and the Access Control Unit that assemble as a temporary response team under the supervision of a team leader appointed by the Operations Section chief. This team reports to the Operations Section chief while coordinating with their branch director. The actual size of the individual
groups and the overall HERT will vary depending on the size of the incident or number of patients expected and hospital capability. During a small-scale incident, team positions may be combined or not activated. However, during large-scale events additional hospital staff and units may be assigned to augment HERT groups. This flexibility of response allows for maximization of personnel within the hospital workforce. The HERT may evolve from a team into a task force as additional groups from within the hospital and outside agencies are assigned for support.

**HERT Organization**

The HERT’s mission, organization, and team positions should be addressed within an annex of the hospital’s EOP. The plan will designate team positions but not the names of individuals assigned to these positions. A HERT consists of the following positions:

- **HERT team leader**—Senior member of the HERT. That person provides overall leadership in coordination and decision making throughout the event. The individual assigned to this position should possess the qualities, leadership, knowledge, skills, and authority to affectively direct and coordinate situations faced by HERT members. The HERT team leader should understand the mission and capabilities of every unit within the team and know hospital functions, medical treatment protocols, structural engineering dynamics, toxicology, security and team protection requirements as well as interpersonal dynamics and unified command functionality. The HERT team leader is not expected to be an expert. However, the individual assuming this position must have a general knowledge and understanding of the information presented by experts within the different organizational units.

- **Safety Officer (SO)**—Though a member of the HERT, the SO is directly responsible to the hospital incident command SO. The SO is responsible for observing all operations of the HERT and ensuring the safety of staff and patients.

- **Access Control Unit**—A major undertaking during emergency situations such as an MCI, HAZMAT, or CBRNE event is the ability to protect hospital personnel and the entrance to the ED and Emergency Treatment Area (ETA). This task requires effective perimeter, access, and parking lot control techniques. The Access Control Unit is led by the Access Control Unit leader who provides overall guidance and direction in ensuring tight and complete control of the external hospital setting and any associated property. Without these controls and security measures, any plan to protect the hospital, its employees, and patients will fail. The Access Control Unit ensures that lockdown or controlled access
protocols are enforced and access points are secured and controlled. A vital component of the security system is protection of the Heating, Ventilating, and Air Conditioning (HVAC) intake vents. It is crucial that these intake vents be protected and secured during events where the possibility exists of contaminating the ventilation system either by accidental introduction to the system or as an intentional act. The Access Control Unit ensures that chain-of-custody procedures are met and that items considered possible evidence are correctly processed and secured. The size of the Access Control Unit depends on the size of the hospital’s grounds, the numbers of individuals necessary to secure all areas, and the number of security personnel available. Hospital staff not needed for other assignments may be assigned as security personnel. The unit may enlarge and be redesignated to a Security Branch with the assignment of individuals from the crowd control and traffic control units.

- Casualty Care Unit—Initiates primary treatment actions and performs secondary triage of patients. This group must be able to function cohesively in the delivery of critical and lifesaving medical care, and must be able to adapt to situational dynamics. The group can expect to handle ambulatory and nonambulatory patient loads, which can be physically and mentally demanding. The treatment group is composed of hospital medical staff or Emergency Medical Technician (EMT)-certified individuals. This position is the first location that patients receive the beginnings of definitive medical care. The treatment group would consist of at least three different teams—postdecontamination ambulatory treatment team, postdecontamination nonambulatory treatment team, and green tag treatment team.

The Casualty Care Unit Leader (CCUL) should be a medical doctor with an emergency treatment specialty. This supervisor provides for a coordinated and appropriate treatment care action plan. The individual in this position will encounter numerous challenges associated with an MCI, HAZMAT, and CBRNE event. These challenges will require attention to detail and a knowledgeable background ensuring effective treatment management. The dynamics of the event, along with limited information on the specific substance involved, make specific treatment actions difficult to define. The CCUL directs and controls the treatment area and team members assigned to this group. This supervisor is in constant communication with an emergency team at the actual event site. This critical link provides the treatment supervisor with the most current information on the substances involved and circumstances surrounding patient exposures. The Casualty Care Unit, comprising the ETA, consists of the following units:
- Patient registration team—Handles registration of all patients, issuance of decontamination kits, and capture of operations information. The patient registration team works with the hospital’s HICS administration section to ensure that all patients moving through the ETA are identified. Registration information is forwarded to the Hospital Command Center (HCC) as patients are processed into the hospital. The patient registration team leader advises the HERT team leader on all matters concerning the registration team and works with the HICS Planning Section to ensure capture of all necessary documentation.

- Triage team—Provides initial triage of all patients. Once patients are triaged, they will move on to decontamination or noncontaminated separation areas. Casualty care team size will vary depending on the size of the incident and the number of expected casualties. Triage team members will normally consist of nonmedical and medical personnel other than nurses and doctors. The professional medical personnel will be working in the follow-up medical area and inside the hospital. Triage team members must constantly train to conduct Simple Triage and Rapid Treatment (START) and JumpSTART triage protocols. They must be capable of working the high-stress environment of numerous seriously injured patients. The Casualty Care Unit leader oversees the triage area and team members and may be a doctor or an emergency care nurse. The individual must have knowledge of triage procedures, medical trauma, and patient care.

Performing triage is a difficult and stressful task practiced throughout the medical community. Triage of medically contaminated patients in an MCI is even more difficult and stressful because of the need to work extremely quickly while wearing PPE. Unit members must be thoroughly trained and become proficient in this skill.

Triage while wearing PPE will restrict certain senses that medical personnel typically use. Even though medical personnel have been trained to use blood-borne pathogen protection over the years, use of PPE designed to protect from highly toxic and dangerous substances poses significant challenges. Team members generally wear two or more sets of gloves with an outer work glove, bulky oversized boots or booties, restrictive outer garments, and respiratory protection that confines and restricts visual, auditory, and respiratory functions.

Triage members are the hospital’s primary defense and provide critical screening of first-arrival patients. Their abilities and skills will enhance the ETA in processing
patients effectively and efficiently, thus reducing patient apprehension and possible patient backlogging at the patient reception area. The Triage team needs to minimize any disturbance that may manifest itself if the crowd of patients feels they are not receiving prompt care. Clear, effective communications with arriving patients and efficient processing are critical.

- **Victim Decontamination Unit**—Establishes and operates decontamination stations along with follow-up monitoring and survey points. This group consists of individual teams for each of the different decontamination lines. Each line includes a team leader and team members. The team leader and team members will normally be nonmedical hospital staff. The number of decontamination team members will be determined by the size of the decontamination area and the number of decontamination lines established. There should be a minimum of two assistants in each undressing area, two assistants in each decontamination rinse and shower area, sufficient survey personnel to quickly and efficiently handle the number of patients leaving the decontamination shower, and two assistants in the dressing area. For nonambulatory patients, there must be three HERT members per patient being decontaminated to ensure no cross-contamination occurs. The Victim Decontamination Unit leader is responsible for all aspects of the decontamination area within the ETA. This individual provides direction and leadership by ensuring equipment is properly and efficiently established, and verifies that proper PPE is being utilized for the suspected contaminant. This person provides oversight of the decontamination process and enforces protocols as established for the event. The patient decontamination group supervisor oversees decontamination of all patients, HERT and hospital staff, and all contaminated equipment. The patient decontamination group supervisor should communicate routinely the status of the decontamination process to the HERT leader and be prepared to adapt to the situation. This individual must be thoroughly knowledgeable of hazardous materials, chemicals, and decontamination techniques and substances.

The Victim Decontamination Unit is the core of HERT organization. Unit members should be well versed and comfortable with operating in the decontamination corridor. Personnel in this position should receive sufficient training and practice to ensure a highly coordinated and functional group. Members should be physically and mentally prepared to operate in restrictive protective garments and uncomfortable conditions for long periods of time. The effectiveness of this group is a key element in protecting the hospital, patients, and support personnel from unnecessary
contamination. The patient decontamination team processes patients through the decontamination system, ensures that removal of contamination is complete, and maintains the flow of patients from the reception area into the hospital setting.

Depending on the size of the incident and the expected numbers of patients, additional support may be necessary. This additional support may be provided from the hospital staff or by outside organizations. Some organizations that may provide support to the HERT include:

- Law enforcement—May be provided by the local jurisdiction or by higher government levels depending on the size of the incident and what is available to the local jurisdiction Emergency Operations Center (EOC) and the assigned IC. Law enforcement may be assigned to help with providing facility security, evidence preservation and collection, apprehension, and chain-of-custody issues.

- Maintenance team—Their expertise in response actions and familiarity with the utilities and ventilation systems make this team an invaluable resource. The maintenance team ensures all response equipment is deployed and functional for the event. They may function in the HERT decontamination corridor to ensure hazard control and containment of collected run-off water is accomplished during and after the event. They play a critical role in ensuring the HVAC intake system is secured and controlled.

- PIO—The HICS PIO may assign a PIO or a PIO team to assist the HERT in managing the media. The PIO will address media requests and work with the media to protect the privacy of patients. Additionally, the PIO will ensure that the media is able to obtain the necessary information to present accurate information to the public.

- Social services group—Provides information and support when patients’ families arrive onscene during an incident response. This group will establish a separate area, away from the ETA, to assemble family members. The social services group supervisor will cooperate with the HERT team leader to obtain information concerning patients and provide the patients’ families with that information.

- HAZMAT team—The hospital’s HAZMAT team may provide a group to the HERT for the time necessary to identify an unknown contaminant. The HAZMAT group has the unique capability to identify nonbiological contaminants and to collect biological samples that can be forwarded to a medical laboratory within the hospital for identification.
Enabling Objective 1-5: Identify in order the procedures for activation of the HERT in response to an MCI involving contamination

HERT Activation Procedures

The HERT activation and operation plan should be highlighted, reviewed, practiced, exercised, and revised routinely as it is the most essential part of a hospital’s response to an MCI. This plan addresses the notification of personnel and provides a listing of trigger events for activating those assets. The plan includes team organization, activation, operating procedures, and deactivation requirements.

Notification Procedures

HERT activation procedures are an important part of the plan. The following areas should be addressed within the HERT activation portion of the plan:

- Establish notification procedures—Could include the hospital public address system, beepers, and cell phones. A recall system should be established with names and phone numbers for off-duty personnel.

- Staging area—An assembly area must be designated and all members must know where to report when responding to notification. All section members, including those in charge of making the notifications, should report to the same location.

- Scheduling conflict management—Priority of work must be established. It would not be unusual for members of the HERT to be performing essential services within their normal job assignments when receiving the emergency notification call.

- Verification of callout—There must be a system of call backs or signal words that serve as callout verification. If a verification system is not in place, pranks could lead to problem situations. This process will reduce or eliminate potential prank callouts.
• Alert roster/standby list—An alert roster/standby list should be maintained by the section designated to provide notification. As it is not unusual for a recall roster to become quickly out-of-date, all department and group leaders must be required to update the list on a scheduled short-term basis.

• HERT family care—Individuals cannot be expected to respond to an MCI call if there is any chance their immediate family will be in danger. The hospital must support team members by planning for immediate family care. This may result in bringing families to the hospital, providing some other evacuation, or providing protective support.

• Standby teams—How many individuals and teams will remain on standby and when will standby teams be notified? How long will standby teams remain active and where will standby personnel report and stage until needed? Standby teams will become important as the incident response extends into hours or days. It is very difficult to work in PPE for long periods of time. Depending on the temperature and weather conditions at the time, HERT members will need to be replaced at intervals ranging from every 30 minutes to several hours. Members may need replacement as they become overwhelmed by the event.

Initial Response Actions

When an MCI or other emergency occurs requiring HERT activation, the hospital is the first step in response. The hospital immediately activates the HICS and command center. Either the person in charge of hospital operations or the IC should obtain information on the incident and make the determination to activate the HERT. Notification procedures are followed and HERT members are activated. The following steps are involved in activating the HERT:

• The IC obtains detailed information on size of the event, wind direction, and other pertinent data. He or she then designates the ETA location with input from the HERT leader and ETA supervisor.

• Team members report to their respective assembly areas.

• The HERT leader works with the security branch director to determine the locations of areas (e.g., restricted areas, vehicle access routes, family gathering area, media gathering area, green tag patient area, and noncontaminated patient area). Once these areas have
been designated, the security members establish barriers and security to enforce the designated areas.

- Designated maintenance personnel open HERT supplies and distribute them to the designated ETA location.

- The IC designates the PPE level for HERT members and sends that information to the HERT leader.

- HERT personnel don the appropriate level of PPE. If time permits, they assist in setting up equipment; otherwise, maintenance personnel establish the ETA.

- As soon as sufficient personnel and equipment are established in the ETA, response and treatment operations begin.

Conclusion

The HERT is the primary hospital defense and preliminary medical care provider for patients arriving from an MCI prior to entry into and through the ED. Every HERT member is valuable in protecting the hospital and its staff and in treating the injured. Members of the HERT must understand their responsibilities and the importance of PPE. Wearing proper PPE and donning it correctly will protect the wearer from contamination being brought to the facility by the patients of an MCI.
TABLE 1.
Hospital Decontamination Zone
Conditions Necessary for Hospitals to Rely on the Personal Protective Equipment (PPE) Selection Presented in Table 3.\textsuperscript{A,B}

1. Thorough and complete hazard vulnerability analysis (HVA) and emergency management plan (EMP), which consider community input, have been conducted/developed, and have been updated within the past year.

2. The EMP includes plans to assist the numbers of victims that the community anticipates might seek treatment at this hospital, keeping in mind that the vast majority of victims may self-refer to the nearest hospital.

3. Preparations specified in the EMP have been implemented (e.g., employee training, equipment selection, maintenance, and a respiratory protection program).

4. The EMP includes methods for handling the numbers of ambulatory and non-ambulatory victims anticipated by the community.

5. The hazardous substance was not released in close proximity to the hospital, and the lapse time between the victims' exposure and victims' arrival at the hospital exceeds approximately 10 minutes, thereby permitting substantial levels of gases and vapors from volatile substances time to dissipate.\textsuperscript{C}

6. Victims' contaminated clothing and possessions are promptly removed and contained (e.g., in an approved hazardous waste container that is isolated outdoors), and decontamination is initiated promptly upon arrival at the hospital. Hospital EMP includes shelter, tepid water, soap, privacy, and coverings to promote victim compliance with decontamination procedures.

7. EMP procedures are in place to ensure that contaminated medical waste and wastewater do not become a secondary source of employee exposure.

And

8. The decontamination system and pre-decontamination victim waiting areas are designed and used in a manner that promotes constant fresh air circulation through the system to limit hazardous substance accumulation.\textsuperscript{D} Air exchange from a clean source has been considered in the design of fully enclosed systems (i.e., through consultation with professional engineer or certified industrial hygienist) and air is not re-circulated.

\textsuperscript{A} The Hospital Decontamination Zone includes any areas where the type and quantity of hazardous substance is unknown and where contaminated victims, contaminated equipment, or contaminated waste may be present. It is reasonably anticipated that employees in this zone might have exposure to contaminated victims, their belongings, equipment, or waste. This zone includes, but is not limited to, places where initial triage and/or medical stabilization of possibly contaminated victims occur, decontamination waiting (staging) areas for victims, the actual decontamination area, and the post-decontamination victim inspection area. This area will typically end at the emergency department (ED) door. In other documents, this zone is sometimes called the "Warm Zone."

\textsuperscript{B} Hospitals that do not meet these conditions must use more protective PPE or conduct a detailed hazard assessment to support a different selection.

\textsuperscript{C} Note: Georgopoulos et al. (2004) suggest that "recognition of an event, identification of transportation means, and transportation to a healthcare facility are not expected to take less than 5 minutes even under ideal circumstances." The 10-minute (approximate) lag time can be reasonably assumed during a mass casualty event, involving chemical release, except in cases where the release occurs immediately adjacent to the hospital (e.g., at a chemical facility next door to the hospital). This number of minutes is approximate and intended to provide guidance regarding what might be considered "immediately adjacent."

\textsuperscript{D} Georgopoulos et al. (2004) recommend using fans to provide air movement.
TABLE 2.  
**Hospital Post-decontamination Zone**  
Conditions Necessary for Hospitals to Rely on the Personal Protective Equipment (PPE) Selection Presented in Table 3

1. Emergency management plan (EMP) is developed and followed in a way that minimizes the emergency department (ED) personnel’s reasonably anticipated contact with contaminated victims (e.g., with drills that test communication between the hospital and emergency responders at the incident site to reduce the likelihood of unanticipated victims).

2. Decontamination system (in the Hospital Decontamination Zone) and hospital security can be activated promptly to minimize the chance that victims will enter the ED and contact unprotected staff prior to decontamination.

3. EMP procedures specify that unannounced victims (once identified as possibly contaminated) disrobe in the appropriate decontamination area (not the ED) and follow hospital decontamination procedures before admission (or re-admission) to the ED.

4. Victims in this area were previously decontaminated by a shower with soap and water, including a minimum of 5 minutes under running water. Shower instructions are clearly presented and enforced. Shower facility encourages victim compliance (e.g., shelter, tepid water, reasonable degree of privacy).

5. EMP procedures clearly specify actions ED clerks or staff will take if they suspect a patient is contaminated. For example: 1) do not physically contact the patient, 2) immediately notify supervisor and safety officer of possible hospital contamination, and 3) allow qualified personnel to isolate and decontaminate the victim.

And

6. The EMP requires that if the ED becomes contaminated, that space is no longer eligible to be considered a Hospital Post-decontamination Zone. Instead, it should be considered contaminated and all employees working in this area should use PPE as described for the Hospital Decontamination Zone (see Table 3).

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1 The Hospital Post-decontamination Zone is an area considered uncontaminated. Equipment and personnel are not expected to become contaminated in this area. At a hospital receiving contaminated victims, the Hospital Post-decontamination Zone includes the ED (unless contaminated). In other documents this zone is sometimes called the “Cold Zone.”

2 Hospitals that do not meet these conditions must use more protective PPE or conduct a detailed hazard assessment to support a different selection.
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### TABLE 3.

Minimum Personal Protective Equipment (PPE)

for Hospital-based First Receivers of Victims from Mass Casualty Incidents

Involving the Release of Unknown Hazardous Substances

<table>
<thead>
<tr>
<th>ZONE</th>
<th>MINIMUM PPE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hospital Decontamination Zone</strong></td>
<td>- Powered air-purifying respirator (PAPR) that provides a protection factor of 1,000. The respirator must be NIOSH-approved.</td>
</tr>
<tr>
<td>(Includes, but not limited to, any of the following employees: decontamination team members, clinicians, set-up crew, cleanup crew, security staff, and patient tracking clerks.)</td>
<td>- Combination 99.97% high-efficiency particulate air (HEPA)/organic vapor/acid gas respirator cartridges (also NIOSH-approved).</td>
</tr>
<tr>
<td><strong>Hospital Post-decontamination Zone</strong></td>
<td>- Normal work clothes and PPE, as necessary, for infection control purposes (e.g., gloves, gown, appropriate respirator).</td>
</tr>
<tr>
<td>(All employees in this zone)</td>
<td>- Chemical resistant suit.</td>
</tr>
<tr>
<td></td>
<td>- Head covering and eye/face protection (if not part of the respirator).</td>
</tr>
<tr>
<td></td>
<td>- Chemical protective boots.</td>
</tr>
<tr>
<td></td>
<td>- Suit openings sealed with tape.</td>
</tr>
</tbody>
</table>

Note: This table is part of, and intended to be used with, the document entitled OSHA Best Practices for Hospital-based First Receivers of Victims from Mass Casualty Incidents Involving the Release of Hazardous Substances.

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1. The Hospital Decontamination Zone includes any area where the type and quantity of hazardous substance are unknown and where contaminated victims, contaminated equipment, or contaminated areas may be present. It is reasonably anticipated that employees in this zone might have exposure to contaminated victims, their belongings, equipment, or waste. This zone includes, but is not limited to, areas where initial triage and medical stabilization of possibly contaminated victims occur, decontamination waiting (staging) areas for victims, the actual decontamination area, and the post-decontamination victim inspection area. This area will typically end at the emergency department (ED) door.

2. The Hospital Post-decontamination Zone includes any area. As a hospital receiving contaminated victims, the Hospital Post-decontamination Zone includes the ED (unless contaminated).

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When the hospital is not the release site, the quantity of contaminants is limited to the amount associated with the victims.

If a hospital is specifically responding to a known hazard, the hospital must ensure that the selected PPE adequately protects the employees from the identified hazard. Thus, hospitals may augment or modify the PPE in Table 3 if the specified PPE is not sufficient to protect employees from the identified hazard. Alternatively, if a hazard assessment demonstrates that the specified PPE is not necessary to effectively protect workers from the identified hazard, a hospital would be justified in selecting less protective PPE, as long as the PPE actually selected by the hospital provides effective protection against the hazard.

OSHA recently proposed an assigned protection factor (APF) of 1,000 for certain designs of hood-style PAPRs (Federal Register, 2005). An OSHA memorandum, which provides interim guidance pending the conclusion of the APF rulemaking, listed several PAPR hood-style respirators that are being assigned an APF of 1,000 for protection against particulates in the pharmaceutical industry (OSHA, 2002c; Memo for RA). The American National Standards Institute (ANSI), in Standard Z88.2 on Respiratory Protection, also indicates an APF of 1,000 for certain PAPRs. A hooded-style PAPR provides greater skin protection, less user acceptance, and does not require fit testing under 29 CFR 1910.134. Thus, it might be preferred over a tight-fitting respirator. However, a tight-fitting full-facepiece PAPR might offer more protection in the event of PAPR battery failure.

Hospitals must use NIOSH-approved CBRN (chemical, biological, radiological, and nuclear) respirators, as they become available, when the HVA reveals a potential WMD threat. Until NIOSH completes its CBRN certification process for PAPRs, use PAPRs that have been tested by the manufacturer for a CBRN environment.

Material for protective gloves, clothing, boots, and hoods must protect workers against the specific substances that they reasonably might be expected to encounter. However, given the broad range of potential contaminants, OSHA considers it vitally important that hospitals also select PPE that provides protection against a wide range of substances. No material will protect against all possible hazards.
References


Lesson Administrative Page

Summary: This module provides an overview of the Hospital Incident Command System (HICS), its establishment and operation, and the correlation of HICS to the Incident Command System (ICS) as mandated by the National Incident Management System (NIMS).

Terminal Learning Objective:

At the conclusion of this module, the healthcare responder will be able to summarize the organization and operation of HICS as it integrates with the ICS during response to a Mass Casualty Incident (MCI).

Enabling Objectives:

At the conclusion of this module, the healthcare responder will be able to:

2-1 Identify the organization of HICS and how it integrates with the requirements of ICS
2-2 Recognize incident management tools and techniques used by HICS during response to a preplanned or unplanned incident
2-3 Identify HICS activation and response requirements during the initial phases of an MCI
2-4 Establish a HICS in response to an MCI involving contamination

Risk Assessment: Low

Duration: 1.5 Hours

Method of Instruction: Facilitated seminar in a classroom environment followed by a facilitated small-group exercise

Instructor Ratio: 1:40 for facilitated seminar; 1:10 for small-group exercise
Enabling Objective 2-1: Identify the organization of HICS and how it integrates with the requirements of ICS

HICS Organization and ICS

As the first receiver of injured individuals from any incident, the hospital must be able to seamlessly interact with all other response agencies and the local jurisdiction emergency management system. The federally mandated NIMS provides this seamless interaction. NIMS includes ICS as its Command and Control system. California’s Emergency Medical Services Authority (EMSA) modified its widely accepted Hospital Emergency Incident Command System (HEICS) version III to meet the requirements of both NIMS and ICS. The revised version was issued as the HICS. Though not mandated for use, acceptance of HICS by a hospital ensures meeting the command portion of NIMS compliance and alleviates the necessity for the hospital to establish its own command system compatible with ICS. HICS, as currently designed, provides the following advantages:

• Intended for emergency and nonemergency events
• Standardized configuration for use by all size hospitals
• Scalable Incident Management Team (IMT) design
• Job Action Sheets (JAS) provide guidance for the roles and responsibilities assigned to specific positions
• Includes a variety of planning and response tools including the following:
  - Incident Planning Guides (IPG)
    - Based on the National Planning Scenarios and internal incidents that pose challenges to healthcare systems
    - Provide preincident considerations from the four phases of Comprehensive Emergency Management (CEM)
  - Incident Response Guides (IRG)

Notes
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- Complement the IPG by providing actions that may be considered in the immediate, intermediate, extended, and demobilization phases of the response

  - Standardized forms

  - Twenty ICS forms, based on the accepted FEMA documents, that have been adapted specifically for hospital response

- Integrates response to Chemical, Biological, Radiological, Nuclear, or Explosives (CBRNE) events into the management structure

  - Technical specialist roles to assist in the Command, Planning, and Operations Sections may be developed into the IMT

- Ready to be used with a standardized curriculum and teaching aids

- Clarifies the components of HICS and its relationship to NIMS

- NIMS compliance allows the hospital to become eligible for receiving federal preparedness funding

- Integrates hospitals with community response agencies such as Emergency Medical Services (EMS), public health, law enforcement, fire agencies, nongovernmental, federal, and all community partners using the ICS

- Assists hospitals in meeting The Joint Commission’s Emergency Management Standards

Notes
HICS Components

HICS employs the standardized concepts of ICS, including command organization, terminology, forms, communications, and approaches so that any hospital can better coordinate with external partners. The primary components of HICS are as follows:

- Guidebook—The HICS Guidebook is available from the Center for HICS Education and Training website: www.hicscenter.org and the EMSA website: http://www.emsa.ca.gov/HICS/default.asp. This guidebook consists of two components—operational information and HICS training curriculum.

- IMT Chart—Provides a listing of the Command Staff and General Staff organizational positions throughout the immediate, intermediate, extended, and demobilization phases.

- Job Action Sheets (JAS)—Provides guidance for individuals assigned to a position identified within the IMT.

- HICS forms—Twenty ICS forms have been modified to meet the specific needs of a hospital. However, these forms were crafted to remain consistent with community response agency ICS forms to ensure community-wide compatibility.

- Scenarios, IPG and IRG—There are 27 disaster scenarios included in the HICS materials. These scenarios address 14 external and 13 internal hazards; each providing a short scenario narrative, an IPG (check list for hazard-specific planning activities), an IRG (hazard-specific response activities) and suggested IMT position recommendations for the following operational periods: immediate, intermediate, extended, and recovery.

- Glossary—Provides an abbreviated listing of emergency management-related terms and definitions for use within the healthcare community.

HICS Command and Control

Management functions used for HICS correspond to ICS employed by other response agencies. For example, in ICS, the Incident Commander (IC) oversees both the Command Staff and General Staff.
• Command Staff—Includes the hospital IC, Public Information Officer (PIO), Liaison Officer, Safety Officer (SO), and any medical/technical specialists needed for the response.

• General Staff—Includes positions within each of the following four ICS Sections:

  – Planning Section—Collects, tracks, documents, plans, and manages information and resources. This section plans current and future operations for the response and recovery periods. A critical function within planning includes the gathering and validation of incident intelligence information.

  – Logistics Section—Ensures the Operations Section has all resources necessary to meet operational objectives. The Logistics Section is responsible for overseeing the receipt, distribution, storage, and ordering of all supplies needed during response and recovery.

  – Operations Section—Oversees the tactical execution of incident goals and objectives. Includes medical care, infrastructure, Hazardous Materials (HAZMAT), security and business continuity branches.

  – Finance/Administration Section—Responsible for tracking and approving expenditures, claims, and costs.

HICS lists 78 positions and uses the same levels of identification as ICS. HICS key positions in order of precedence are as listed below:

• IC

• Command Staff

• Section Chiefs

• Branch Directors

• Unit Leaders

• Managers (Planning Section)
HICS is designed as a position-driven system, not a person-driven system. That is, using management by objectives; positions are only activated as needed to complete operational period objectives. The most qualified individual, rather than the most senior should be assigned a position to ensure the best operational response.

A good method to visually identify HICS assignments is the use of vests with IMT titles. When the hospital command center is activated, the individual dons the vest for easy identification by others.

The first person to identify the need for an incident response becomes the IC until relieved by either the preassigned HICS IC or another more appropriate person. Change of command is accomplished when the assigned IC has an understanding of the incident response and is ready to assume control. When there is a change of IC, everyone within the hospital command center and activated community partners should be informed.

HICS and the Hospital Command Center (HCC) are activated when triggering events necessitate facility-wide incident coordination. In all activations, the IC is the first position activated and assumes command of all aspects of the response until other positions are deemed necessary and are activated. Individuals who are activated report to the next person above them on the IMT. Unity of command clearly states that each person reports to only one supervisor. However, it is important to consider that span of control suggests any position activated should assume responsibility for only three-to-seven subordinates, with the optimum of five. When span of control is reached, additional branches and/or units may be activated to maintain the optimal control.

Enabling Objective 2-2: Recognize incident management tools and techniques used by HICS during response to a preplanned or unplanned incident

Incident Management Characteristics

Within the ICS framework, all incidents are managed by the establishment of objectives that are clearly communicated to all involved parties. Control objectives are higher-level goals that remain consistent throughout an incident. For example, “ensuring patient safety” or “maintain communication capability” would be considered control objectives. In contrast, operational period objectives are tactical goals that guide the operational response. For example, “implement patient decontamination plans” or “activate satellite telephone system” would be considered operational period objectives. These latter objectives may change throughout an incident and are
Hospital Incident Command System

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re-evaluated during each operational period. Tactical objectives are written to guide responders and should be accomplished within the operational period. They are recorded on HICS Form 202: Incident Objectives (an example of this form is provided at the end of this module) and should be clearly communicated to all response personnel, as well as collaborating agencies.

Operational period objectives should be task oriented and have the following Specific, Measurable, Action-oriented, Realistic, Time-sensitive (SMART) characteristics:

- Specific—Wording must be precise and unambiguous in describing the objective.
- Measurable—Design and statement of objectives should make it possible to conduct a final accounting as to whether objectives were achieved.
- Action-oriented—Objectives must have an action verb that describes the expected accomplishments.
- Realistic—Objectives must be achievable with the resources that the agency (and assisting agencies) can allocate to the incident, even though it may take several operational periods to accomplish them.
- Time-sensitive—Timeframe should be specified.

Incident Action Planning

Effective planning processes are a critical component within all phases of emergency management. Planning can reduce impacts caused by an event such as staff and patient injuries/disabilities and recovery costs. In addition, planning increases overall response effectiveness by improving use of resources, enhancing communications, providing clearer direction and limiting potential duplicative efforts.

Incident action planning occurs during the response and recovery phases and is simply establishing incident objectives with an ordered sequence of actions to be completed within a specific timeframe. IAPs serve as guides for incident responses, clearly identifying the overall mission and goals of each response.

The cornerstone of incident action planning is “management by objective.” That is, once the incident objectives are established, personnel are assigned and resources are marshaled to fulfill the objective. Incident objectives are best determined by individuals who understand the hospital mission and its Emergency Operations Plan (EOP), including capabilities, limitations, and
policies for response and recovery. In addition, consideration should be given toward coordination with community activities.

A written plan is preferable to an oral plan because it clearly demonstrates responsibility, helps protect the community or hospital from liability, and provides documentation when requesting local, state, and federal assistance. A written plan can also be used as a communication tool to bridge information and plans among the facility and external partners, including regional coordinating centers.

**Phases of Comprehensive Incident Action Plan**

Five primary phases should be followed in sequence to ensure a comprehensive Incident Action Plan (IAP). These phases are designed to enable the accomplishment of incident objectives within a specified period. The IAP must provide clear, strategic direction and a comprehensive listing of the tactical objectives, resources, reserves, and support required to accomplish each incident objective. The comprehensive IAP will state the sequence of events in a coordinated way for achieving multiple incident objectives (Department Homeland Security [DHS], 2004).

During the initial stages of incident management, a simple IAP must be developed and communicated through concise oral briefings. Frequently, the plan must be developed very quickly with incomplete information of the situation. As the incident management effort evolves over time, additional lead-time, staff, information systems, and technologies enable more detailed planning and cataloging events and lessons learned (DHS, 2004).

The five primary phases in the planning process as described by the NIMS are as follows (DHS, 2004):

1. Understand the situation—The first phase includes gathering, recording, analyzing, and displaying situation and resource information in a manner that will ensure the following:
   - A clear picture of the magnitude, complexity, and potential impact of the incident
   - The ability to determine the resources required to develop and implement an effective IAP
   - Complete HICS Form 201—Incident Briefing
2. Establish incident objectives and strategies—The second phase includes formulating and prioritizing incident objectives and identifying an appropriate response strategy. Incident objectives and strategies must conform to the legal obligations and management objectives of all affected agencies. Reasonable alternative strategies that will accomplish overall incident objectives are identified, analyzed, and evaluated to determine the most appropriate strategy for the situation at hand.

- Establish the first operational period (This is the time scheduled for completion of the initial set of incident objectives. It is usually set by the IC and does not conform to shift times. It can be long or short, depending on the intensity of the incident).

- Complete HICS Form 202—Incident Objectives

3. Develop the plan—The third phase involves determining tactical direction and the specific resources, reserves, and support requirements for implementing the selected strategy for one operational period. This phase is usually the responsibility of the IC who bases his or her decision on resources allocated to enable a sustained response. After determining the availability of resources, the IC develops a plan that makes best use of these resources. Prior to formal planning meetings, each member of the Command Staff and each functional Section Chief are responsible for gathering certain information to support these decisions. During the planning meeting, section chiefs develop the plan collectively.

- Complete HICS Form 203—Organizational Assignment List

- Complete HICS Form 204—Branch Assignment List (as necessary)

- Complete HICS Form 261—Incident Action Plan Safety Analysis

4. Prepare and disseminate the plan—The fourth phase involves preparing the plan in a format appropriate for the incident complexity level. For initial response, the format is a well-prepared outline for an oral briefing. For most incidents spanning multiple operational periods, the plan will be developed in writing to ensure appropriate operational briefings during shift changes or operational periods.

5. Evaluate and revise the plan—The planning process includes a requirement to evaluate planned events and check the accuracy of information to be used in planning for subsequent operational periods. The General Staff should regularly compare planned

Notes
Hospital Emergency Response Training for Mass Casualty Incidents

progress with actual progress. When deviations occur and new information emerges, that information should be included in the first step of the process used for modifying the current plan or developing the plan for the subsequent operational period.

HICS Forms

The HICS forms are intended to assist with documentation and allow ease of communication between healthcare organizations and community response agencies. The forms may be completed electronically or manually. A listing of the 20 available HICS forms is enclosed at the end of the module.

Enabling Objective 2-3: Identify HICS activation and response requirements during the initial phases of an MCI

Putting HICS into Operation

In addition to actual responses, HICS can be implemented for preplanned incidents such as a major sporting event or community celebration. When put into effect for planned events, the hospital administration determines the positions that must be activated based on the initial incident objectives. It is important to note that activating the hospital command center and establishing HICS positions for a planned event is a precautionary decision. It would normally be done when the possibility of an incident is considered real or as a test for of the hospital’s EOP.

When activating the command center for an actual response, the first several minutes will probably be very chaotic. Patients may arrive at the Emergency Department (ED) or the front door of the hospital before the hospital is aware that an incident has occurred. The first person to identify an incident will notify the hospital’s administration. The administration will then activate the command center. If the IC is in the facility, he or she immediately takes command. If the IC is not in the facility or cannot take immediate control, the senior person where the incident response is occurring takes command and becomes the IC. This individual may be the nurse in charge of the ED or a charge nurse on a floor.
The following are a few steps that might be included when activating a hospital command center and implementing HICS. For a more detailed review, refer to the *HICS Guidebook, Chapter 6—Life Cycle of an Incident*.

- Assume command and inform hospital personnel that the command center has been activated.

- Assess the incident from information known at the moment. The IMTs should be provided with the *HICS Guidebook* for guidance to determine the HICS positions that should be activated and notified for duty. All possible information will never be available. The IC must use what is known and make informed decisions.

- Establish the initial incident objectives and determine the first operational period. This plan will normally be unwritten at this stage of the incident. However, over time, the IAP will be formalized on either paper or electronic forms. The initial IAP will be an evaluation of what is needed to respond to the incident and directions given verbally by the IC to those who will meet the objectives.

- As soon as possible, the IC should designate an individual to take notes and gather information concerning what is being accomplished, supplies are being used, and other resources that may be needed. If necessary, Planning and Logistics Section personnel may assume this role.

- The Liaison Officer should contact the appropriate community response agency to receive all additional information and to notify them of command center activation. This may include the Liaison Officer at the incident scene, local EMS agency, public health department, Regional Health Coordination Center and/or the jurisdiction’s EOC. It is important for the hospital to integrate into the community Multiagency Command System (MAC) as soon as possible. Planning for potential hazards allows identification of the specific agencies that need to be contacted.

- Continue to collect information and support operations. Conduct periodic command meetings for coordinating strategies and resources. In addition, conduct section meetings. It is important to keep all response staff informed and focused on the response. As the situation changes, new objectives should be considered as well as additional personnel and operational periods.
When assuming any HICS position, be ready to make decisions and let those who implement the decisions know what is to be accomplished. When an incident is first identified, information is going to be limited. However, timely decisions that are coordinated with the IAP helps to maintain patient care services.

**Enabling Objective 2-4: Establish a HICS in response to an MCI involving contamination**

**Scenario:**

8:00 a.m.: You are working in the ED and just received a phone call from the 9-1-1 dispatch center: “all emergency services organizations (Police Department [PD], Fire Department [FD], EMS, and HAZMAT) are responding to an incident at the local post office.” Numerous individuals are said to be lying on the floor while others have been seen running from the building. Outside, there are more than 15 individuals lying on the ground in obvious distress. At the time of the incident, the post office was in the middle of the April 15th tax rush mailing.

**Scenario Update**

8:15 a.m.: Dispatch calls again. Mutual aid from the local PD and FD has been requested. Police and firefighters that rushed into the building are unconscious within and outside the building.

8:20 a.m.: Hospital administration just notified the ED that the predesignated HICS IC is not in the hospital and because of the time, no other senior individuals have reported to work.

8:25 a.m.: Fully dressed out fire HAZMAT responders arrive at the ED ambulance bay with victims in the back of a pick-up truck.

9:00 a.m.: Fire HAZMAT has tentatively identified the incident as an intentional release of some type of nerve agent. The agent is suspected to be sarin.

10:00 a.m.: A worker in the hospital laboratory has dropped a container of acid, which is now spreading throughout the laboratory.

**Notes**
Conclusion

HICS is the hospital version of ICS. It is fully compliant with NIMS and will help the hospital integrate with all other emergency responders during a disaster whether large or small. HICS is a complete system, providing organizational positions, documents, and guides for response. Though it is an integrated system, individuals must be trained in its use and understand what is expected of them within the system. This orientation session does not make anyone an expert on HICS, but it does introduce many of the important concepts.
Scenario List for HICS

External Scenarios

Scenario 01: Nuclear Detonation - 10-Kiloton Improvised Nuclear Device
Scenario 02: Biological Attack - Aerosol Anthrax
Scenario 03: Biological Disease Outbreak - Pandemic Influenza
Scenario 04: Biological Disease Outbreak - Plague
Scenario 05: Chemical Attack - Blister Agent
Scenario 06: Chemical Attack - Toxic Industrial Chemicals (TIC)
Scenario 07: Chemical Attack - Nerve Agent
Scenario 08: Chemical Attack - Chlorine Tank Explosion
Scenario 09: Natural Disaster - Major Earthquake
Scenario 10: Natural Disaster - Major Hurricane
Scenario 11: Radiological Attack - Radiological Dispersal Devices (RDD)
Scenario 12: Explosives Attack - Improvised Explosive Device (IED)
Scenario 13: Biological Attack - Food Contamination
Scenario 15: Cyber Attack

Internal Scenarios

Scenario 01: Bomb Threat
Scenario 02: Evacuation, Complete or Partial Facility
Scenario 03: Fire
Scenario 04: Hazardous Material (HAZMAT) Spill
Scenario 05: Hospital Overload
Scenario 06: Hostage/Barricade
Scenario 07: Infant/Child Abduction
Scenario 08: Internal Flooding
Scenario 09: Loss of Heating/Ventilation/Air Conditioning (HVAC)
Scenario 10: Loss of Power
Scenario 11: Loss of Water
Scenario 12: Severe Weather
Scenario 13: Work Stoppage

All-Hazards Planning Guide

Scenario annexes include IPG and IRG for each scenario
HICS Organizational Chart

Command Staff

Section Chiefs - General Staff
## OPERATIONS SECTION CHIEF

### Mission:
Develop and implement strategy and tactics to carry out the objectives established by the Incident Commander. Organize, assign, and supervise Staging, Medical Care, Infrastructure, Security, Hazardous Materials, and Business Continuity Branch resources.

### Immediate (Operational Period 0-2 Hours)

<table>
<thead>
<tr>
<th>Time</th>
<th>Initial</th>
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Receive appointment and briefing from the Incident Commander. Obtain packet containing Operations Section Job Action Sheets.

Read this entire Job Action Sheet and review incident management team chart (HICS Form 207). Put on position identification.

Notify your usual supervisor of your HICS assignment.

Determine need to appoint Staging Managers, Branch Directors, and Unit Leaders in Operations Section; distribute corresponding Job Action Sheets and position identification.

Complete the Branch Assignment List (HICS Form 204).

Brief Operations Section Branch Directors and Staging Manager on current situation and incident objectives; develop response strategy and tactics; outline Section action plan and designate time for next briefing.

Participate in Incident Action Plan preparation, briefings, and meetings as needed; assist in identifying strategies; determine tactics, work assignments, and resource requirements.

Obtain information and updates regularly from Operations Section Branch Directors and Staging Manager; maintain current status of all areas; inform Situation Unit Leader of status information.

Maintain communications with Logistics Section Chief and Staging Manager to ensure the accurate movement and tracking of personnel and resources to Staging Area.

Ensure Operations Section personnel comply with safety policies and procedures.

Document all key activities, actions, and decisions in an Operational Log (HICS Form 214) on a continual basis.

Document all communications (internal and external) on an Incident Message Form (HICS Form 213). Provide a copy of the Incident Message Form to the Documentation Unit.

### Intermediate (Operational Period 2-12 Hours)

<table>
<thead>
<tr>
<th>Time</th>
<th>Initial</th>
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<tbody>
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Communicate regularly with the Incident Commander, Public Information Officer and Liaison Officer; brief regularly on the status of the Operations Section.

Designate time(s) for briefings and updates with Operations Section leadership to develop or update the Section action plan.

August 2006
# Intermediate (Operational Period 2-12 Hours)

<table>
<thead>
<tr>
<th>Ensure the following are being addressed:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Section Staff health and safety</td>
</tr>
<tr>
<td>- Patient tracking</td>
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<tr>
<td>- Patient care</td>
</tr>
<tr>
<td>- Patient family support</td>
</tr>
<tr>
<td>- Interfacility transfers (into and from facility)</td>
</tr>
<tr>
<td>- Fatality management</td>
</tr>
<tr>
<td>- Information sharing with local EOC, public health, and law enforcement in coordination with the Liaison Officer</td>
</tr>
<tr>
<td>- Personnel and resource movement through Staging Area</td>
</tr>
<tr>
<td>- Documentation</td>
</tr>
</tbody>
</table>

| Initiate the Resource Accounting Record (HICS Form 257) to track equipment used during the response. |
| Schedule planning meetings with Branch Directors and Staging Manager to update the Section action plan and demobilization procedures. |
| Coordinate patient care treatment standards and case definitions with public health officials, as appropriate. |

| Ensure that the Operations Section is adequately staffed and supplied. |
| Coordinate personnel needs with Labor Pool & Credentialing Unit Leader, supply and equipment needs with the Supply Unit Leader, projections and needs with the Planning Section, and financial matters with the Finance/Administration Section. |
| Ensure coordination with any assisting or cooperating agency. |

# Extended (Operational Period Beyond 12 Hours)

| Continue to monitor Operations Section personnel’s ability to meet workload demands, staff health and safety, resource needs and documentation practices. |
| Continue to maintain the Resource Accounting Record (HICS Form 257) to track equipment used during the response. |
| Conduct regular situation briefings with Operations Section Branch Directors and Staging Manager. |

| Address issues related to ongoing patient care: |
| Ongoing patient arrival |
| Bed availability |
| Patient transfers |
| Patient tracking |
| Staff health and safety |
| Mental health for patients, families, staff, incident management personnel |
| Fatality management |
| Staffing |
| Staff prophylaxis |
| Medications |
| Medical equipment and supplies |
| Personnel and resource movement through Staging Area |
| Linkages with the medical community, area hospitals, and other healthcare facilities |
| Documentation |

August 2008
### Extended (Operational Period Beyond 12 Hours)

<table>
<thead>
<tr>
<th>Time</th>
<th>Initial</th>
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</thead>
<tbody>
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</tbody>
</table>

- Ensure your physical readiness through proper nutrition, water intake, rest, and stress management techniques.
- Observe all staff and volunteers for signs of stress and inappropriate behavior. Report concerns to the Employee Health & Well-Being Unit. Provide for staff rest periods and relief.
- Upon shift change, brief your replacement on the status of all ongoing operations, issues, and other relevant incident information.

### Demobilization/System Recovery

<table>
<thead>
<tr>
<th>Time</th>
<th>Initial</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- As needs decrease, return Operations Section staff to their usual jobs and combine or deactivate positions in a phased manner, in coordination with the Demobilization Unit Leader.
- Coordinate patient care restoration to normal services.
- Coordinate final reporting of patient information with external agencies through Liaison Officer and Public Information Officer.
- Work with Planning and Finance/Administration Sections to complete cost data information.
- Debrief staff on lessons learned and procedural/equipment changes needed.
- Upon deactivation of your position, brief the Incident Commander on current problems, outstanding issues, and follow-up requirements.
- Upon deactivation of your position, ensure all documentation and Operational Logs (HICS Form 214) are submitted to the Documentation Unit.
- Submit comments to the Incident Commander for discussion and possible inclusion in an after-action report; topics include:
  - Review of pertinent position descriptions and operational checklists
  - Recommendations for procedure changes
  - Section accomplishments and issues
- Participate in stress management and after-action debriefings. Participate in other briefings and meetings as required.

### Documents/Tools

- Incident Action Plan
- HICS Form 204 – Branch Assignment Sheet
- HICS Form 207 – Incident Management Team Chart
- HICS Form 213 – Incident Message Form
- HICS Form 214 – Operational Log
- HICS Form 257 – Resource Accounting Record
- Hospital emergency operations plan
- Hospital organization chart
- Hospital telephone directory
- Radio/satellite phone
Example of IPG

Internal Scenario 1

**BOMB THREAT**

INACCIDENT PLANNING GUIDE

Does your Emergency Management Plan Address the following issues?

<table>
<thead>
<tr>
<th><strong>Mitigation &amp; Preparedness</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Does your hospital maintain bomb threat procedures that are reviewed annually and revised as needed?</td>
<td></td>
</tr>
<tr>
<td>2. Does hospital have process to develop unified command with local law enforcement and/or FBI?</td>
<td></td>
</tr>
<tr>
<td>3. Does your hospital provide training to security and hospital personnel on how to recognize and respond to suspicious activity, including unidentified packages and persons exhibiting suspicious behavior?</td>
<td></td>
</tr>
<tr>
<td>4. Does your hospital have procedures for identifying and immediately removing unattended vehicles during bomb threats?</td>
<td></td>
</tr>
<tr>
<td>5. Does your hospital have a bomb threat kit (updated blueprints, floor plans, light sticks, pads, pencils, phone list, etc.) available?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Response &amp; Recovery</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Does your hospital have a procedure to conducting a thorough search of the entire facility and grounds?</td>
<td></td>
</tr>
<tr>
<td>2. Does your hospital have a plan to use non-electronic communication methods during a bomb threat because case electronic signals could detonate the bomb(s)?</td>
<td></td>
</tr>
<tr>
<td>3. Does your hospital have a procedure to rapidly lockdown the facility and ensure all access and egress points of the building and grounds are secured?</td>
<td></td>
</tr>
<tr>
<td>4. Does your hospital have plans for vertical and horizontal evacuation (e.g., department, floor, wing, and building) of the facility?</td>
<td></td>
</tr>
<tr>
<td>5. Does your hospital have a mechanism for initiating bomb threat procedures and for disseminating information throughout the facility without causing alarm or panic?</td>
<td></td>
</tr>
<tr>
<td>6. Does your hospital have a safe external evacuation area accessible to large vehicles, in case it becomes necessary to move patients and staff to another location?</td>
<td></td>
</tr>
<tr>
<td>7. Does your hospital coordinate with local law enforcement to secure facility and campus areas?</td>
<td></td>
</tr>
</tbody>
</table>
BOMB THREAT

INCIDENT RESPONSE GUIDE

Mission: To safely manage staff, patients, and visitors during a bomb threat or suspicious package situation.

Directions

☐ Read this entire response guide and review incident management team chart

☐ Use this response guide as a checklist to ensure all tasks are addressed and completed

Objectives

☐ Document all bomb threat information

☐ Immediate respond to the bomb threat when received or suspicious object is found

☐ Maintain security of the facility, consider lockdown and/or evacuation

☐ Control and inspect packages and materials entering critical areas for suspicious objects

☐ Maintain patient care services

☐ Ensure safety of the staff, patients, and visitors

Immediate (Operational Period 0-2 Hours)

COMMAND

(Incident Commander):

☐ Activate Command staff and Section Chiefs as appropriate

☐ Consider the possibility of a “dirty bomb” and evaluate/prepare for secondary radiation, chemical, and/or biological contamination

(Liaison Officer):

☐ Notify appropriate authorities of bomb threat and coordinate internal and external response agencies (e.g., law enforcement, bomb squad)

☐ Communicate with other healthcare facilities to determine:

• Situation status

• Surge capacity

• Patient transfer/bed availability

• Ability to loan needed equipment, supplies, medications, personnel, etc.
### Example of Community-Based IAP Form ICS

<table>
<thead>
<tr>
<th>INCIDENT BRIEFING</th>
<th>1. Incident Name</th>
<th>Simpson Command</th>
<th>2. Date</th>
<th>1 June 2005</th>
<th>3. Time</th>
<th>0750</th>
</tr>
</thead>
</table>

4. Map Sketch

**Special Note:**
Fire showing Chemical involved

![Map Sketch Image](image)

5. Current Organization

---

**Unified Incident Commander:**
- **Fire/HAZMAT/POLICE/EMS**
- **Safety Officer:** Martin Smith
- **Liaison Officer or Agency Representative:** Roselle Nickelson
- **Information Officer:** Grady

**Planning EOC**
- **Fire:** Public Works
- **Emergency:** EOC

**Operations EOC**
- **Fire:** Chief Larner

**Logistics EOC**
- **Legal**
- **Northwide Comptroller**

**Air**
- **Air Operations**
- **Air Support**
- **Air Attack**
- **Air Refueling**

---

6. Prepared by (Name and Position)
### Example of IAP Form ICS (continued)

#### 6. Resources Summary

<table>
<thead>
<tr>
<th>Resources Ordered</th>
<th>Resource Identification</th>
<th>ETA</th>
<th>On Scene</th>
<th>Location/Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire IA</td>
<td>IC</td>
<td>0747</td>
<td></td>
<td>UC Post</td>
</tr>
<tr>
<td>Type 1 Pumper</td>
<td>E-1, E-2, E-3</td>
<td>0743</td>
<td></td>
<td>Suppression</td>
</tr>
<tr>
<td>HAZMAT</td>
<td></td>
<td></td>
<td></td>
<td>HAZMAT/Monitoring/Decon</td>
</tr>
<tr>
<td>Fire Type II</td>
<td>E-10, E-11</td>
<td>0756</td>
<td></td>
<td>Evacuation</td>
</tr>
<tr>
<td>Police</td>
<td>102, 103, 104</td>
<td>0742</td>
<td></td>
<td>Investigations/Perimeter/Security</td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>105</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>201</td>
<td>0767</td>
<td></td>
<td>Special Ops - EOD, ESU</td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>108</td>
<td></td>
<td></td>
<td>Evacuation</td>
</tr>
<tr>
<td>EMS Type II</td>
<td>EMS-1, Med 1, 2, 3, 4</td>
<td></td>
<td></td>
<td>Triage / Treatment / Transport</td>
</tr>
</tbody>
</table>

#### 7. Summary of Current Actions

- Determine downwind hazards
- Fire suppression
- Investigate / Interview
- Casualty Collection / Treatment
- Scene security and safety
### Example of IAP Form ICS (continued)

<table>
<thead>
<tr>
<th>ORGANIZATION ASSIGNMENT LIST</th>
<th>Communications Unit</th>
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<tbody>
<tr>
<td></td>
<td>Medical Unit</td>
</tr>
<tr>
<td></td>
<td>Security Unit</td>
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<tr>
<td></td>
<td>Food Unit</td>
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</table>

<table>
<thead>
<tr>
<th>1. Incident Name</th>
<th>Simpson Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Date</td>
<td>1 June 2005</td>
</tr>
<tr>
<td>3. Time</td>
<td>0730</td>
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</table>

<table>
<thead>
<tr>
<th>4. Operational Period</th>
<th>0730 -</th>
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<table>
<thead>
<tr>
<th>5. Incident Commander and Staff</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Incident Commander</td>
<td>O'Hara</td>
</tr>
<tr>
<td>Deputy</td>
<td>Remington</td>
</tr>
<tr>
<td>Safety Officer</td>
<td>Martin, Smith</td>
</tr>
<tr>
<td>Information Officer</td>
<td>Grady</td>
</tr>
<tr>
<td>Liaison Officer</td>
<td>Roselle, Nickelson</td>
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</tbody>
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<thead>
<tr>
<th>6. Agency Representative</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Fire</td>
<td>O'Hara</td>
</tr>
<tr>
<td>Police</td>
<td>Remington</td>
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<tr>
<td>EMS</td>
<td>Lutz</td>
</tr>
<tr>
<td>Public Works</td>
<td>Williams</td>
</tr>
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<thead>
<tr>
<th>7. Planning Section</th>
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</thead>
<tbody>
<tr>
<td>Chief</td>
<td></td>
</tr>
<tr>
<td>Deputy</td>
<td></td>
</tr>
<tr>
<td>Resources Unit</td>
<td></td>
</tr>
<tr>
<td>Situation Unit</td>
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<tr>
<td>Documentation Unit</td>
<td></td>
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<tr>
<td>Demobilization Unit</td>
<td></td>
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<tr>
<td>Technical Specialists</td>
<td></td>
</tr>
<tr>
<td>Human Resources</td>
<td></td>
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<tr>
<td>Training</td>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>C. Branch III - Division/Groups</th>
<th>EMS</th>
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</table>

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<tr>
<th>8. Logistics Section</th>
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<tbody>
<tr>
<td>Chief</td>
<td></td>
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<tr>
<td>Deputy</td>
<td></td>
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<tr>
<td>Supply Unit</td>
<td></td>
</tr>
<tr>
<td>Facilities Unit</td>
<td></td>
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<tr>
<td>Ground Support Unit</td>
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</table>

<table>
<thead>
<tr>
<th>9. Operations Section</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chief</td>
<td>Larner</td>
</tr>
<tr>
<td>Deputy</td>
<td>Bolton</td>
</tr>
<tr>
<td>Police</td>
<td></td>
</tr>
<tr>
<td>Fire</td>
<td></td>
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<tr>
<td>a. Branch I - Division/Groups</td>
<td></td>
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<tr>
<td>Branch Director</td>
<td>Fire</td>
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<tr>
<td>Deputy</td>
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<tr>
<td>Division/Group</td>
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<tr>
<td>Fire</td>
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<td>b. Branch II - Division/Groups</td>
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<tr>
<td>Branch Director</td>
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<td>Division/Group</td>
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<tr>
<td>Police</td>
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<table>
<thead>
<tr>
<th>d. Air Operations Branch</th>
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<tbody>
<tr>
<td>Air Operations Branch Director</td>
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<tr>
<td>Air Attack Supervisor</td>
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<tr>
<td>Air Support Supervisor</td>
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<tr>
<th>10. Finance Section</th>
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<tbody>
<tr>
<td>Chief</td>
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<tr>
<td>Deputy</td>
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Example of Incident Briefing Form 201 HICS
HICS 201 – INCIDENT BRIEFING

PURPOSE: DOCUMENT INITIAL RESPONSE INFORMATION AND ACTIONS TAKEN AT STARTUP.

ORIGINATION: INCIDENT COMMANDER.

COPIES TO: COMMAND STAFF, SECTION CHIEFS, AND DOCUMENTATION UNIT LEADER.

INSTRUCTIONS:

Print legibly, and enter complete information.

1. INCIDENT NAME If the incident is internal to the hospital, the name may be given by the hospital’s Incident Commander. If the incident affects the larger community, the name may be given by a local authority (e.g., fire department, local EOC, etc.).

2. DATE OF BRIEFING Use the international standard date notation YYYY-MM-DD, where YYYY is the year, MM is the month of the year between 01 (January) and 12 (December), and DD is the day of the month between 01 and 31. For example, the fourteenth day of February in the year 2006 is written as 2006-02-14.

3. TIME OF BRIEFING Use the international standard notation hh:mm, where hh is the number of complete hours that have passed since midnight (00-24), and mm is the number of complete minutes that have passed since the start of the hour (00-59). For example, 5:04 PM is written as 17:04. Use local time.

4. EVENT HISTORY AND CURRENT ACTIONS SUMMARY Document input from Section Chiefs and affected leadership and/or organizations involved.

5. CURRENT ORGANIZATION Use proper names to identify personnel who are performing incident management functions as part of the HICS organization structure.

6. NOTES (INCLUDING ACCOMPLISHMENTS, ISSUES, WARNINGS/DIRECTIVES) Self-explanatory. Use blank space for maps and other diagrams.

7. PREPARED BY (NAME AND POSITION) Use proper name and HICS position title.

8. FACILITY NAME Use when transmitting the form outside of the hospital.

WHEN TO COMPLETE: Prior to briefing in the current operational period.

HELPFUL TIPS: Distribute copies to all staff before initial briefing.
### Example of Incident Objectives Form 202 HICS

**INCIDENT OBJECTIVES**

<table>
<thead>
<tr>
<th>1. INCIDENT NAME</th>
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<table>
<thead>
<tr>
<th>2. DATE PREPARED</th>
<th>3. TIME PREPARED</th>
<th>4. OPERATIONAL PERIOD / DATETIME</th>
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<tr>
<th>5. GENERAL COMMAND AND CONTROL OBJECTIVES FOR THE INCIDENT (INCLUDE ALTERNATIVES)</th>
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<tr>
<th>6. WEATHER / ENVIRONMENTAL IMPLICATIONS FOR PERIOD: (INCLUDE AS APPROPRIATE: FORECAST, WIND SPEED/DIRECTION, DAYLIGHT)</th>
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<tr>
<th>7. GENERAL SAFETY / STAFF MESSAGES TO BE GIVEN</th>
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</thead>
<tbody>
<tr>
<td>Examples: Personal Protective Equipment (PPE), Precautions, Case Definitions (refer to HICS 201 Incident Action Plan, Safety Analysis)</td>
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<tr>
<th>8. ATTACHMENTS (MARK IF ATTACHED)</th>
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</thead>
<tbody>
<tr>
<td>□ HICS 203 - Organization Assignment List</td>
</tr>
<tr>
<td>□ HICS 204 - Bench Assignment List</td>
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<tr>
<td>□ HICS 205 - Incident Communications Plan</td>
</tr>
<tr>
<td>□ HICS 206 - Medical Plan</td>
</tr>
<tr>
<td>□ HICS 207 - Facility System Status Report</td>
</tr>
<tr>
<td>□ HICS 208 - Incident Action Plan Safety Analysis</td>
</tr>
<tr>
<td>□ Traffic Plan</td>
</tr>
<tr>
<td>□ Incident Map</td>
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<tr>
<td>□ Other</td>
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</table>

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<tr>
<th>9. PREPARED BY (PLANNING SECTION CHIEF)</th>
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</table>

<table>
<thead>
<tr>
<th>10. APPROVED BY (INCIDENT COMMANDER)</th>
</tr>
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</tbody>
</table>

**Purpose:** Define objectives and issues for operational period, coordination, planning section chief.

Copies to: Command Staff, General Staff, and Documentation Unit Leader.
Hospital Incident Command System

Hospital Emergency Response Training for Mass Casualty Incidents

HICS 202 – INCIDENT OBJECTIVES

PURPOSE: DEFINE OBJECTIVES AND ISSUES FOR OPERATIONAL PERIOD.

ORIGINATION: PLANNING SECTION CHIEF.

COPIES TO: COMMAND STAFF, GENERAL STAFF, AND DOCUMENTATION UNIT LEADER.

INSTRUCTIONS:

Print legibly, and enter complete information.

1. INCIDENT NAME: If the incident is internal to the hospital, the name may be given by the hospital's Incident Commander. If the incident affects the larger community, the name may be given by a local authority (e.g., fire department, local EOC, etc.).

2. DATE PREPARED: Use the international standard date notation YYYY-MM-DD, where YYYY is the year, MM is the month of the year between 01 (January) and 12 (December), and DD is the day of the month between 01 and 31. For example, the fourteenth day of February in the year 2006 is written as 2006-02-14.

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4. OPERATIONAL PERIOD DATE/TIME: Identify the operational period during which this information applies. This is the time period established by the hospital's Incident Commander, during which current objectives are to be accomplished and at the end of which they are evaluated. For example, a 12-hour operational period might be 2006-08-16 18:00 to 2006-08-17 06:00.

5. GENERAL COMMAND AND CONTROL OBJECTIVES FOR THE INCIDENT (INCLUDE ALTERNATIVES)
   Use input from Section Chiefs and from affected leadership and/or organizations involved. Key questions to consider include: What is the problem? What are the obstacles? What resources are needed to address the objectives? What are considerations for the next operational period?

6. WEATHER / ENVIRONMENTAL IMPLICATIONS FOR PERIOD (INCLUDE AS APPROPRIATE: FORECAST, WIND SPEED/DIRECTION, DAYLIGHT) Document weather and environmental factors that could affect operations.

7. GENERAL SAFETY / STAFF MESSAGES TO BE GIVEN: Summarize decisions made during Command meetings to convey to staff. Refer to HICS 261, Incident Action Plan Safety Analysis, to identify safety messages.

8. ATTACHMENTS (MARK IF ATTACHED): Check boxes that correspond with the attachments to this form.

9. PREPARED BY (PLANNING SECTION CHIEF): Use proper name.

10. APPROVED BY (INCIDENT COMMANDER): The signature of the Incident Commander indicates approval of the objectives.

11. FACILITY NAME: Use when transmitting the form outside of the hospital.

WHEN TO COMPLETE: Prior to briefing in the current operational period.

HELPFUL TIPS: This document serves as a roadmap to incident management. Use this form during the initial operational period, and use updated versions prior to the beginning of subsequent operational periods. Refer to this form during briefings and debriefings.
HICS 202 – INCIDENT OBJECTIVES

PURPOSE: DEFINE OBJECTIVES AND ISSUES FOR OPERATIONAL PERIOD.

ORIGINATION: PLANNING SECTION CHIEF.

COPIES TO: COMMAND STAFF, GENERAL STAFF, AND DOCUMENTATION UNIT LEADER.

INSTRUCTIONS:

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**Listing of HICS Standard Forms**

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>201</td>
<td>Incident Briefing</td>
<td>Incident Commander</td>
</tr>
<tr>
<td>202</td>
<td>Incident Objectives</td>
<td>Section Chiefs</td>
</tr>
<tr>
<td>203</td>
<td>Organizational Assignment List</td>
<td>Resource Unit Leader</td>
</tr>
<tr>
<td>204</td>
<td>Branch Assignment List</td>
<td>Branch Directors</td>
</tr>
<tr>
<td>205</td>
<td>Communications Log</td>
<td>Communications Unit Leader</td>
</tr>
<tr>
<td>206</td>
<td>Staff Medical Plan</td>
<td>Support Branch Director</td>
</tr>
<tr>
<td>207</td>
<td>Organization Chart</td>
<td>Incident Commander</td>
</tr>
<tr>
<td>213</td>
<td>Incident Message Form</td>
<td>All Positions</td>
</tr>
<tr>
<td>214</td>
<td>Operational Log</td>
<td>Command Staff and General Staff</td>
</tr>
<tr>
<td>251</td>
<td>Facility System Status Report</td>
<td>Infrastructure Branch Director</td>
</tr>
<tr>
<td>252</td>
<td>Section Personnel Time Sheet</td>
<td>Section Chiefs</td>
</tr>
<tr>
<td>253</td>
<td>Volunteer Staff Registration</td>
<td>Labor Pool &amp; Credentialing Unit Leader</td>
</tr>
<tr>
<td>254</td>
<td>Disaster Victim/Patient Tracking Form</td>
<td>Patient Tracking Manager</td>
</tr>
<tr>
<td>255</td>
<td>Master Patient Evacuation Tracking Form</td>
<td>Patient Tracking Manager</td>
</tr>
<tr>
<td>256</td>
<td>Procurement Summary Report</td>
<td>Procurement Unit Leader</td>
</tr>
<tr>
<td>257</td>
<td>Resource Accounting</td>
<td>Section Chiefs</td>
</tr>
<tr>
<td>258</td>
<td>Hospital Resource Directory</td>
<td>Resource Unit Leader</td>
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<tr>
<td>259</td>
<td>Hospital Casualty/Fatality Report</td>
<td>Patient Tracking Manager</td>
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<td>260</td>
<td>Patient Evacuation Tracking Form</td>
<td>Inpatient Unit Leader, Outpatient Unit Leader, Casualty Care Unit Leader</td>
</tr>
<tr>
<td>261</td>
<td>Incident Action Plan Safety Analysis</td>
<td>Safety Officer</td>
</tr>
</tbody>
</table>
HICS Job Action Sheet Assignments

Incident Commander
Public Information Officer
Safety Officer
Liaison Officer
Medical/Technical Specialist—Biological/Infectious Disease
Medical/Technical Specialist—Chemical
Medical/Technical Specialist—Radiological
Medical/Technical Specialist—Clinic Administration
Medical/Technical Specialist—Hospital Administration
Medical/Technical Specialist—Legal Affairs
Medical/Technical Specialist—Risk Management
Medical/Technical Specialist—Medical Staff
Medical/Technical Specialist—Pediatric Care
Medical/Technical Specialist—Medical Ethicist
Operations Section Chief
Staging Manager
Personnel Staging Team Leader
Vehicle Staging Team Leader
Equipment/Supply Staging Team Leader
Medication Staging Team Leader
Medical Care Branch Director
Inpatient Unit Leader
Outpatient Unit Leader
Casualty Care Unit Leader (Equivalent to the Casualty Care Team leader in HERT)
Mental Health Unit Leader
Clinical Support Services Unit Leader
Patient Registration Unit Leader (Equivalent to the Patient Registration Team Leader in HERT)
Infrastructure Branch Director
Power/Lighting Unit Leader
Water/Sewer Unit Leader
HVAC Unit Leader
Buildings/Grounds Damage Unit Leader
Medical Gases Unit Leader
Medical Devices Unit Leader
Environmental Services Unit Leader
Food Services Unit Leader
Hazardous Materials Branch Director
Detection And Monitoring Unit Leader
Spill Response Unit Leader
Patient Decontamination Unit Leader
Facility/Equipment Decontamination Unit Leader
Security Branch Director (Equivalent within the HERT is the Security Group Supervisor)
Access Control Unit Leader
Crowd Control Unit Leader
Traffic Control Unit Leader
Search Unit Leader
Law Enforcement Interface Unit Leader
Business Continuity Branch Director
Information Technology Unit Leader
Service Continuity Unit Leader
Records Preservation Unit Leader
Personnel Tracking Manager
Materiel Tracking Manager
Situation Unit Leader
Patient Tracking Manager
Bed Tracking Manager
Documentation Unit Leader
Demobilization Unit Leader
Logistics Section Chief
Service Branch Director
Communications Unit Leader
Information Technology/Information Services Unit Leader
Staff Food & Water Unit Leader
Support Branch Director
Employee Health & Well-Being Unit Leader
Family Care Unit Leader
Supply Unit Leader
Facilities Unit Leader
Transportation Unit Leader
Labor Pool & Credentialing Unit Leader
Finance/Administration Section Chief
Time Unit Leader
Procurement Unit Leader
Compensation/Claims Unit Leader
Cost Unit Leader
References


Health Effects of CBRNE

Update: December 2013
Summary: This module describes various illnesses and injuries that can result from exposure to Chemical, Biological, Radiological, Nuclear, or Explosives (CBRNE) materials. It includes information necessary to suspect, identify, and treat a broad array of emergency medical conditions resulting from a CBRNE incident in addition to other causes. Historical cases are presented to illustrate examples of a CBRNE and a Mass Casualty Incident (MCI), along with some possible challenges for medical response.

Terminal Learning Objective:

At the conclusion of this module, the healthcare responder will be able to differentiate the medical responses to a variety of illnesses and injuries that may result from an MCI.

Enabling Objectives:

At the conclusion of this module, the healthcare responder will be able to:

3-1 Identify characteristics, exposure routes, exposure indicators, health effects, and treatment protocols for exposures to chemical hazards

3-2 Recognize selected biological agents that may cause an MCI and their characteristics

3-3 Identify the health effects of exposure to radiation during an MCI involving a radiological incident

3-4 Recognize injuries and expected physical effects resulting from an explosion

Risk Assessment: Low

Duration: 1.5 Hours

Method of Instruction: Facilitated seminar in a classroom environment

Instructor Ratio: 1:40
Enabling Objective 3-1: Identify characteristics, exposure routes, exposure indicators, health effects, and treatment protocols for exposures to chemical hazards

Classification of Chemical Hazards

Chemical agents are classified according to their physical state, which may be solid, liquid, or gas. The physical state determines the onset time and physiological effectiveness of chemical agents. Military classification is often used when referring to chemical agents. Knowledge of this classification coupled with emergency response vocabulary promotes an ease of communication within the interacting agencies.

Chemical hazards can be classified as follows:

- Toxic Industrial Chemicals (TIC)
  - Department of Transportation (DOT) Class 1: Explosives
  - DOT Class 2: Gases
  - DOT Class 3: Flammable liquids; combustible liquids
  - DOT Class 4: Flammable solids, spontaneously combustible materials, and dangerous when wet materials and/or water-reactive substances
  - DOT Class 5: Oxidizing substances and organic peroxides
  - DOT Class 6: Toxic substances and infectious substances
  - DOT Class 7: Radioactive materials
  - DOT Class 8: Corrosive substances
  - DOT Class 9: Miscellaneous hazardous materials/products, substances, or organisms

- Incapacitating agents or Riot Control Agents (RCA)
Chemical Warfare Agents (CWA)

- Blister
- Choking
- Blood
- Nerve

Each of these classifications is discussed below.

NOTE: For additional references to the Centers for Disease Control and Prevention (CDC)’s Agency for Toxic Substances and Disease Registry (ATSDR) ToxProfiles, refer to http://www.atsdr.cdc.gov/toxprofiles/index.asp.

Chemical agents, when used as weapons, are intended to kill, seriously injure, or incapacitate people through physiological effects. Characterized by the rapid onset of medical symptoms (minutes to hours), chemical agents often produce easily observed signatures (Jagminas and Erdman, 2004).

**TIC When Used as a Weapon**

**Case Study:** A large-scale, military chemical release happened during World War I (WWI). In April 1915, the German military released more than 150 tons of chlorine near Ypres, France. The chlorine was stored in thousands of canisters placed within the German trenches and opened when the wind blew toward the Canadian and French troops. Although reports considered “politically motivated” claimed that thousands died, “actual French and German accounts from the time refer to 625 wounded and three dead” (Trumpener, 1978).

**Incapacitating Agents and RCA**

An incapacitating agent is defined by the U.S. Department of Defense (DOD) as “an agent that produces temporary physiological or mental effects, or both, which will render individuals incapable of concerted effort in the performance of their assigned duties” (DOD, 2005). Incapacitating agents are not primarily intended to kill.
RCA, also called irritants, lachrymators, and tear gas, produce discomfort and eye closure, rendering a person temporarily incapable of functioning. Patients are exposed through inhalation and absorption of small particles suspended in the air. RCA are not gases, but are micropulverized solids. They cause pain, burning, or discomfort to exposed mucus membranes and skin. These effects occur within seconds of exposure, but seldom persist for more than a few minutes once the exposure has ended. RCA are relatively easy to obtain, and many are commercially available as self-protection devices. They could also easily mask the use of a more serious agent.

The term incapacitation, when used in a general sense, is roughly equivalent to the term disability as used in occupational medicine, and denotes inability to perform a task because of a quantifiable physical or mental impairment. In this sense, any CWA may incapacitate a patient. However, by military definition of this type of agent, incapacitation refers to impairments that are temporary and nonlethal, lasting from hours to days (Compton, 1987). RCA cause temporary loss of vision due to blepharospasm, but the loss of vision does not last long enough for them to be considered incapacitants. Although incapacitation may result from physiological changes such as mucus membrane irritation, diarrhea, or hyperthermia, the term incapacitating agent as militarily defined refers to a compound that produces temporary and nonlethal impairment of military performance by virtue of its psychobehavioral effects (Department of the Army, n.d.).

An example of an incapacitating agent is 3-Quinuclidinyl benzilate (BZ), an odorless and colorless aerosol. An example of an RCA is Orthochlorobenzylidene malononitrile (CS), a commonly used agent for riot-control purposes.

Characteristics of Incapacitating Agents and RCA

Because of the prevalence of RCA over military incapacitating agents, this section will address the characteristics, health effects, and treatment protocols of RCA. RCA are characterized by a very low toxicity (chronic or acute) and short action duration. Little or no latent period occurs after exposure. CS is the most commonly used agent for riot-control purposes. During exposure, an individual is incapable of effective, concerted action.

Exposure Indicators and Health Effects

People exposed to RCA may experience some or all of the following symptoms immediately after exposure:

- Eyes: Excessive tearing, burning, blurred vision, and redness
Health Effects of CBRNE

Hospital Emergency Response Training for Mass Casualty Incidents

- Nose: Runny nose, burning, and swelling
- Mouth: Burning, irritation, difficulty swallowing, and drooling
- Lungs: Chest tightness, coughing, choking sensation, wheezing, and shortness of breath
- Skin: Burns and rash
- Other: Nausea and vomiting

These RCA affect the eyes, airways, and skin. Exposure to CS causes burning, irritation, tearing, and pain in the eyes. Airway symptoms include burning, sneezing, coughing, shortness of breath, and increased secretions such as runny nose and salivation. Gagging and vomiting may also occur. People with pre-existing respiratory problems such as upper respiratory infections, asthma, or emphysema, may be more sensitive to CS. The very old or very young may be more sensitive to chemical exposures than other individuals. In these groups, symptoms may also take longer to clear up.

Skin symptoms may include burning, redness, and irritation. High concentrations of CS can cause blistering. Effects usually occur within seconds after exposure begins and symptoms usually end within 30–60 minutes after exposure stops. For some people, symptoms can take a few days to clear up completely. Effects on skin may take longer to improve.

Treatment Protocols

NOTE: Treatment will depend on local protocols and the situation. A large number of casualties will affect the level of treatment possible on scene.

Once a gas exposure patient exits the hot zone, further decontamination is not necessary. Symptoms should disappear once the patient is no longer exposed to the chemical agent (U.S. Department of Health and Human Services [HHS] and the Agency for Healthcare Research and Quality [AHRQ], 2005). Clothing should be changed in the cold zone. If symptoms persist, the eyes, mouth, and skin may be washed with water. Soap should be used on the skin, but oil-based lotions should not be used. Skin decontaminants containing bleach should not be used. Bleach reacts with CS to form a combination more irritating to the skin than CS alone. Chest discomfort can usually be relieved by reassurance (Department of the Army, 1996).
CS hydrolyzes more rapidly in alkaline solutions, and an acceptable skin decontamination solution is 6.7% sodium bicarbonate, 3.3% sodium carbonate, and 0.1% benzalkonium chloride (Department of the Army, 1996).

In the event of pulmonary effects from massive chemical exposure, transport to a hospital is required. Management is the same as that for lung-damaging agents such as chlorine and phosgene:

- Initial:
  - Assess for patient airway
  - Ensure adequate respiration and pulse
  - Stabilize cervical spine with a collar and backboard if trauma is suspected
  - Administer supplemental oxygen, as required
  - Assist ventilation with a bag-valve-mask device, if necessary
  - Place on a cardiac monitor
  - Watch for signs of airway swelling and obstruction

**Blister Agents**

Blister, or vesicant, agents will produce injuries and force responders to wear Personal Protective Equipment (PPE). Exposure to blister agents may also be fatal. Vesicants blister the skin and any other part of the body they contact. Vesicants act on the eyes, mucus membranes, lungs, skin, and blood-forming organs. They can also damage the respiratory tract if inhaled, and may cause vomiting and diarrhea if ingested.

Mustard is a blister agent that poses both a contact and vapor hazards. Its color ranges from clear to dark brown, depending on purity. Mustard is a viscous, oily liquid at room temperature. It has an odor similar to garlic, onion, or mustard. Odor should not be relied upon for detection as it indicates exposure. Under temperate conditions, mustard gas hydrolyzes more rapidly in alkaline solutions.

**Notes**
evaporates slowly and is primarily a liquid hazard, but its vapor hazard increases with increasing temperature. At 100° F or above, it becomes a vapor hazard. Mustard freezes at 57° F, and since a solid is difficult to disperse, mustard is often mixed with substances with a lower freezing point (e.g., lewisite [the mixture is HL]). Lewisite is an oily, colorless liquid with the odor of geraniums; it is more volatile than mustard.

Phosgene oxime is a solid at temperatures below 95° F, but the vapor pressure of the solid is high enough to produce symptoms. Pure phosgene oxime is a colorless, crystalline solid. The munitions grade agent is a yellowish-brown liquid.

**Exposure Indicators and Health Effects**

Mustard agent exposure may elicit no effects for hours, whereas lewisite and phosgene oxime produce pain (effect seen immediately), severe itching, and blisters. Tearing and inflammatory reactions begin to appear immediately or up to several hours after exposure, which causes pain, extreme light sensitivity, and spasmodic winking. Other indicators of exposure include: bloody diarrhea, nausea, vomiting, extreme weakness, nasal secretions, hoarseness, progressive coughing, loss of voice, labored breathing, and destruction of mucus membranes (Department of the Army, 1995).
<table>
<thead>
<tr>
<th>Name</th>
<th>Means of Exposure</th>
<th>Physical Characteristics &amp; Warning Properties</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur Mustard (HD)</td>
<td>Skin contact and/or inhalation</td>
<td>Colorless to amber, oily liquid with garlic odor</td>
<td>Delayed onset (tissue damage occurs immediately, but signs of exposure and pain occur two to 24 hours later). Blisters on skin; coughing (lesions on lungs); itchiness or burning sensation in eyes, and possibly nausea and vomiting.</td>
</tr>
<tr>
<td>Lewisite (L)</td>
<td>Skin contact and/or inhalation</td>
<td>Light amber liquid with odor of geraniums</td>
<td>Blisters on skin; burning, watery, and swollen eyes; coughing (upper airway irritation), and blood poisoning</td>
</tr>
<tr>
<td>Nitrogen Mustard (HN-3)</td>
<td>Skin contact and/or inhalation</td>
<td>Amber odorless liquid</td>
<td>Blisters on skin; lung damage</td>
</tr>
<tr>
<td>Phosgene Oxime (CX)</td>
<td>Skin contact and/or inhalation</td>
<td>Solid or liquid with disagreeable, irritating odor</td>
<td>Immediate painful burning on skin; burning, reddening, and tearing of eyes; upper respiratory irritation, coughing with hoarseness</td>
</tr>
</tbody>
</table>


Notes
Treatment Protocols

NOTE: Treatment will depend on local protocols and the situation. A large number of casualties will affect the level of treatment possible onscene.

In a single exposure, eyes are more susceptible to mustard than the respiratory tract or skin. Conjunctivitis onset follows an exposure time of about one hour to a concentration barely perceptible by odor. This exposure does not affect the respiratory tract or skin significantly. A latent period of four to 12 hours follows mild exposure, after which there is lacrimation (tearing) and a sensation of grit in the eyes. The conjunctivae and lids become red and edematous. Heavy exposure irritates the eyes after one to three hours and produces some severe lesions. Although temporary blindness may occur, permanent blindness is very rare (Department of the Army, 1995).

Onscene treatment for blister agent exposure involving mustard agents is as follows:

- Skin blistering—Immediate decontamination using copious amounts of water; ensure the agent is absorbed (contained) by blotting the agent with an absorbent material.

- Ocular irritation—Irrigation with tepid water.

- Respiratory—Provide cough suppressants and bronchodilators; intubate if airway is compromised.

- Nausea and emesis—Atropine sulfate, 0.4–0.6 milligrams IM or IV.

Onscene treatment for blister agent exposure involving lewisite is as follows:

- Rapid decontamination is the easiest method to lessen the effects of lewisite. As with mustard, lewisite blisters should be cleaned to avoid secondary infections.

- Monitor fluid balances and rehydrate as necessary.
• British Anti-Lewisite (BAL), or dimercaprol, is a lewisite antidote. Data indicates that a suggested dose of 0.5 cc per 25 lbs. of BAL in oil injected intramuscularly will reduce the effects of lewisite. A BAL ointment was developed but is no longer manufactured. Caution should be exercised when dispensing BAL as side effects can occur. Patients may experience cramps, nausea, and vomiting for up to 30 minutes following treatment (Devereaux, Amundson, Parrisch, and Lazarus, 2002).

Onscene treatment for blister agent exposure involving phosgene oxime is as follows:

• There is no known antidote for phosgene oxime. External treatment should be as it would be for any skin ulcer or lesion.

• Patients should be decontaminated as quickly as possible.

• Inhalation patients may need oxygen support.

Choking Agents

Chemical agents that attack the lung tissue, possibly resulting in pulmonary edema, are classified as lung-damaging or choking agents. The classification of CWA includes phosgene (CG), diphosgene (DP), chlorine (CL), and chloropicrin (PS). Phosgene (CG) is the most dangerous choking agent. The toxic action of phosgene (CG) is typical of most choking agents.

Because phosgene and chlorine-choking agents are heavier than air, they will settle into low places in the surrounding terrain. Subways, sewers, and manholes would, for instance, be concentration areas if phosgene or chlorine were used, therefore, evacuation to higher floors in buildings and evacuations of subways would be appropriate.

Phosgene is transported as a liquid. Military dispersion during WWI followed the explosion of liquid-filled shells, with subsequent rapid vaporization and white cloud formation due to its slight solubility in an aqueous environment (Trumpener, 1975). It spontaneously converts to a colorless, low-lying gas four times as dense as air. Phosgene has a characteristic odor of newly mown or, at low concentrations, moldy hay (Environmental Protection Agency [EPA], 2007).
Chlorine, also transported as a liquid, has a very pungent odor and a yellowish-green color. In its gaseous state, chlorine is approximately twice as heavy as air.

**Exposure Indicators and Health Effects**

These agents primarily attack the airway and lungs, causing irritation of the entire airway from the nose to the lungs. Fluid fills the lungs and pulmonary edema (commonly referred to a dry-land drowning) occurs; symptom onset usually occurs immediately.

Although some agents have distinct odors, smell is not a good method of detection. Once inhaled, these agents cause immediate physiological damage that may range from mild transient irritation of the sinuses, pharynx, and bronchi upon initial exposure of phosgene, to pronounced immediate irritation of the upper and lower respiratory tract when exposed to chlorine. Patients may cough or appear to be choking. However, it could be two to four hours after exposure before the patients begin to show serious symptoms. Exposure to a high chlorine vapor concentration can facilitate reaction with body moisture causing serious burns and degradation to clothing. Self-aid is simply to evacuate the contaminated area, decontaminate by flushing with soap and water, and aerate (HHS and Centers for Disease Control and Prevention [CDC], 2005).
## Class: Choking Agents

<table>
<thead>
<tr>
<th>Name</th>
<th>Means of Exposure</th>
<th>Physical Characteristics &amp; Warning Properties</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine (Cl)</td>
<td>Inhalation</td>
<td>Colorless to slightly yellow gas with sharp irritating odor</td>
<td>Shortness of breath, nose and throat irritation, painful coughing, tightness of chest; within 48 hours, fluid build-up in lungs results in fatal choking (like drowning).</td>
</tr>
<tr>
<td>Phosgene (CG)</td>
<td>Inhalation</td>
<td>Colorless gas with odor of freshly mown hay or corn</td>
<td></td>
</tr>
<tr>
<td>Diphosgene (DP)</td>
<td>Inhalation</td>
<td>Colorless liquid with odor of freshly mown hay or corn</td>
<td></td>
</tr>
<tr>
<td>Chloropicrin (PS)</td>
<td>Inhalation</td>
<td>Oily, colorless liquid with pungent odor</td>
<td>Vomiting and fluid build-up in lungs</td>
</tr>
</tbody>
</table>


### Treatment Protocols

**NOTE:** Treatment will depend on local protocols and the situation. A large number of casualties will affect the level of treatment possible onscene.

A patient exposed to a lung-damaging agent should be kept at rest for 24–48 hours until the danger of pulmonary edema is past. Chest tightness and coughing should be treated with immediate rest and comfortable warmth. The patient should be transported in a full Fowler’s position. Mandatory evacuation to a hospital in cases of significant respiratory involvement is recommended (Department of the Army, 1995). Initial management of patients of choking agents is as follows:

- Assess the need for patient airway.
- Ensure adequate respiration and pulse.

### Notes
Administer supplemental oxygen as required. Ventilation assistance with a bag-valve-mask device may be necessary.

Place the patient on a cardiac monitor.

Watch for signs of airway swelling and obstruction.

**Blood Agents**

Blood agents affect the body by being absorbed into the blood. Examples are arsine, carbon monoxide, cyanogen chloride, hydrogen cyanide, potassium cyanide, sodium cyanide, and sodium monofluoroacetate (compound 1080).

The blood agents hydrogen cyanide (AC) and cyanogen chloride (CK) are liquids that vaporize near room temperature. AC is a bluish-white liquid with a characteristic bitter almond odor (Occupational Safety and Health Administration [OSHA], 2007). CK is a colorless liquid with an acrid choking odor, and causes burning pain in the patient’s eyes (CDC, 2007). These signs may provide enough warning to enable evacuation or ventilation of the attack site before the agent reaches a lethal concentration.

**Exposure Indicators and Health Effects**

At high doses, cyanide exposure causes gasping, frothy sputum or vomiting, loss of consciousness, and death. Sodium or potassium cyanides are white-to-pale yellow salts that can be easily used to poison food or drinks. Onset of symptoms occurs very rapidly, sometimes within seconds. Additional symptoms resulting from exposure to high doses include palpitations, confusion, hyperventilation, anxiety, stupor, coma, vertigo that may progress into agitation, and death. At high doses, cyanides cause immediate collapse. At lower doses, symptoms may be delayed. Medical treatments are available, but they must be used immediately for severely exposed patients.

Hydrogen cyanide acts as a cellular asphyxiant. By binding to mitochondrial cytochrome oxidase, it prevents utilization of oxygen in cellular metabolism. Severe exposures to hydrogen cyanide may cause abrupt onset of profound central nervous system, cardiovascular, and respiratory effects, leading to death within minutes.
**Class: Blood Agents**

<table>
<thead>
<tr>
<th>Name</th>
<th>Means of Exposure</th>
<th>Physical Characteristics &amp; Warning Properties</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen Cyanide (AC)</td>
<td>Inhalation</td>
<td>Colorless gas with bitter almond odor</td>
<td>Vomiting, dizziness, watery eyes, and deep and rapid breathing; high concentrations lead to convulsions, inability to breathe, loss of consciousness, and death.</td>
</tr>
<tr>
<td>Cyanogen Chloride (CK)</td>
<td>Inhalation</td>
<td>Colorless liquid with sharp, pungent odor</td>
<td></td>
</tr>
</tbody>
</table>


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**Case Study:** In 1984, the world’s worst industrial disaster occurred in Bhopal, India. Late at night on December 2, approximately 27 metric tons of methyl isocyanate (MIC), and possibly phosgene, hydrogen cyanide, nitrogen oxides, and carbon monoxide, were released in proximity to a highly populated area over a one to two hour period (Ramana, 2002). Environmental factors, including low wind speed and a thermal inversion, prevented dissipation of the chemicals and resulted in exposure of 200,000 of the 900,000 residents of Bhopal (Ramana, 2002; Singh & Ghosh, 1987). The release produced more than 80,000 patients with approximately 3,000 deaths (Varma & Guest, 1993). There has been considerable controversy over whether the release was an industrial accident or the intentional act of terrorists. In either case, Bhopal is a striking example of the effectiveness of chemical agents. The primary point, however, is to be aware of the three factors that caused the mass fatalities in Bhopal: the tremendous volume of chemicals used, the release location (populated area), and environmental conditions.
Treatment Protocols

**NOTE:** Treatment will depend on local protocols and the situation. A large number of casualties will affect the level of treatment possible on scene.

Before treatment is rendered, the patient should be removed from the contaminated area. Following hydrogen cyanide or cyanogen chloride poisoning, if the patient’s respirations are feeble or have ceased, the healthcare responder should immediately administer assisted ventilation with oxygen. Assisted ventilation should continue until spontaneous breathing returns or until 10 minutes after the last sign of heart activity has occurred (Department of the Army, 1995).

In “Smoke Inhalation and Hydrogen Cyanide Poisoning” (2005), Dr. Richard Alcorta, EMS director for the Maryland Institute of Emergency Medical Services Systems, states that aggressive airway management with delivery of 100% oxygen can save the lives of patients of cyanide poisoning. Other on scene treatments include:

- Intubation, if the patient is unconscious or if the airway cannot be protected.
- Establish an IV line and provide cardiac monitoring.
- Administer sodium bicarbonate if the patient is unconscious or hemodynamically unstable.
- Administer cyanide antidotes during prehospital care if the diagnosis is relatively certain. Avoid the sodium nitrite portion of the Taylor cyanide antidote kit (also called the Lilly® or Pasadena® kit) in patients with carbon monoxide poisoning. Anticonvulsants may be needed for generalized seizures. Vasopressors such as epinephrine are indicated for hypotension unresponsive to fluid intake.
- Although poor tissue utilization of oxygen in cyanide poisoning should theoretically render supplemental oxygen administration useless, supportive care with oxygen administration has proven effective in a number of poisonings.

New treatments for cyanide exposures are being developed. While sodium thiosulfate is considered tried and tested, other antidotes react more quickly and are undergoing scrutiny by the medical community. Hydroxocobalamin, for instance, is an attractive antidote, due to its
Nerve Agents

Nerve agents are a group of particularly toxic CWA developed before and during World War II (WWII). They are related chemically to organophosphate insecticides. The primary agents in this group are tabun (GA), sarin (GB), soman (GD), cyclohexyl sarin or cyclosarin (GF), and VX.

G-series nerve agents are nonpersistent and are easily dispersed as a liquid or vapor. The vapors are highly toxic, resulting in illness and death if untreated. VX behaves differently in that it is oily—similar to baby oil in appearance and viscosity—and persistent. Although nerve agents are liquids, when dispersed the more volatile ones constitute both a liquid and a vapor hazard.

Organophosphates are widely used as agricultural insecticides. Malathion, for example, is commercially available in the United States. The organophosphates developed for military use, however, are approximately 100,000 times more potent. While they are commonly referred to as nerve gas, nerve agent is the preferred term for these poisons, which are dispersed as aerosol and form vapor under normal atmospheric conditions.

The four nerve agents that have received the greatest military attention are tabun, sarin, and soman (among the so-called G agents), and VX. Two clinically significant characteristics that distinguish the nerve agents from one another are the primary mode of absorption and the methods by which the agents interact with the nervous system. The table under the Exposure Indicators and Health Effects section below summarizes the properties of these agents.

Exposure Indicators and Health Effects

Muscarinic effects include pinpoint pupils; blurred or dim vision; conjunctivitis; eye and head pain; hypersecretion by salivary, lacrimal, sweat, and bronchial glands; narrowing of the bronchi; nausea, vomiting, diarrhea, and cramping, abdominal pains; urinary and fecal incontinence; and slow heart rate. Nicotinic effects include skeletal muscle twitching, cramping, and weakness. Nicotinic stimulation can initially obscure certain muscarinic effects and produce rapid heart rate and high blood pressure. Onset of symptoms occurs immediately. These muscarinic signs and symptoms are known by the acronym DUMBELS:

- Defecation/diarrhea
• Urination
• Miosis
• Bronchoconstriction/bronchorhea
• Emesis
• Lacrimation
• Salivation

GB, GA, and VX are highly toxic military agents that disrupt the patient’s nervous system by overstimulation. A nerve agent antidote is available. DuoDote® is available to counter the effects of nerve agent exposure.

**NOTE:** Additional information on DuoDote is provided later in the module.
## Class: Nerve Agents

<table>
<thead>
<tr>
<th>Name</th>
<th>Means of Exposure</th>
<th>Physical Characteristics &amp; Warning Properties</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tabun (GA)</td>
<td>Skin contact and/or inhalation</td>
<td>Brownish to colorless liquid with odor ranging from none to fruity</td>
<td>Dim or blurred vision, runny nose, chest tightness, difficulty in breathing, muscle twitches, heart rate irregularities, nausea, vomiting; high concentrations lead to loss of consciousness and seizures, resulting in paralysis and death.</td>
</tr>
<tr>
<td>Sarin (GB)</td>
<td>Inhalation mostly; limited exposure through skin</td>
<td>Colorless liquid with no odor</td>
<td></td>
</tr>
<tr>
<td>Soman (GD)</td>
<td>Skin contact and/or inhalation</td>
<td>Colorless liquid with fruity to camphor-like odor</td>
<td></td>
</tr>
<tr>
<td>Cyclohexyl sarin (GF)</td>
<td>Skin contact and/or inhalation</td>
<td>Colorless liquid with no odor</td>
<td></td>
</tr>
<tr>
<td>VX</td>
<td>Skin contact and/or inhalation</td>
<td>Amber liquid with no odor</td>
<td></td>
</tr>
</tbody>
</table>

Treatment Protocols

NOTE: Treatment will depend on local protocols and the situation. A large number of casualties will affect the level of treatment possible on scene.

It is crucial that the patient undergoes decontamination as soon as possible after exposure. Any nerve agent liquid on the skin, on clothing, or in the eyes must be removed. The appearance of nerve agent poisoning symptoms calls for immediate IM nerve agent antidote injection (refer to subhead below). Since inhalation is the most probable exposure route, the most likely initial symptom will be rhinorrhea (runny nose), then miosis (constricted pupils), followed by a feeling of tightness or constriction in the chest. After cutaneous splash, the initial systemic symptoms may be localized sweating and localized muscular twitching, followed by nausea and abdominal cramps. In the case of ingestion, the first symptoms are likely to be nausea and vomiting. In any case, use of nerve agent antidotes is very important. Examine patients for symptoms and administer the DuoDote Auto-Injector as recommended.

After administering DuoDote, the patient may experience dry mouth and eyes, blurred vision, photophobia, confusion, headache, dizziness, and other symptoms (Meridian Medical Technologies, Inc., 2012b). This may indicate that enough atropine has been taken to overcome the dangerous nerve agent effects. If the injection does not relieve the nerve agent symptoms, the patient should be administered two more DuoDote injections (not to exceed a total of three injections). If symptoms still persist and the pulse (heart rate) drops below 90 per minute, bronchial secretions persist, or the skin remains moist, the patient can be administered additional atropine injections to maintain adequate atropinization (Department of the Army, 1995).

Severe nerve agent exposure may rapidly cause unconsciousness, muscular paralysis, and the cessation of breathing. When this occurs, antidote alone will not save life. Immediately after administering three sets of DuoDote, assisted ventilation must be started by responders and should be continued until normal breathing is restored. The individual may have impaired vision and decision-making functions, and overall alertness may be impaired. There could also be breathing difficulty. For this reason, patients should be lying on their side until transported to a hospital (Department of the Army, 1995).

DuoDote Auto-Injector

On October 4, 2006, King Pharmaceuticals, Inc. received approval from the U.S. Food and Drug Administration (FDA) to market the DuoDote Auto-Injector. The single, prefilled, single-chambered auto-injector is filled with 2.1 mg of atropine and 600 mg of pralidoxime, used to
treat symptoms of chemical nerve agent poisonings and toxic levels of organophosphorous insecticides. The drugs are administered with a single injection.

Physiological Reactions Resulting From Employment of DuoDote

Administration of the DuoDote Auto-Injector blocks the communication link between acetylcholine (to include excess amounts) “at muscarinic cholinergic receptors on smooth muscle, cardiac muscle, and secretory gland cells and in peripheral autonomic ganglia and the central nervous system” (Meridian Medical Technologies, Inc., 2012b). This turns off the muscle, nerve, or gland, allowing it to return to a resting state, and the SLUDGEM or DUMBELS signs and symptoms begin to lessen.

Employment of DuoDote

The DuoDote Auto-Injector is designed to perforate clothing, so care should be taken with the injector’s needle. When administering DuoDote to very thin people, the elderly, and/or small children, the buttock is the alternate injection site. It is recommended that Emergency Medical Services (EMS) personnel administer DuoDote. The following is excerpted from How to Inject Duodote:

1. Tear open the plastic pouch at any of the notches. Remove the DuoDote Auto-Injector from the pouch.

2. Place the DuoDote Auto-Injector in the dominant hand, and then firmly grasp the center of the DuoDote Auto-Injector with the green tip (needle end) pointing down.
3. With the other hand, the user should pull off the gray safety release. The DuoDote Auto-Injector is now ready to be administered.

4. The injection site is the mid-outer through area. The DuoDote Auto-Injector can inject through clothing.

5. Swing and firmly push the Green Tip straight down (a 90° angle) against the mid-out thigh. Continue to firmly push until you feel the DuoDote Auto-Injector trigger.

**NOTE: After the auto-injector triggers, hold the DuoDote Auto-Injector firmly in place against the injection site for approximately 10 seconds.**

6. Remove the DuoDote Auto-Injector from the thigh and look at the Green Tip. If the needle is visible, the drug has been administered. If the needle is not visible, check to be sure the Gray Safety Release has been removed, and then repeat above steps beginning with Step 4, but push harder in Step 5.

7. After the drug has been administered, push the needle against a hard surface to bend the needle back against the DuoDote Auto-Injector.

8. Put the used DuoDote Auto-Injector back into the plastic pouch, if available. Leave used DuoDote Auto-Injector with patient to allow other medical personnel to see the number of DuoDote Auto-Injector(s) administered.


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**Notes**
After use of the DuoDote Auto-Injector, a blood-borne pathogen exists in the needles. To prevent spreading of diseases, dispose of the device as hazardous waste. All patients should be monitored, and secondary or follow-up triage and treatment should take place after decontamination is complete.

Enabling Objective 3-2: Recognize selected biological agents that may cause an MCI and their characteristics

Biological Agents

Biological agents are organisms or toxins that can kill or incapacitate people, livestock, and crops. Bacteria are single-celled organisms capable of causing a variety of diseases in animals, plants and humans. They may also produce extremely potent toxins inside the human body. These single-celled organisms may be cultured in nutrient media.

Rickettsia are very small bacteria that must live inside the cells of their hosts. Many are serious disease-causing organisms (pathogens) that may cause long-term illness and death. Blood-sucking insects and ticks often transmit these agents.

Viruses are micro-organisms smaller than bacteria. They are incapable of metabolism and completely dependent upon the host cell for reproduction.

Toxins are potent poisons produced by a variety of living organisms—including bacteria, plants, and animals. Some biological toxins are the most toxic substances known (Smithson, n.d.).

Categories of Biological Agents

The following agent category definitions are provided by the CDC:

- Category A Agents—Category A are considered high-priority agents. The U.S. public health system and primary healthcare providers must be prepared to address various biological agents, including pathogens rarely seen in the United States. High-priority agents include organisms that pose a risk to national security because they:
Health Effects of CBRNE

Hospital Emergency Response Training for Mass Casualty Incidents

- Can be easily disseminated or transmitted from person to person
- Result in high mortality rates and have the potential for major public health impact
- Might cause public panic and social disruption
- Require special action for public health preparedness

• Category B Agents—Second-highest priority agents include those that are:
  - Moderately easy to disseminate
  - Result in moderate morbidity rates and low mortality rates

Anthrax

Anthrax is a disease caused by *Bacillus anthracis*. This bacterium that primarily causes disease in cattle, sheep, and other hoofed animals. These bacteria are capable of forming spores when conditions are not ideal for supporting growth. This inactive stage of the organism makes it more resilient and an ideal candidate for use in bioterrorism.

Routes of entry: In spore form, anthrax can be transmitted to humans through the respiratory tract, where it can lead to inhalation anthrax, the most lethal form of the disease (90% mortality rate). Inhalation anthrax could occur from inhalation of aerosolized spores released during a biological weapon attack. Inhalation anthrax usually occurs when individuals work with animal hides, wool, or bonemeal and inhale the spores. Although the incubation period is one to seven days, the disease is not contagious, requiring direct contact with spores to cause infection.

Anthrax-causing bacteria are most commonly transmitted to man through cuts or abrasions in the skin (e.g., cutaneous: 5–20% mortality rate) or through the digestive tract by eating contaminated and undercooked foods (gastrointestinal anthrax). Cutaneous anthrax features a painless necrotic ulcer with a black eschar and local edema.

Notes
Signs and symptoms: Inhalation anthrax will begin with nonspecific symptoms of fever, malaise, and fatigue. A nonproductive cough and vague chest discomfort may be present. These initial symptoms may be followed by a short period of symptomatic improvement, ranging from hours to three days in duration. This is followed by an acute phase, including the abrupt onset of severe respiratory distress with dyspnea, stridor, diaphoresis, and cyanosis. Bacteremia and toxemia, septic shock, systemic infection (e.g., meningitis in approximately 50% of the cases), and death usually occurs within 24 to 36 hours from acute phase onset.

Cutaneous anthrax begins with initial symptoms of fever, sore throat, and difficulty swallowing. The disease may progress to an acute phase with symptoms including a necrotic ulcer or eschar involving the hard palate, tonsils, or posterior oropharyngeal wall; edema of cervical tissues (possibly resulting in upper airway obstruction); and cervical lymphadenopathy. Most acute cases progress to septic shock and death (U. S. Headquarters, Departments of the Army, The Navy, and The Air Force, and Commandant, Marine Corps, 2000).

Gastrointestinal anthrax begins with vague initial symptoms such as fever, anorexia, nausea, and vomiting. Abdominal pain, bloody vomiting, bloody diarrhea, and possibly massive abdominal swelling may follow these symptoms. Continued progression to septic shock and death may occur.

**NOTE:** The following medical management issues should be handled according to local protocol.

Basic treatment: Supportive care includes maintaining the airway, providing resuscitative fluids, and providing vasopressors as indicated for shock.

**NOTE:** Normally, specific therapy will be performed in a hospital, but responders may need to administer specific therapy treatment, depending on the incident.

Protective measures are as follows:

- Report all cases to line and medical chains of command.
- Employ body-substance isolation precautions.
- Use sporicidal agents such as disinfectant-strength iodophors for general area disinfection. Autoclaving, steam sterilizing, or burning is required for complete eradication of spores (U.S. Headquarters, Departments of the Army et al., 2000).
Plague

Plague is a disease caused by the bacterium *Yersinia pestis*. In the United States, the last urban plague epidemic occurred in Los Angeles in 1924–25; since that time, human plague appears in mostly scattered cases in rural areas (an average of 10 to 20 people each year). Globally, the World Health Organization (WHO) reports 1,000 to 3,000 cases of plague annually (n.d.). In North America, plague is found in certain animals and their fleas from the Pacific Coast to the Great Plains, and from southwestern Canada to Mexico. Most human cases in the United States occur in two regions: 1) northern New Mexico, northern Arizona, southern Colorado, and southern Utah; 2) California, southern Oregon, and far western Nevada (CDC, n.d.c.).

Routes of entry: Plague is normally transmitted to humans from rats through the bite of infected fleas. Infection by flea bite leads to bubonic plague. Plague-causing bacteria can also be aerosolized and transmitted to humans through the respiratory tract, causing pneumonic plague. Pneumonic plague is highly contagious and, if untreated, results in death.

Signs and symptoms: Plague incubation period is 2 to 10 days. Following an aerosol release of the organisms, unprotected individuals will present with acute pneumonic plague featuring high fever, systemic inflamed buboes, toxicity, productive cough, and hemoptyisis. Bubonic plague symptoms progress with bacteremia, resulting in systemic infection, septic shock, and thrombosis of small arteries, resulting in gangrene possibly appearing on the nose, lips, fingers, and toes. Early diagnosis at the onset of symptoms is essential (CDC, n.d.c).

NOTE: The following medical management issues should be handled according to local protocol.

Basic treatment: Supportive care should include IV hydration, supplemental oxygen, and respiratory support.

NOTE: Normally, specific therapy would be performed in a hospital, but healthcare responders may need to administer specific therapy treatment, depending on the incident.

Protective measures are as follows:

- Report case(s) to line and medical chains of command.
- Employ body-substance isolation precautions.
PPE considerations.

For suspected pneumonic plague (presented as a biological weapon), apply respiratory droplet isolation for a minimum of the first 48 hours of therapy.

Isolate patients.

Conduct terminal disinfection of all items used in care of patients (U. S. Headquarters, Departments of the Army et al., 2000).

**Tularemia**

Tularemia is a disease caused by the bacterium *Francisella tularensis*. Known also as rabbit fever or deerfly fever, tularemia is a zoonosis (animal disease that causes disease in humans) that has been reported in all states except Hawaii; it affects rodents, rabbits, and hares, as well as a number of species of birds and reptiles. Tularemia has great potential as a biological weapon. The Russians worked extensively with this bacterium, and one report suggests that they used it against the German Army in WWII (CDC, n.d.g).

Entry routes: *Francisella tularensis* is highly infectious. As few as 10 organisms are sufficient to result in a fatal infection. Most human infections arise when the bacterium enters the body through breaks in the skin, or through mucus membranes after handling infected animals. Infection can also occur from the bite of infected deerflies, ticks, or mosquitoes. Inhalation of contaminated dust or ingestion of contaminated foods or water are other ways for humans to become infected.

Signs and symptoms: Some of the symptoms mirror other possible biological agents, including fever, chills, headache, and malaise.

**NOTE:** The following medical management issues should be handled according to local protocol.
Basic treatment: Supportive care may include respiratory support and hydration. Open lesions should be covered and topical antibiotics applied.

**NOTE:** Normally, specific therapy would be performed in a hospital, but responders may need to administer specific therapy treatment, depending on the incident.

Protective measures are as follows:

- Report case(s) to line and medical chains of command.

- Employ body substance isolation precautions that require wearing gloves to ensure that no body substances touch the attending person’s body (U. S. Headquarters, Departments of the Army et al., 2000).

**Q Fever**

Q Fever, a Category B biological agent, is a disease caused by *Coxiella burnetii*, a rickettsia pathogen. *Coxiella burnetii* is a highly infectious agent. This agent was developed for use in biological warfare programs and is considered a potential terrorist threat. The pathogen is capable of forming spores; therefore, it is rather resistant to heat and drying. The map within the text illustrates the number of reported cases of Q Fever discovered within the United States in 2002.

Routes of entry: Q Fever can become airborne and be inhaled by humans. A single *C. burnetii* organism may cause disease in a susceptible person. In nature, cattle, sheep, and goats are the primary reservoirs of *C. burnetii*. Organisms are excreted in the milk, urine, and feces of infected animals. Other modes of transmission to humans, including tick bites and human-to-human transmission, are rare.

Signs and symptoms: Only about one-half of those infected with *C. burnetii* show signs of clinical illness, with many patients becoming ill within two to three weeks after exposure. Most acute cases of Q Fever begin with sudden symptom onset. Symptoms include high fever, severe headache, general malaise, joint pain, confusion, sore throat, chills, sweats, nonproductive
cough, nausea, vomiting, diarrhea, abdominal pain, and chest pain. These nonspecific symptoms make it difficult to accurately diagnosis without appropriate laboratory testing. Only 1–2% of people with acute Q Fever die of the disease. Primary treatment for Q Fever is with the antibiotic doxycycline, which has been shown to be very effective (CDC, n.d.d).

NOTE: The following medical management issues should be handled according to local protocol.

Basic treatment: While acute Q Fever may run a brief, self-limited course without therapy, suspected cases of acute Q Fever should be treated to reduce the risk chronic disease development.

Protective measures are as follows:

- Report case(s) to line and medical chains of command.

- Employ body-substance isolation precautions.

- Decontaminate exposed clothing and equipment (U. S. Headquarters, Departments of the Army et al., 2000).

Smallpox

Smallpox, a Category A agent, is a disease caused by the smallpox virus, *Variola major*. Due to a successful global vaccine program, the WHO declared in 1980 that smallpox was eradicated. Small quantities of live virus are still held in freezers at secure research facilities in the United States (e.g., CDC) and Russia. Despite the WHO’s declaration, a potential dissemination threat remains because there is the possibility that some countries not signatory to the 1972 Biological Weapons Convention may have viral stocks.

Routes of entry: Smallpox virus is a highly contagious respiratory hazard, spread person-to-person as an aerosol. The virus can also be spread through direct contact with infected bodily fluids or contaminated objects such as bedding or clothing.

Notes
Signs and symptoms: Symptoms begin acutely with malaise, high fever, rigors, vomiting, headache, and backache. Approximately 15% of patients develop delirium. Two to three days following symptom onset, a rash appears on the face, hands, and forearms, followed by eruptions on the lower extremities, spreading to the trunk over the next seven days. Scabs form 8 to 14 days after disease onset, leaving depressed pigmented scars. Smallpox can be confused with chickenpox by the untrained eye. Smallpox lesions tend to feel as if they are deep in the skin, in contrast to the lesions of chickenpox, which feel superficial. Chickenpox itches; smallpox lesions can be very painful, similar to monkeypox and cowpox. Because the earliest stage of smallpox can resemble rashes caused by many other diseases besides chickenpox, identification can be difficult without laboratory tests (U. S. Headquarters, Departments of the Army et al., 2000). Smallpox can be distinguished from chickenpox by the appearance of a rash. Smallpox first appears as a rash and emerges as red spots on the tongue and in the mouth. The rash then appears on the face, spreading to the arms, and legs and then the hands and feet. Chickenpox appears as a rash that is most prominent on the chest and abdomen.

The mortality rate for the major form of the disease is approximately 30% in unvaccinated populations and 3% in vaccinated populations. As the incubation period for smallpox averages 12 days, patients should be isolated for a minimum of 16 to 17 days following exposure. A single case of smallpox would constitute an international emergency. Given the severity of this disease, communities need to have a response plan in place, providing details for surveillance, contact management, isolation, and treatment (CDC, n.d.f).

**NOTE:** The following medical management issues should be handled according to local protocol.
Basic treatment: Provide supportive care and vaccine within four days of exposure. There is no specific antiviral therapy available for smallpox (U. S. Headquarters, Departments of the Army et al., 2000).

**NOTE:** Some of the following functions will be performed and directed by other authorized agencies.

Protective measures are as follows:

- Immediately report case(s) to line and medical chains of command.
- Employ body-substance isolation precautions.
- Isolate all smallpox patients into a group, as well as those exposed to smallpox, and maintain daily surveillance for 17 days after last known contact with a case.
- Sterilize (autoclave and boil) all bedclothes and fabrics exposed to the patient.
- Spray or mop all floors, walls, and other hard surfaces in the patient isolation area with disinfectant solution (e.g., phenolic and quaternary ammonium compounds, formalin, or a 5% chlorine solution), allowing it to remain on the surfaces for at least four hours (U. S. Headquarters, Departments of the Army et al., 2000).

**Viral Hemorrhagic Fevers**

Designated as Category B agents, VHF are caused by a number of viral agents, primarily Arenaviruses and Filoviruses. Examples are Ebola, Marburg, Lassa, Junin, and Machupo viruses. These viruses were named for places where the first cases of each were reported. These highly contagious and extremely lethal viruses are known to occur naturally, although for some the natural reservoir has not been identified.

Routes of entry: Typically, these viruses are spread by person-to-person contact, especially contact with the bodily fluids of sick patients.

Signs and symptoms: Specific signs and symptoms vary by the type of VHF, but initial signs and symptoms often include very high fever, fatigue, dizziness, muscle aches, loss of strength, and exhaustion. Patients with severe cases of VHF often show signs of bleeding under the skin, in internal organs, or from body orifices like the mouth, eyes, or ears. Although patients may
bleed from many sites around the body, they rarely die due to blood loss. Severely ill patients may also exhibit shock, nervous system malfunction, coma, delirium, and seizures. Some types of VHF are associated with kidney failure. Fatality rates of patients with VHF vary from less than 10% to approximately 90%, depending on the type of VHF. With a few noteworthy exceptions, there is no cure or established drug treatment for VHF. Isolation and quarantine protocols are essential for consequence management in outbreaks of VHF (CDC, n.d.h).

NOTE: The following medical management issues should be handled according to local protocol.

Basic treatment: Treatment is primarily supportive, with special attention to fluid and electrolyte balance. Patients require treatment for shock, blood loss, renal failure, seizures, and coma. Treatment may include intensive care and specific interventions such as mechanical ventilation, dialysis, and neurological support.

Protective measures are as follows:

- Report case(s) to line and medical chains of command.
- Employ body-substance isolation precautions.
- Patients should be isolated and exposure limited to caregivers only (U. S. Department of the Army et al., 2000).

**Botulinum Toxin**

Botulinum toxin is a Category A agent produced by the bacteria *Clostridium botulinum*. It often appears as paralytic food poisoning. Botulinum toxin is one of the most lethal substances known to man. It would require approximately 0.08 micrograms to kill a person weighing 176 pounds. Botulinum toxin is about 100,000 times more toxic than sarin (CDC, n.d.b).

Routes of entry: Normally encountered by ingestion of improperly canned food, botulinum toxin can also be injected, as well as aerosolized and presented as an inhalation threat. Inhalation is the least effective route. Botulism is not communicable person to person.

Signs and symptoms: Symptoms, including descending paralysis, weakness, dizziness, dry mouth and throat, and blurred vision begin to appear; other symptoms may include facial...
Health Effects of CBRNE

Hospital Emergency Response Training for Mass Casualty Incidents

paralysis, and slurred speech. Symptom onset may begin less than 24 hours after ingestion or inhalation of the toxin.

NOTE: The following medical management issues should be handled according to local protocol.

Basic treatment: Supportive care includes respiratory support; hydration; bowel, bladder, and skin care; physical therapy; and psychological support. Treatment may include antitoxins, artificial ventilation, and other supportive measures (U. S. Headquarters, Department of the Army et al., 2000).

Protective measures are as follows:

- Report case(s) to line and medical chains of command.
- Employ body-substance isolation precautions.
- Patients may be evacuated with other classes of patients (U. S. Headquarters, Departments of the Army et al., 2000).

Ricin

Ricin, a Category B agent, is a toxin derived from the watersoluble component of castor beans (Ricinus communis). The wash from preparing castor oil contains up to 5% ricin. Because of its lethality, very little ricin is needed to cause great harm. In fact, as little as 24 micrograms of ricin can kill a person. Ricin exposure affects protein synthesis.

Routes of entry: Ricin is transmitted to patients through the respiratory system, ingested in food, or injected. Ricin is not communicable person to person.
Signs and symptoms: Signs and symptoms will vary based on the route of entry. Symptoms from inhalation of ricin include necrotizing (tissue-killing) lesions of the upper and lower airway, necrotizing pneumonia, and pulmonary edema. The symptoms from either ingestion or IM injection include gastric bleeding, liver necrosis, local lymphoid necrosis, inflammation of the spleen, and pulmonary congestion. Symptoms begin within 4 to 12 hours of exposure if the ricin is inhaled or swallowed, and death may occur within 36 to 72 hours depending on the exposure route and dose received. About 24 micrograms of ricin could kill a person weighing 176 pounds. Ricin is approximately 20 to 50 times more toxic than the nerve agent sarin (CDC, n.d. e).

**NOTE:** The following medical management issues should be handled according to local protocol.

Basic treatment: Supportive care including intensive care measures such as supplemental oxygen, endotracheal intubation, and mechanical ventilation; positive end-expiratory pressure; and hemodynamic monitoring may be required for the respiratory distress (U. S. Headquarters, Departments of the Army et al., 2000).

Protective measures are as follows:

- Report case(s) to line and medical chains of command.

- Employ body-substance isolation precautions (U. S. Headquarters, Departments of the Army et al., 2000).

**Case Study: Ricin in Sen. Frist’s Mailroom:** In February 2004, ricin was discovered on an automatic mail sorter in a mailroom in the Dirksen Senate Office Building. The mailroom served the office of Senate Majority Leader Bill Frist. The discovery prompted 16 employees to go through decontamination procedures. No reports of ricin poisoning came from the incident. This was the third incident in less than five months involving ricin. A letter addressed to the White House was intercepted in November 2003 after it was found to contain ricin. The toxin was also found in October 2003 in a letter at a postal-handling facility in Greenville, S.C. The typewritten letter was addressed to the DOT and demanded that changes in truckers’ sleep/work schedules not be implemented (Starr, Carroll, Feig, Barrette, Ahlers, & Madden, 2004).
Enabling Objective 3-3: Identify the health effects of exposure to radiation during an MCI involving a radiological incident

Health Effects of Radiological Material

Most information regarding the health effects of radiological material on the human body has been gathered from accidental exposures or contamination such as the accident at Chernobyl, Russia or Goiania, Brazil (discussed in the case study). To better treat injuries that may be sustained, the healthcare responder must understand how the body reacts to radiological material. Knowing the difference between exposure and contamination will also help the healthcare responder to make triage and treatment decisions.

Exposure vs. Contamination

In determining response to a radiological material release, healthcare responders must determine whether materials are present on the patients’ bodies. Presence of radioactive material on the clothing and bodies is a hazard to healthcare responders and requires decontamination procedures for removal. On the other hand, patients who have been exposed to radiation but have no radioactive material on their bodies will not require decontamination but may require immediate medical attention (IMC Worldwide, n.d.).

- External exposure—Occurs when all or part of the body is exposed to penetrating radiation from an external source. During exposure, radiation is absorbed by the body, or it can pass completely through the body, depending on the type of radiation. A similar occurrence takes place during an ordinary chest x-ray. Following external exposure, people are not radioactive and can be safely approached and processed by healthcare responders. No special handling is required because of the exposure to radiation (IMC Worldwide, n.d.).

The danger to patients from exposure to radiation decreases as the distance to the source increases; therefore, a solution to decreasing danger from the harmful effects of radiation involves moving the patient away from the radiation source. Time, distance, and shielding are the means of decreasing exposure to radiation (IMC Worldwide, n.d.).

Notes
External contamination—An externally contaminated person has radiological material physically attached to skin, hair, and clothing that presents a continuing hazard to the patient and healthcare responders until it is removed. Everyone and everything near the radioactive material release must be treated as externally contaminated until thoroughly screened for the presence of radioactive material—this includes patients, responders, structures, equipment, papers, and evidence. An externally contaminated person is receiving an external radiation exposure as long as the radioactive material is present. To minimize patient and healthcare responder exposures, the radioactive material should be removed from the patient as soon as possible, and the material immediately isolated to prevent further exposure. In most instances, removal of the patient’s external clothing is effective in removing the radiation source and decreases exposure hazards (IMC Worldwide, n.d.).

Radioactive dust clinging to a person’s skin and clothing will continue to emit radiation. In addition, the person may eventually inhale some of the dust. Food and water may become contaminated, causing radioactive material to be ingested. Only 0.01 grams (10mg) of cesium-137 dust clinging to a person’s skin or clothing might result in 60 rem/hr of radiation exposure (Nordin, 2003).

Internal contamination and internal exposure—Occurs when unprotected patients ingest, inhale, or receive radioactive material through an open wound. Internally contaminated patients present a minimal radiation risk to healthcare responders. The internally contaminated patient, however, may be externally contaminated. The skin, mouth, and nose are the most obvious routes to internal contamination. Internally contaminated people receive an internal exposure as long as the radioactive material remains within their bodies. In general, internal contamination is much more dangerous to the patient than external contamination, as the radioactive material is in direct contact with the patient’s tissues without the shielding provided by the patient’s clothing and skin. Radioactive materials, once inside the human body, may be incorporated by the body and become part of the bodily organs and tissues (IMC Worldwide, n.d.).
Health Risk

The dose is the total amount of radiation received. The larger the dose received, the greater the health risk becomes. The dose rate is the length of time over which the dose is received. Dose rate exposures are categorized as either acute or chronic (HHS and CDC, 2005). Acute exposures are large doses occurring over a short period (HHS and CDC, 2005). Acute exposures normally pose a high health risk with symptoms occurring within hours or days. Symptoms of acute radiation exposure include skin burning, vomiting, and indigestion. Chronic exposures are small doses occurring over a long period. Chronic exposures normally pose a smaller health risk, with symptoms (e.g., tumors, etc.) delayed for years. Alpha and beta emitters generally pose only internal exposure hazards. Gamma radiation, however, also poses an external hazard for a distance of several meters (IMC Worldwide, n.d.).

Acute Radiation Syndrome

Acute Radiation Syndrome (ARS) is the name given to a group of signs and symptoms that develop after total body (or large body volume) irradiation at doses greater than 100 rads are delivered over a short period. The severity of ARS is primarily related to the total dose, dose rate, portion of the body irradiated, type of radiation, and age and health of the patient.

Case Study: In Goiania, Brazil, in 1987, two scrap-metal scavengers removed a radioactive source capsule from an abandoned radiotherapy machine. Later, at the home of one of the scavengers, the capsule, containing 1,375 curies of cesium-137, was opened. The blue, glowing powder inside was sprinkled or rubbed on the faces and bodies of several people, who then passed the powder along to other people with whom they came into contact. Before the incident ended, authorities identified 249 people who were contaminated by the radioactive material. Of the 249 contaminated, 151 were both internally and externally contaminated; of that 151, five died. It was estimated that some of those contaminated received doses of up to 800 rads.

The internal contaminants were purged from the contaminated bodies to a limited degree. Medical personnel treated the contamination with a dye, prussian blue, which was found to be very effective in removing cesium-137 from the bodies of patients (Zimmerman & Loeb, 2004).
Signs and symptoms that develop in ARS occur through four distinct phases:

- **Prodromal phase**—Depending on the radiation dose, patients may experience various symptoms, including loss of appetite, nausea, vomiting, fatigue, and diarrhea. After high radiation doses, additional symptoms such as prostration, fever, and increased excitability may develop. The prodromal phase begins a few hours to four days after exposure. Most patients seek medical care at this stage.

- **Latent phase**—Brief reprieve from symptoms, when the patient may appear to have recovered. This period may last up to four weeks, depending on the dose. This time interval decreases as the dose increases.

- **Manifest illness phase**—Period of time when overt illness develops—characterized by infection, bleeding, electrolyte imbalance, diarrhea, changes in mental status, and shock. This phase may last two to three weeks and is the most difficult to manage from a therapeutic standpoint, because it is the maximum state of immunoincompetence the patient will suffer.

- **Recovery phase or death**—Follows the period of overt illness. Recovery may take weeks or months. If the patient survives the manifest illness phase, recovery is almost assured; therefore, treatment in the first six weeks to two months after exposure is crucial to ensure recovery from a rapidly received, high dose of ionizing radiation (Department of the Army, 1989).

Depending on the magnitude of the radiation dose, specific systems in the body are affected (Department of the Army, 1989). At doses greater than 100 rads, the bone marrow (hematopoietic system) is involved, leading to infection and bleeding. At doses greater than 600 rads, the gastrointestinal system becomes involved, leading to severe (and often continuing) nausea, vomiting, diarrhea, electrolyte imbalance, and sepsis. At doses greater than 1,000 rads, the central nervous system becomes involved with rapid onset of cerebral edema and cardiovascular collapse.

- **Hematopoietic subsyndrome**—Symptoms include nausea, vomiting, anorexia, and diarrhea. If severe diarrhea occurs during the first two days, the radiation dose may have been lethal. The hematopoietic prodrome may last up to three days, followed by about three weeks of latency, during which the patient will suffer from significant fatigue and weakness. Clinical symptoms of manifest illness appear 21-30 days after exposure and may last up to two weeks. Severe hemorrhage from platelet loss and infections associated
with pancytopenia from bone-marrow suppression are lethal factors in the hematopoietic subsyndrome (Department of the Army, 1989). Systemic effects from the hematopoietic subsyndrome include:

- Immunodysfunction
- Increased infectious complications
- Hemorrhage
- Anemia
- Impaired wound healing (Department of the Army, 1989)

- Gastrointestinal subsyndrome—Overlaps the hematopoietic subsyndrome, but its consequences are more immediate and more lethal. Symptoms include severe nausea, vomiting, watery diarrhea, and cramps, occurring within hours after irradiation, followed by a much shorter asymptomatic latent period of five to seven days. At that point, the manifest illness begins, with vomiting and severe diarrhea accompanied by fever. At higher doses, bloody diarrhea, shock, and death may ensue. Systemic effects of this subsyndrome may include:
  
  - Malnutrition from malabsorption
  
  - Vomiting and abdominal distension from paralytic ileus
  
  - Dehydration, acute renal failure, and cardiovascular collapse from shifts in fluids and electrolytes
  
  - Anemia from gastrointestinal bleeding
  
  - Sepsis from damaged intestinal lining (Department of the Army, 1989)

- Neurovascular subsyndrome—This subsyndrome is difficult to define. There is little information on lethal doses for human exposure and causes of death are confusing. Cardiovascular shock accompanies such high doses, resulting in a massive loss of serum and electrolytes through leakage into extravascular tissues. The ensuing circulatory problems of edema, increased intracranial pressure, and cerebral anoxia can bring death
within two days. Neurovascular subsyndrome stages are extremely compressed. A burning sensation may occur within minutes; nausea and vomiting may occur within the hour; confusion, prostration, and loss of balance thereafter. A latent period follows with apparent improvement for a few hours, only to be followed by severe manifest illness. Within five to six hours, the symptoms include a return of severe watery diarrhea, respiratory distress, and gross central nervous system signs (Department of the Army, 1989).

**Enabling Objective 3-4:** Recognize injuries and expected physical effects resulting from an explosion

### Injuries and Expected Physical Effects from an Explosion

The physical effects of an explosion and the patient’s distance from the source determine the types of injuries a healthcare responder may encounter. In determining onscene treatment of these injuries, the healthcare responder should consider if any other CBRNE material has been used in an attack. Exposure to or contamination from another hazard may change the triage category into which a patient may fall.

### Explosion Effects

An explosion is a violent release of energy caused by the almost instantaneous combustion or decomposition of a chemical compound or mixture of compounds that releases extreme heat and an extremely large quantity of gaseous products. An explosion creates three primary effects. Multiple secondary effects are caused by those primary effects. The primary effects of an explosion are as follows:

- Incendiary and thermal effect—Occurs in the immediate vicinity of the seat of the explosion with both high and low explosives. The effect varies greatly from one compound to another. This effect is caused by the release of energy caused by deflagration or decomposition of the substance. Low explosives generally produce longer incendiary thermal effects than high explosives. High explosives produce higher temperatures, but for a shorter time. The incendiary effect is usually seen as a bright flash or fireball at the moment of detonation.

### Notes
Variations of Blast Effects Associated with Positive and Negative Phase Pressures with Time, www.mega.nu

- Fragmentation effect—Caused by the movement of physical items at the detonation point. Fragments may be pieces of the explosive device such as the casing and fuzing or it can be pieces of the surrounding environment such as car parts from a car bomb. Fragmentation, called shrapnel, consists of items added by the perpetrator such as nails or washers with the intent to cause additional physical injuries. Fragmentation adds to the destructive force of the explosive device, by tearing into materials in its path.

- Blast effect—Caused by the immense quantity of gas produced as products of the detonation reaction. This gas moves outward at extreme speeds moving the atmosphere and physical objects as it expands. The outward force of the blast pressure diminishes with distance from the seat of the explosion. The leading edge of the pressure wave is called the shock front. It is where the majority of the pressure effect is felt. There are two stages of blast pressure are as follows:

  - Positive pressure—Occurs as the gases produced by the detonation expand outward away from the seat of the explosion. This expansion creates extreme pressure and moves the atmosphere outward. This outward movement delivers violent force to everything in its path. The positive-pressure phase continues until the force of the expanding gases equals atmospheric pressure. Blast pressure diminishes rapidly with the inverse square of the distance traveled.

  - Negative pressure—When the expanding gas pressure diminishes to atmospheric pressure, air rushes back into the void created by the expansion of the explosive gases. The negative-pressure phase force is said to be equal to that of the positive phase but that force is expended over a two to three times longer period, therefore, it is less damaging. Loose debris, grass, and dirt found within the crater and near the seat of the explosion are result from the negative-pressure phase. These items are moved back toward the seat of the explosion by the inward moving atmosphere.

  - Ground or water shock—The force felt as the explosive pressure moves through the ground or water. Explosive pressure moves in all directions. It can be likened to
sound waves moving outward or ripples in a pond radiating from a rock thrown in the water. The pressure moves outward as an expanding ball. When the pressure comes up against ground or water, the pressure expands outward through the ground or water as a shock wave. This can be felt as a ground shake or pressure felt moving through water. Ground shock can cause extensive damage to physical structures as they are shaken by the wave moving through the substance.

Just as the shock wave moves through the ground and the water, it will also move through the human body. The effect of this pressure and frequency wave moving through the body and reflecting from substances with different densities can cause extensive internal damage to human organs.

**Explosion-Related Injuries**

Injuries from explosions can be grouped according to the parts of the body affected as shown in the following table:

<table>
<thead>
<tr>
<th>System</th>
<th>Injury or Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory</td>
<td>Tympanic Membrane (TM) rupture, ossicular disruption, cochlear damage, foreign body</td>
</tr>
<tr>
<td>Eye, Orbit, Face</td>
<td>Perforated globe, foreign body, air embolism, fractures</td>
</tr>
<tr>
<td>Respiratory</td>
<td>Blast lung, hemothorax, pneumothorax, pulmonary contusion and hemorrhage, Arteriovenous (A-V) fistulas (source of air embolism), airway epithelial damage, aspiration pneumonitis, sepsis</td>
</tr>
<tr>
<td>Digestive</td>
<td>Bowel perforation, hemorrhage, ruptured liver or spleen, sepsis, mesenteric ischemia from air embolism</td>
</tr>
<tr>
<td>Circulatory</td>
<td>Cardiac contusion, myocardial infarction from air embolism, shock, vasovagal hypotension, peripheral vascular injury, air embolism-induced injury</td>
</tr>
<tr>
<td>CNS Injury</td>
<td>Concussion, closed and open brain injury, stroke, spinal cord injury, air embolism-induced injury</td>
</tr>
<tr>
<td>Renal Injury</td>
<td>Renal contusion, laceration, acute renal failure due to rhabdomyolysis, hypotension, and hypovolemia</td>
</tr>
<tr>
<td>Extremity Injury</td>
<td>Traumatic amputation, fractures, crush injuries, compartment syndrome, burns, cuts, lacerations, acute arterial occlusion, air embolism-induced injury</td>
</tr>
</tbody>
</table>

*Source: HHS and CDC (2006) “Explosions and Blast Injuries: A Primer for Clinicians”*
Primary Injuries

Primary blast injuries are those caused by the initial blast wave itself. The wall of compressed air within the blast wave impacts the human body and injures gas-containing organs such as the middle ear, lungs, and bowels. Experimental studies conducted in WWII demonstrated that injuries were caused by contact of the blast wave with the body surfaces and not because of the pressure wave gaining access to these organs through natural openings. It is believed that the injuries occur because of the speed with which blast waves strike the body. Internal structures do not have time to stabilize. Slowly applied pressure on the chest, for example, would allow the air in the lungs to escape through the trachea. Primary blast injury to the lungs occurs when the lungs are unable to vent properly (Wightman & Gladish, 2001). Some of the more common blast injuries can be grouped into four categories:

- Lung injury—Blast lung is a direct consequence of the overpressurization wave created by a high explosive detonation. Signs of blast lung may be present at the time of initial evaluation, but may show up as late as 48 hours after the explosion. Blast lung symptoms include shortness of breath, cough, spitting up blood, or chest pain following the blast (HHS and CDC, 2005).

- Ear injury—Auditory system blast injuries cause a significant number of deaths, but these injuries are easily overlooked during initial evaluation. TM perforation is the most common middle ear injury. Signs of ear injury are usually present at the time of initial evaluation, and include hearing loss, tinnitus, otalgia, vertigo, bleeding from the external canal, TM rupture, or mucopurulent otorhea. All patients exposed to blast waves should be assessed and undergo audiometry (HHS and CDC, 2005).

- Abdominal injury—Gas-containing portions of the gastrointestinal tract are most vulnerable to primary blast effect. Injuries can include immediate bowel perforation, hemorrhage, mesenteric shear injuries, solid organ lacerations, and testicular rupture. Blast abdominal injuries should be suspected in anyone exposed to blast waves and experiencing abdominal pain, nausea, vomiting, hematemesis, rectal pain, tenesmus, testicular pain, or unexplained hypovolemia (HHS and CDC, 2005).

- Brain injury—Concussions or mild traumatic brain injury can occur without a direct blow to the head. In evaluating patients, consider the proximity of the patient to the blast when patients present complaints involving headache, fatigue, poor concentration, lethargy, depression, anxiety, insomnia, or other constitutional symptoms (HHS and CDC, 2005).
Health Effects of CBRNE

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Secondary Injuries

Patients at some distance from the blast scene may be injured by objects accelerated by the blast wind. Blast winds may be generated that exceed the speed of hurricanes, but these winds are not sustained. Nonetheless, blast winds can propel objects considerable distances. Blunt-force trauma is common following explosions. Penetrating neck and torso trauma is a common cause of death following explosions. After the 1998 terrorist bombing of the U.S. Embassy in Nairobi, Kenya, flying glass wounded people up to two kilometers from the site (Wightman & Gladish, 2001).

Tertiary Injuries

Tertiary injuries are those that result from individuals being thrown about by the blast wind. Any part of the body can be affected by the resulting impacts. The most common tertiary blast effect injuries include fractures, traumatic amputations, and closed and open brain injuries. In a study of the Oklahoma City bombing, it was found that 11% of the injuries were caused by patients being pushed or blown by the force of the explosion. This study did not include the causes of death for those who died from the explosion (Oklahoma Government, 2005).

Quaternary Injuries

Quaternary injuries are those injuries that are related to an explosion but not due to either primary, secondary, or tertiary effects. These may include crush injuries, closed or open brain injuries, asthma, Chronic Obstructive Pulmonary Disease (COPD), or other breathing difficulties resulting from inhalation of dust, smoke, or toxic materials. They can include angina, hyperglycemia, or hypertension, or may act to exacerbate existing conditions (Wightman & Gladish, 2001).

Notes
Study of Injuries Sustained in Attack on Murrah Federal Building

The Glass Research and Testing Laboratory at Texas Tech University performed a study of the effects of the Oklahoma City bombing in 1995. It found the leading cause of injury was flying glass due to the explosion. It was estimated that 80% of those injured in the bomb blast suffered glass-related injuries. University researchers visited Oklahoma City following the disaster and found glass from the Murrah Federal Building strewn over an area ranging six miles to the north of the building, one mile to the south, and one mile on either side of the building (Saflex, 2005).

Following the destruction of the Murrah Federal Building in Oklahoma City in 1995, various studies were conducted to determine the types of injuries received by the surviving patients. In October 1996, one surveyor began contacting persons 18 years of age and older identified as survivors of the bombing; of 914 persons eligible for the study, 494 participated (Oklahoma Government, 2005).

The most common types of injuries reported during the survey were soft tissue injuries, comprising 61% of all injuries. Organ system injuries, including auditory and inhalation injuries, accounted for 19% of the total, followed by orthopedic injuries, amounting to 12% of the total injuries. The most frequently reported cause of injury, 38%, was from glass. Smoke and dust inhalation accounted for 15%. Hearing injuries were reported by 49% of the study population. These injuries included ruptured eardrums, either short-term or long-term hearing loss, tinnitus, and equilibrium problems (Oklahoma Government, 2005).
Body Regions of Injury, Oklahoma City Bombing

<table>
<thead>
<tr>
<th>Body Region</th>
<th>Number of Injuries (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head/Neck and Face</td>
<td>1,082 (39%)</td>
</tr>
<tr>
<td>Upper Extremities</td>
<td>561 (20%)</td>
</tr>
<tr>
<td>Lower Extremities</td>
<td>444 (16%)</td>
</tr>
<tr>
<td>Chest</td>
<td>396 (14%)</td>
</tr>
<tr>
<td>Back</td>
<td>166 (6%)</td>
</tr>
<tr>
<td>Pelvis</td>
<td>56 (2%)</td>
</tr>
<tr>
<td>Abdomen</td>
<td>35 (1%)</td>
</tr>
<tr>
<td>Other</td>
<td>52 (2%)</td>
</tr>
<tr>
<td>Total</td>
<td>2,792</td>
</tr>
</tbody>
</table>

(Oklahoma Government, 2005)

Medical Management Options

Medical management options recommended by the CDC include the following:

- Blast injuries are not confined to the battlefield. They should be considered for any patient exposed to an explosive force.

- Clinical signs of blast-related abdominal injuries can be initially silent until illnesses such as sepsis are advanced.

- Standard penetrating and blunt trauma to anybody surface is the most common injury seen among survivors. Primary blast lung and blast abdomen are associated with a high mortality rate. Blast lung is the most common fatal injury among initial survivors.

- Blast lung presents soon after exposure. It can be confirmed by finding a “butterfly” pattern on chest x-ray. Prophylactic chest tubes (i.e., thoracostomy) are recommended prior to general anesthesia and/or air transport.

- Auditory system injuries and concussions are easily overlooked. The symptoms of mild Traumatic Brain Injury (TBI) and Post-Traumatic Stress Disorder (PTSD) can be identical.

Notes
• Isolated TM rupture is not a marker of morbidity.

• Traumatic amputation of any limb is a marker for multisystem injuries.

• Air embolism is common and can present as stroke, myocardial infarction, acute abdominal pain, blindness, deafness, spinal cord injury, or claudication. Hyperbaric oxygen therapy may be effective in some cases.

• Compartment syndrome, rhabdomyolysis, and acute renal failure are associated with structural collapse, prolonged extrication, severe burns, and some poisonings.

• Consider the possibility of exposure to inhaled toxins from explosive residue, including nitrates, and poisonings (e.g., CO, CN, oxides of nitrogen) in both industrial and criminal explosions.

• Wounds can be grossly contaminated. Consider delayed primary closure and assess tetanus status. Ensure close follow-up of wounds; head injuries; and eye, ear, and stress-related complaints.

• Communications and instructions may need to be written, because of tinnitus and sudden temporary or permanent deafness.

Conclusion

An incident involving CBRNE materials will result in mass casualties with a large number of victims arriving at the hospital while still contaminated with dangerous materials. Hospital based first receivers to include members of the Hospital Emergency Response Team (HERT) must be able to recognize contaminants and their effects upon patients to not only ensure proper treatment of the patients but also to protect the themselves and the hospital from contamination. This module provided an introduction to the various types of CBRNE materials and the effects they will produce on the human body.

Injuries from explosions may be categorized according to the way the wounds were inflicted. Primary blast injuries are those received from the blast wave striking the outside of the body. The injuries result from the air pressure alone. Injuries are usually to lungs, ears, abdomen, and head. Secondary injuries are those received by being struck by objects being blown around by the blast winds; blunt trauma and penetrating wounds are common. Tertiary injuries are those caused by individuals being blown around and slammed into other objects by the blast wind—
common injuries include fractures, traumatic amputations, and head injuries. Quaternary injuries are all the injuries not included in the first three categories. They can include brain injuries, asthma, or other breathing difficulties from inhaling dust, smoke, or toxic materials. Quaternary injuries can include the exacerbation of existing conditions.
References


Health Effects of CBRNE

Hospital Emergency Response Training for Mass Casualty Incidents


Personal Protective Equipment

Update: December 2013
Lesson Administrative Page

**Summary:** This module explains the importance of wearing PPE, levels of PPE, and hazards associated with wearing PPE. The module explains PPE selection criteria and the latest recommendations as they relate to hospital first receivers based upon hazards associated with a Mass Casualty Incident (MCI).

**Terminal Learning Objective:**

At the conclusion of this module, the healthcare responder will be able to select and use the appropriate PPE level as a hospital first receiver in response to a disaster involving victim contamination.

**Enabling Objectives:**

At the conclusion of this module, the healthcare responder will be able to:

4-1 Identify components of the required PPE level based upon a given situation involving contamination according to the Occupational Safety and Health Administration (OSHA) as hospital first responders during a disaster

4-2 Recognize the medical and safety hazards of wearing PPE during response to a disaster involving contamination as hospital first responders

4-3 Properly don and doff PPE Level C when responding to a hospital emergency involving contamination

**Practical Exercise:** None

**Risk Assessment:** Low

**Duration:** 3 Hours

**Method of Instruction:** Facilitated seminar in a classroom environment followed by a small-group hands-on training

**Instructor Ratio:** 3:40 for facilitated seminar; 2:10 for small-group hands-on training
Introduction

Healthcare responders should always use appropriate PPE when entering a potential Chemical, Biological, Radiological, Nuclear, or Explosives (CBRNE) incident area (as determined by the Incident Commander [IC] or according to local protocol). Without appropriate PPE, responders jeopardize their own safety and the safety of fellow responders, as well as delay triage and/or evacuation of victims. Responders should not enter a warm or hot zone without the proper level of protection and training; they must be decontaminated prior to reentering the cold zone from the warm zone. Noll, Hildebrand, and Yvorra in Hazardous Materials Managing the Incident, define PPE as:

Equipment provided to shield or isolate a person from the chemical, physical, and thermal hazards that may be encountered at a hazardous materials incident. Adequate PPE should protect the respiratory system, skin, eyes, face, hands, feet, head, body, and hearing. PPE includes personal protective clothing, self-contained positive-pressure breathing apparatus, and Air-Purifying Respirators (APR). (2005)

Hazardous Waste Operations and Emergency Response (HAZWOPER), 29 Code of Federal Regulations (C.F.R.) §1910.120(q)(3)(iii) requires that the person in charge of the Incident Command System (ICS) implement appropriate emergency operations, ensuring that PPE worn is appropriate for the hazards (2013).

Responding to a CBRNE event requires using appropriate PPE. However, based on the emergency response jurisdictional capabilities, emergency responders may or may not be adequately equipped with PPE.
**Enabling Objective 4-1:** Identify the components of the required level of PPE based upon a given situation involving contamination according to the OSHA as hospital first responders during a disaster

**Levels of PPE**

According to General Description and Discussion of the Levels of Protection and Protective Gear, Appendix B to 29 C.F.R., there are four basic levels of PPE (A, B, C, and D). The components of each determine the level of protection provided by each set. Selection of the appropriate PPE level to be used in a CBRNE incident will be made by the IC with support from the Command Staff and the Hazardous Materials (HAZMAT) Team Leader.

This decision is a complex one that considers many factors, including the following:

- Identification of hazards or suspected hazards.
- Routes of potential hazards to responders (e.g., inhalation, skin absorption, ingestion, and eye or skin contact).
- Performance of PPE materials in providing a barrier to the hazards (General Description and Discussion of the Levels of Protection and Protective Gear, Appendix B to 29 C.F.R. § 1910.120, 2013).

The National Fire Protection Association (NFPA®) Technical Committee on Hazardous Materials Protective Clothing and Equipment has developed three consensus standards that specify minimum documentation, design and performance criteria, and test methods for chemical-protective clothing. These standards are often referenced as minimum requirements in purchase specifications and cover the following:

- **NFPA 1991—Vapor Protective Ensembles for Hazardous Materials Emergencies**

**Notes**
• **NFPA 1994—Protective Ensemble for Chemical/Biological Terrorism Incidents**

*NFPA 1994* was originally released in 2001 as a result of the growing terrorism problem. It established performance requirements for protective clothing used at chemical and biological terrorism incidents and defined four classes of protective ensembles based on the perceived threats at an incident. In 2007, NFPA released a new edition listing three classes. An independent third party must certify an ensemble to meet class requirements. The entire ensemble—suit, gloves, respirator, and boots, must be certified and worn together or certification is invalid. Ensemble differences are based on:

- Ability of the design to resist inward leakage of chemical and biological contaminants.
- Resistance of the suit to Chemical Warfare Agents (CWA) and Toxic Industrial Chemicals (TIC).
- Strength and durability of these materials, as all *NFPA 1994* ensembles (i.e., garment, gloves, and footwear) are designed for a single exposure.

Many of the *NFPA 1994* testing requirements are similar to those found in both *NFPA 1991* and *1992*. In addition, the standard permits dual certification.

**Respiratory Protection**

One of the most critical components of PPE is respiratory protection. Both Level A and Level B suits require a full-facepiece Self-Contained Breathing Apparatus (SCBA) or a National Institute for Occupational Safety and Health (NIOSH) -approved positive-pressure Supplied Air Respirator (SAR) with escape SCBA. SCBA or positive-pressure SAR is required in atmospheres that are Immediately Dangerous to Life and Health (IDLH).

According to HAZWOPER, 29 C.F.R. §1910.120(q)(3)(iv), emergency responders should wear personal protective clothing equivalent to PPE Level B as minimum protection in environments posing an inhalation or potential inhalation hazard:

Employees engaged in emergency response and exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard shall wear positive pressure self-contained breathing apparatus while engaged in emergency response, until such time that the individual in charge of the ICS determines through the use of air monitoring that a
decreased level of respiratory protection will not result in hazardous exposure to employees. (2013)

SCBA can be used in IDLH atmospheres; however, the equipment is heavy and increases fatigue. SCBA utilizes medical grade D or better compressed air. Compressed air pressure in an SCBA is at either 2216 psi or 4500 psi. Depending on the cylinder size and pressure, the time a responder can operate on a single tank is rated at 30 minutes, 45 minutes, or 60 minutes. Actual time depends on the responder’s air usage rate.

A Powered Air-Purifying Respirator (PAPR) or Air-Purifying Respirator (APR) are normally used with Level C PPE in conditions below IDLH. There are a number of PAPR and APR designs. Each must have filters designed for that particular mask. Filters are identified by their use and are marked with numbers and bands. Some of the more common filters and their uses are as follows:

- R95 or better filter—CS, CN, and oleoresin capsicum spray
- Yellow or black band—Organic Vapor (OV)
- High-Efficiency Particulate Air (HEPA) Filter—Blood Borne Pathogens

**PPE Level A**

According to General Description and Discussion of the Levels of Protection and Protective Gear, Appendix B to 29 C.F.R., PPE Level A provides:

The highest level of protection for skin, eyes, and the respiratory system based on either the measured (or potential for) high concentration of atmospheric vapors, gases, or particulates; or the site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the skin. (2013)

PPE Level A provides maximum protection against vapors, gases, or particulates with a fully encapsulating, chemical-resistant suit, gloves, boots, and a full facepiece, positive-pressure, SCBA or a positive-pressure SAR (air hose) and escape SCBA. Some HAZMAT teams use PPE Level A for initial entry into unknown environments.
Level A equipment includes the following components:

- PPE Level A includes a pressure-demand, full-facepiece, SCBA, or pressure-demand airline respirator with escape SCBA, approved by the NIOSH

- Vapor-protective suits: Totally Encapsulating Chemical Protective (TECP) suits constructed of protective clothing materials that meet the following criteria:
  - Cover the wearer’s torso, head, arms, and legs
  - Include boots and gloves that may either be an integral part of the suit or separate and tightly attached
  - Completely enclose the wearer by itself or in combination with the wearer’s respiratory equipment, gloves, and boots
  - All components of a TECP suit, such as relief valves, seams, and closure assemblies, should provide equivalent chemical-resistant protection. Vapor-protective suits should meet the requirements in *NFPA 1991, Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies*
  - Coveralls (optional)
  - Long underwear (optional)
  - Gloves, outer, chemical-resistant
  - Gloves, inner, chemical-resistant
  - Boots, chemical-resistant, steel-toe and shank
  - Hard hat (under suit) (optional)
  - Disposable protective suit, gloves, and boots (depending on suit construction, can be worn over totally encapsulating suit)

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- Two-way radios (worn inside encapsulating suit) (2006)

General Description and Discussion of the Levels of Protection and Protective Gear, Appendix B to 29 C.F.R., [Part B] [I] requires Level A protection for workers in environments when:

- The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either the measured (or potential for) high concentration of atmospheric vapors, gases, or particulates; or the site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the skin.

- Substances with a high degree of hazard to the skin are known or suspected to be present and skin contact is possible.

- Operations must be conducted in confined, poorly ventilated areas, and the absence of conditions requiring Level A have not yet been determined (2013).

While OSHA adequately defines selection of PPE in a chemical hazard environment, the Centers for Disease Control and Prevention (CDC) and NIOSH provide guidance on the selection of PPE in a biological agent release. In October 2001, the CDC and NIOSH issued “Interim Recommendations for the Selection and Use of Protective Clothing and Respirators Against Biological Agents.” This recommendation is based on potential threats posed by biological agents and was made based on the realization that some devices used intentionally by terrorists have the capacity to disseminate large quantities of biological agents in aerosol form. Therefore, the CDC and NIOSH recognize the need for protection beyond that of an APR with filters ranging from N95 to N100. The recommendation for use of PPE Level A in a biological agent release is as follows:

Responders should use a NIOSH-approved, pressure-demand SCBA in conjunction with a Level A protective suit in responding to a suspected biological incident where any of the following information is unknown or the event is uncontrolled:

- Type(s) of airborne agent(s)
- Dissemination method

Notes
• When dissemination via an aerosol-generating device is still occurring or it has stopped but there is no information on the dissemination duration, or what the exposure concentration might be (NIOSH, 2006)

**PPE Level B**

Encapsulated Level B ensembles are similar to Level A ensembles but are not vapor tight and do not have attached gloves (Hawley, 2004).

PPE Level B is appropriate when the substance type and its atmospheric concentration have been identified and require the highest level of respiratory protection but a lesser level of skin protection. The following components constitute Level B equipment:

• The SCBA is a positive-pressure, full-facepiece, or positive-pressure, SAR with escape SCBA (NIOSH-approved)

• Hooded, chemical-resistant clothing (overalls and long-sleeved jacket, coveralls, one- or two-piece chemical splash suit; disposable chemical-resistant overalls)

• Coveralls (as needed)

• Gloves, outer, chemical-resistant

• Gloves, inner, chemical-resistant

• Boots, outer, chemical-resistant, steel-toe and shank

• Boot covers, outer, chemical-resistant (disposable; optional)

• Hard hat (optional)

• Two-way radios (worn inside encapsulating suit, as needed, when available and when applicable to local jurisdictional protocols)

• Faceshield (optional)

• Cooling vest (as required)

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**Notes**
In explosive atmospheres, additional protection is required. OSHA requires Level B protection in the following situations:

1. Type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection.
2. Atmosphere contains less than 19.5% oxygen.
3. Presence of incompletely identified vapors or gases is indicated by a direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the skin.

**NOTE:** This involves atmospheres with IDLH concentrations of specific substances that present severe inhalation hazards and that do not represent a severe skin hazard; or that do not meet the criteria for use of APR (General Description and Discussion of the Levels of Protection and Protective Gear, Appendix B to 29 C.F.R. § 1910.120, 2013).

The NIOSH recommendation for use of PPE Level B in a biological agent release is as follows:

Responders may use a Level B protective suit with an exposed or enclosed NIOSH-approved pressure-demand SCBA if the situation can be defined in which:

- The suspected biological aerosol is no longer being generated.
- Other conditions may present a splash hazard (NIOSH, 2006).

**PPE Level C**

Level C uses a chemical-resistant suit along with an APR or PAPR, rather than a SCBA or SAR. It provides protection from nuclear and/or radiological residue and biological agents with HEPA, acid gas, and organic vapor filters. PPE Level C allows for extended operations but requires knowledge of the parameters and the contamination before utilizing APR or PAPR. This is the biological and radiological modification of Level C. It is applicable to such calls as “white powder.”
PPE Level C should be used when the concentration(s) and type(s) of airborne substance(s) are known and the criteria for using APR are met.

The following components constitute Level C equipment:

- Full-face or half-mask APR, NIOSH-approved

**NOTE:** Corrective insert lenses or contact lenses may be used with APR if they do not interfere with the APR or protective clothing. Facial hair (beards) may interfere with the APR or protective clothing.

- Hooded, chemical-resistant clothing (overalls, two-piece chemical splash suit, disposable chemical-resistant overalls)
- Coveralls (optional)
- Gloves, outer, chemical-resistant
- Gloves, inner, chemical-resistant

**NOTE:** Different jurisdictions may have responders wear more than two pairs of gloves for protection depending on the situation and hazard.

- Boots, outer, chemical-resistant, steel-toe and shank
- Boots covers, outer, chemical-resistant (disposable) (optional)
- Hard hat (optional)
- Escape mask (optional)
- Two-way radios (worn under outside protective clothing)
- Faceshield (optional)
- Chemical-resistant tape

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**Notes**
NOTE: Chemical tape has a permeability rating and has been tested for resistance to certain types of agents.

The OSHA definition for the use of Level C PPE is for when the concentration(s) and type(s) of airborne substance(s) are known and the criteria for using APRs are met. In general, PPE Level C is used when inhalation risk is known to be below levels expected to harm personnel and when eyes, mucous membranes, and skin exposure are unlikely.

The NIOSH recommendation for use of PPE Level C in a biological agent release is as follows:

Responders may use a full-facepiece respirator with a P100 filter or PAPR with HEPA filters when it can be determined that:

- An aerosol-generating device was not used to create high-airborne concentration.
- Dissemination was by a letter or package that can be easily bagged (NIOSH, 2006).

**PPE Level D**

Level D is limited to coveralls or other work clothes, boots, and gloves. This is basically any type of protective clothing and equipment that is required for the performance of an assigned mission that does not include respiratory protection. Level D consists of a work uniform and affords minimal protection. Level D should be used for nuisance contamination only.

The following components constitute Level D equipment:

- Coveralls, work clothes, and uniforms
- Gloves (optional)
- Boots/shoes, chemical-resistant, steel-toe and shank
- Boots, outer, chemical-resistant (disposable; optional)
- Safety glasses or chemical splash goggles

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- Hard hat (optional)
- Escape mask (optional)
- Faceshield (optional)

Regulatory Standards

The amount and type of protection required in a CBRNE incident depends upon the hazard and duration of anticipated exposure. However, high agent concentrations and operations in restricted environments can affect the protection provided by PPE. The OSHA, NIOSH, NFPA, and Environmental Protection Agency (EPA) classification systems are typically used to describe general areas of protection.

OSHA regulations are incorporated into the C.F.R, which regulate workplace conditions and the safety and health of employees. HAZWOPER, 29 C.F.R. § 1910.120 provides guidance for employees working with or around hazardous materials. HAZWOPER, 29 C.F.R. § 1910.120 (q) provides guidance for emergency responders, and Appendix B lists the components of the levels of PPE. OSHA regulations also indicate that guidance provided by the NFPA should be followed in a hazardous environment. The OSHA website is https://www.osha.gov/.

Respiratory Protection, 29 C.F.R. § 1910.134 details requirements for respiratory protection. It includes the requirement for a written respirator program and proper training for each person who will wear a respirator. Of specific interest to the wearer is Appendix A, Fit-testing Procedures, and Appendix B, User Seal Check Procedures.

NFPA 1994 Protective Ensembles for First Responders to CBRN Terrorism Incidents provides design and protection capability requirements for individual items of protective equipment divided into the three protective classes.

The EPA guidelines mirror OSHA regulations. These guidelines focus specifically on workers who will be involved in environmental response and remediation. The EPA website also provides a listing of the effectiveness of protective materials against chemical degradation: http://www.ehso.com/OSHA_PPE_EPA_Levels.htm.

Notes
NIOSH is associated with the CDC. Guidance from NIOSH includes the PPE most effective against biological agents. NIOSH also certifies equipment that may be used by responders and provides reports regarding management practices related to the safety of emergency workers who respond to large-scale disaster and terrorist attacks. The NIOSH website is http://www.cdc.gov/niosh/homepage.htm.

First Receivers

In January 2005, OSHA published *Best Practices for Hospital-Based First Receivers*. This document provides guidance to hospitals and first receivers regarding the selection and use of appropriate PPE. Best practices presented in this document indicate the minimum PPE that OSHA anticipates will generally be needed for protection of first receivers faced with a wide range of unknown hazards.

OSHA makes a clear distinction between the site at which a hazardous substance has been released and hospital-based decontamination facilities, helping to define the maximum amount of contamination to which first receivers may be exposed. Each hospital must consult its own Hazard Vulnerability Analysis (HVA) and additional information available from the community to determine its anticipated role and coordinate activities with other local emergency response agencies. The complete document is available at https://www.osha.gov/dts/osta/bestpractices/firstreceivers_hospital.pdf.

**Enabling Objective 4-2:** Recognize the medical and safety hazards of wearing PPE during response to a disaster involving contamination as hospital first responders

Limitations of PPE

In determining the appropriate level of PPE, the IC must consider the limitations associated with its use. In order to perform his or her duties safely, each responder must be aware of the potential hazards. The emergency medical responder may also be responsible for the safety and health of other responders and should be aware of potential situations that arise from the use of PPE.

Notes
Safety

To utilize PPE safely, responders must have completed OSHA training for the specific PPE being used. Responders should only use PPE that is NIOSH certified. Due to heat stress and physiological and psychological factors involved in working with PPE, responders must take care not to become casualties. Because communication is limited, the buddy system is used. Essentially, this rule says that all operations must employ two people working together—each checking the safety and status of the other.

Heat and psychological stress place constraints upon the choice and use of PPE. The responder and supervisor must be alert to the dangers of heat and psychological stresses (e.g., claustrophobia, agitation, and disorientation) while encapsulated. Because PPE does not allow the body to rid itself of heat build-up, the outside temperature and body heat produced by the working body determine the potential for heat stress. The PPE type and material and the responder’s physical condition contribute to the ability to tolerate high heat levels. Factors such as humidity, wind, sun, and shade also contribute to heat stress and the time that someone can safely work while encapsulated.

Knowing the expected work rate, ambient temperature, physical and mental condition of the responder, and other environmental factors helps to avoid many problems. Before entering a potential CBRNE environment in Level C, three variables must be known: the oxygen content of the mission area, the type of hazard present in the area, and the concentration of that agent. The IC will provide this information, make the decision about whether responders should enter or not, and prescribe the level of protection and required filter type.

Physical and Psychological Stressors

PPE is associated with a number of potential physical and psychological limitations, including those listed below:

- Impaired communication—Wearing a facepiece or mask may result in poor communication and/or speech intelligibility. Hand signals should be part of Standard Operating Procedures/Standard Operating Guidelines (SOP/SOG).

- Impaired vision—Facepieces may limit the field of vision. Prescription inserts or contact lenses should be used with SCBA, if needed. Glasses should not be worn.
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- Heat-related issues—Encapsulation and moisture-impermeable materials always leads to heat stress. Conversely, wearing PPE in cold, freezing weather can also adversely affect the responder.

- Encapsulation—Adds to psychological trauma to both responders and victims.

- Dexterity issues—Weight and bulkiness of PPE may result in impaired mobility.

NOTE: When wearing inner and outer gloves, placing an additional pair of latex gloves over the outer (butyl) gloves may provide better fit and dexterity. Note also that upon doffing these exterior gloves that care should be taken not to spread any contaminant or blood-borne pathogens. Responders should use local jurisdictional protocols to address these issues. Care must be taken during the process of glove disposal to prevent contamination. Follow local jurisdictional protocols.

Communication, especially verbal, person-to-person communication, is difficult while in PPE. It may be necessary to use hand and arm signals. Visual identification and monitoring of personnel is crucial in low-visibility environments. Using reflective tape provides a means of distinctively marking personnel to denote experience levels, rank, and other information as necessitated by the SOP/SOG.

Other communications systems are available, such as continuous transmission, push-to-transmit, or voice-activated systems. Effective use of these systems requires responder training and experience in their utilization. Because protective masks cause voice distortion, emergency medical responders must train themselves to speak slowly and enunciate clearly to ensure clarity when receiving and giving information.

Prevention and Treatment of Heat-Related Injuries

Heat exhaustion and heat cramps are the most frequently encountered heat injury. Less common, but of greater significance, is heat stroke. Causes of most heat injuries are loss of salt and water from the body, and failure of the sweat mechanism with a resulting increase in body temperature (heat stroke). Heat cramps are primarily caused by excessive loss of salt from the body. The symptom is extremely painful contraction of voluntary muscles, especially in the abdomen.

Notes
Heat injury prevention involves application of measures for decreasing heat exposure as much as possible. HHS provides the following means to prevent the onset of heat injuries (NIOSH, 1992):

- Encourage responders to drink water; thirst is not a good indicator of a heat injury.
- Gradually acclimate responders to working in PPE.
- Maintain good physical condition.
- Take rest breaks from working in PPE—in the shade, if possible.
- Train responders to recognize early signs of heat-related injuries and take appropriate action by notifying medical personnel.

Emergency medical responders should take precautions against cold stress and prevent hypothermia. Although no full-protective clothing ensemble is designed specifically for frigid weather, various gloves, gauntlets, and aprons protect against extreme cold. Layering of clothing offers additional protection. Application of antifog spray may help to alleviate fogging of the suit facepiece, which causes severe visual problems in other types of weather as well (Hawley, 2004).

**Enabling Objective 4-3:** Properly don and doff PPE Level C when responding to a hospital emergency involving contamination

**Donning and Doffing PPE Level C**

**Inspection and Maintenance Procedures**

Proper PPE inspection procedures can mean the difference between life and death when working in a contaminated environment. During the incident, the responder must trust the suit; there is no time to perform a detailed inspection prior to establishing the Emergency Treatment Area (ETA). In the same regard, the suit must be properly donned to ensure that it will provide necessary protection to the wearer. There are specific steps and procedures for inspecting,
donning, and doffing PPE. Preventive maintenance and documentation are integral elements of a comprehensive PPE program; unfortunately, they are often one of the most neglected.

Establish a records file for all chemical-vapor clothing and respiratory protection units to document their respective histories. This documentation should include date of purchase, manufacturer and vendor, serial number, material of construction, and any other unique or specific information. For chemical vapor-protective clothing, establish a logbook for each suit that records each time the clothing is worn, inspection and maintenance data, unusual conditions or observations, decontamination solutions used and procedures followed, and dates with appropriate signatures. Periodic records review may pinpoint an item with excessive maintenance costs or out-of-service times.

Consult the manufacturer’s maintenance and testing recommendations for maintenance intervals and procedures. At a minimum, inspect protective clothing at the following benchmarks:

- Upon receipt from the manufacturer
- After each use
- Periodic inspections: Monthly, quarterly, or per manufacturer’s recommendations
- Whenever questions arise regarding selected protective equipment or when there are problems with similar equipment

Each inspection will cover different areas in varying levels of thoroughness, depending on the type of protective clothing. Detailed inspection procedures are usually available from the manufacturer.

Documentation and maintenance of all appropriate records is a top priority. Assign individual inventory or record numbers to all reusable pieces of protective clothing, including gloves. This will simplify the process of tracking gloves, liquid-chemical splash suits, and chemical-vapor suits over an extended period and facilitate monitoring for potential problems.

Chemical-vapor clothing should undergo a tightness test at intervals as established by the suit manufacturer and NFPA 1991—Vapor Protective Ensembles for Hazardous Materials

Notes
Emergencies. Both chemical-vapor and splash-protective clothing should also undergo visual inspections for any signs of degradation, stress cracks, or damage.

All protective clothing must be stored properly to prevent damage caused by dust, moisture, sunlight, chemical exposures, temperature extremes, and impact. The manufacturer’s storage guidelines should always be followed. Numerous equipment failures during actual use have been attributed to improper storage procedures. Many response organizations store all chemical-vapor suits in sealed packaging to ensure they are not tampered with or damaged.

Though the healthcare facility may have a program in place for protective clothing maintenance, each individual should inspect the suit assigned to them to ensure there are no tears or questions as to its reliability. This provides peace of mind and confidence in the equipment.

Respirator Inspection and Maintenance Procedures

Respirators come in various shapes and sizes. The individual’s selected respirator must fit the face comfortably and must fully seal to ensure proper protection. The individual should evaluate each available facepiece type and select one that provides the most acceptable fit. Check the following when identifying the appropriate respirator:

- Room for eye protection
- Room to talk
- Chin properly placed
- Adjust straps—Place the facepiece on the face then slip the straps over the head. Adjust the straps so that they provide adequate tension to seal the mask
- Fit across the bridge of the nose
- Proper size to span distance from nose to chin
- Tendency of respirator to slip (check to see if it does)
- Observation in a mirror to evaluate fit and position

Notes
A respirator will not seal if there is any hair between the mask and the face. Beards, sideburns, and long hair may create problems. Once an appropriate fit is achieved, conduct a seal test with the respirator. To conduct a seal test perform the following steps:

- **Positive-pressure check**—Close off the exhalation valve and exhale gently into the facepiece. A slight positive pressure should build up inside the facepiece without any evidence of outward leakage. Sealing the exhalation valve can be achieved by cupping the hands over the valve or by removing the valve and reinstalling after the test.

- **Negative-pressure check**—Close off the inlet opening of the canister or cartridge by covering with the palm of the hand then gently inhale. The facepiece should collapse around the face with no leakage around the seal. Hold breath for 10 seconds to ensure a proper seal is maintained.

PAPR may have facepieces that must be fit tested or they may have a one-size-fits-all full-face unit that includes a clear face lens and a butyl rubber or Tyvek© hood as an integral unit. The full-face type with hood does not require fit testing.

No matter the type of respirator, APR or PAPR, the unit should be checked to ensure proper operation on a regular schedule. The assigned wearer should be the individual to check the respirator rather than assigning a logistics person to perform the inspections. This allows the wearers to have full knowledge of the item to which they will trust their health in a dangerous environment. The following maintenance procedures are standardized for each general type of respirator:

- **APR**—Install a new filter before each incident involving contamination. To check respirator serviceability perform the following steps:
  - Check the rubber face blank to ensure there are no tears or cracks and the rubber is flexible.
  - Check head straps to ensure all are in place, there are no tears, each is still elastic, and the straps operate properly.
  - Look inside the APR where the filter inlets are located. There should be a rubber disk covering the inlet valve. Check this disk to ensure it lays flat and rotates freely.
Looking at the outside of the mask, check the outlet valve. There should be a rubber disk covering the outlet valve. This disk should be protected by a cover. Open the cover and ensure the rubber piece rotates freely and lays flat.

Check the clear faceshield for scratches, cracks, or other deterioration

- PAPR—Install new filters before each use in a contaminated environment. The maintenance procedure for a PAPR depends on the type of facepiece being used. PAPR use either a standard full facepiece with the hose attaching to the front of the mask or they utilize a hood. To check PAPR serviceability perform the following steps:
  - Standard facemask—Perform the same procedures listed above for the APR
  - One-size-fits-all hood—A new hood should be installed before use in a contaminated environment
    - Check the hood and the inner and outer shoulder shroud for flexibility and cracks
    - Check the elastic neckband under the faceshield to ensure it is still elastic and that there are no holes
    - Check hood size
  - Inspect the blower unit for cracks
  - Inspect the blower intake manifolds for cracks, dirt, and dust
  - Examine the battery pack for damage
  - Inspect the entire length of the breathing tube, checking for tears, holes, or cracks. Bend the tube to check flexibility
  - Check the system to ensure that it is providing adequate air flow as follows:
    - Install filters on the blower unit
Disconnect the breathing tube from the blower unit, turn on the blower and install the base of the flow meter into the blower outlet connection. Ensure that the blower and flow meter are in a vertical position.

Check to ensure that the center of the float is at or above the 6 cfm (cubic feet per minute) mark for hooded systems, 4 cfm for mask systems. If the float is below the recommended mark, first replace the filters; if this does not solve the problem then check the user’s guide for troubleshooting tips.

- Filters—“The useful service life of a chemical [filter] cartridge will depend upon the flow rate, the specific type [filter], volatility, and concentration of the contaminants and environmental conditions such as humidity and temperature. Replace the filter in accordance with an established change schedule, filter time-use restrictions, or an end of service life indicator, whichever comes first. Change earlier if smell, taste, or irritation from the contaminant is detected” (3M Breathe Easy, n.d.). Replace the filter if it becomes damaged, soiled, or there is an increase in breathing resistance.

**Donning and Doffing PPE**

There are numerous systematic approaches to don and doff PPE. The best method is one that works for the individual and the organization. The most important requirement is to fully tape all seams after donning PPE and to ensure that the individual doffing PPE never touches the outside of the outfit when removing it. The respirator is normally doffed last to maintain protection of the face and lungs until exiting the decontamination corridor. There are times, such as when wearing a PAPR, that this may not be possible, but the organization will need to identify and practice methods before an emergency incident occurs.

It is best to have support personnel assist when donning and doffing PPE. It is very difficult to tape seams while wearing chemically protective gloves. The tape has a tendency to stick to the gloves making it a very difficult process. Ensure that support personnel use the appropriate level/class of PPE to assist with the doffing process. This will be based on the nature of the contaminants and decontamination operations. In general, this will typically consist of chemical gloves and eye protection if a splash hazard is present. Personnel coming out of the contaminated area may be tired, extremely hot and sweaty, and anxious to remove their PPE. Vision may also be obscured through facepiece fogging. Heat stress is a genuine concern. The decontamination team must consider these problems. However, they must not allow any shortcuts in the doffing process.
procedures. Once an individual has doffed PPE and moved out of the warm zone, he or she should be hydrated, medically evaluated, and debriefed as needed.

Donning PPE

1. Remove all nonessential personal property (e.g., watches, rings, sharp objects, wallets, etc.) and secure them in the branch facility.

2. Put on the coveralls. The Tyvek disposable protective overgarment is one type of coverall that may be used. This overgarment is available with or without integrated booties. The protective overgarment is worn over the individual’s regular clothing. Workout shorts and t-shirts should be worn during warm and hot weather.

3. Put on Tyvek booties if the coverall has no feet.

4. Put on over boots and tuck the legs of the coveralls into the outer boots. Some individuals wear a second set of Tyvek booties over the protective boots. This second set provides contamination protection for the outer boots since most radiological contamination will be located within inches of the ground.

5. If working alone for this portion of the donning procedure, tape the junction of the boot and overgarment. If a partner is assisting in the donning, this step can be left until after gloves are donned.

6. Roll up the overgarment sleeves and put on inner lightweight PVC or latex gloves. Cotton gloves may be worn under the inner gloves for comfort.

7. Put on outer gloves and unroll the overgarment sleeves over the gloves.

8. Tape all seams on the legs and wrists. An assistant is needed to ensure proper taping of the suit. Chem tape should be used to tape open areas of the suit. Tape must be tight enough to secure the openings between the gloves/outer shoe covers and the coveralls, but loose enough to be comfortable. Tape must seal the openings, which may require wrapping it two to three times around the arms and legs. A secure taping will protect the wearer against entry of contamination. Be sure to tab the ends of the tape to allow for easier removal. It will be very difficult to remove the tape if a tab is not made.

Notes
9. Don a respirator

   a. If not a full-face respirator then also don safety glasses or goggles

   b. Fitted facemask respirator:

      1) Place the respirator on the face and pull the straps over the head. Tighten the straps
         so they are comfortable but not tight. Perform the positive-pressure and negative-
         pressure checks to ensure a proper seal

      2) Pull the hood over the head. If wearing a full-face respirator tape the hood to the
         respirator

   c. PAPR:

      1) Attach the breathing tube to the blower unit and to the hood or facemask.

      2) Place the blower unit against the lower back with the breathing tube facing
         upward. Fasten the waist belt around the waist.

      3) Attach a fully charged battery to the blower unit and attach the battery to the PAPR
         waist belt.

      4) Don the hood, tucking the inner shroud inside the protective suit, zip up the suit,
         and smooth the outer shroud over the shoulders.

      5) Tape the outer shroud to the protective suit ensuring that no openings are left for
         entrance of contamination.
Doffing PPE

After working within a contaminated environment, PPE should only be doffed while moving through a decontamination line. The decontamination line is established as part of the ETA specifically for processing healthcare staff. The following procedures are used while moving through the decontamination line to doff PPE:

1. Initial decontamination—Individuals departing the hot zone step into the decontamination corridor for initial decontamination. The support team will use either wet or dry decontamination methods for the external part of the PPE. If it has been determined that no contamination exists, the individual can be quickly assisted in removing PPE and processing through the remainder of the corridor.

2. Remove tape—Remove all tape sealing the gloves, respirator, and boots. Deposit tape in the designated container.

3. Remove outer boots—This step will depend on the type of contamination. When the contaminant is radiological the boots can be removed as step three. If the contaminant is chemical or when the protective suit includes sealed footies, the boots are removed along with the coveralls. The boot removal area is divided into hot and cold zones by a marking across the decontamination area. Outer boots are not to be worn across the line. A chair is placed on the hot side of the line allowing the individual to sit and remove their boots. As one boot is removed, place the foot on the warm side of the line. Remove the second boot and place that foot into the warm area. Stand up and move on.

4. Remove outer gloves—Remove the first outer glove by touching only the outside of the glove. Remove the second outer glove with the assistance of a support team member. Another method is to slide the other hand under the back of the glove and work the glove off the hand without touching the outside of the glove. It is imperative that the clean hand does not touch the outer portion of the outer glove or contamination will spread.

5. Remove hood—Tilt head back and allow hood to fall off. Hands can be slid under the hood to slide it off the head. A support person may be needed to help remove the hood. Do not touch the outside of the hood during removal. If the hood is a separate item from the coveralls, it is not removed at this time. Instead, it is pulled over the head covering the face and left in place until the respirator is removed.

Notes
6. Remove PAPR blower unit—When wearing a PAPR, the decontamination area assistant will unsnap the blower unit waist band and hold the blower unit as the individual moves through the remaining decontamination line steps. If an assistant is not available, unsnap the blower unit before removing the outer gloves. An alternate method is to have closed plastic bags staged in the decontamination area. The individual can then reach inside a plastic bag, place the outer portion of the bag over the waist buckle and unsnap the blower unit. This bag can then be used to fold over the blower unit, keeping contamination from the individual’s inner gloves while moving through the decontamination line.

7. Remove coveralls—The coverall removal area is divided with a marked boundary for warm and cold areas. Unzip or otherwise slide coveralls off the shoulders and down over the hips. Be sure not to touch the outside of the coveralls while removing them from the body. Once the coveralls are down over the hips, the individual can sit down for further removal. Do not allow the coveralls to touch the chair or contamination will spread to the underclothing and possibly to the next team member. Touch only the inside of the suit when sliding it down. A support team member will help during this operation. Slide the coverall leg over the foot without allowing the outside to touch the shoe. Repeat the same with the other leg and slide the coverall down so that it can be stepped out of when moving on to the next station. Step out of the coverall with one foot and place that foot on the cold side of the boundary. Step out with the other foot and enter the cold area for final check. Before being checked, grab the coveralls by the inside and deposit in the designated bucket. A support team member may perform this step if sufficient help is available. If wearing a hood-style PAPR, an assistant will fold the outer shroud over the head, turning it inside out before removing the coverall. The individual will have very limited sight, so an assistant is necessary for the remaining steps of the procedure.

8. Remove respirator.
   
   a. Partial-face respirator—Remove safety glasses/goggles and respirator by touching only those portions that were protected by the coverall hood. Place these items in the appropriate bucket.

   b. Full-face respirator—Place hands on the head straps and remove the respirator by looking down, sliding the head straps over the head, and in one smooth motion, without allowing the respirator to touch the body, deposit the respirator into the appropriate bucket.

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c. PAPR with hood—Slide the hands under the inner shroud and remove the hood by sliding it over the head, letting it fall into the appropriate bucket as the assistant turns off the power supply and drops the blower unit into the bucket following the hood.

9. Remove inner gloves—Using the same technique as for the outer gloves, remove the inner gloves and deposit them in the designated bucket.

Ensure that support personnel use the appropriate level/class of PPE to assist with the doffing process. This will be determined by the nature of the contaminants and decontamination operations. In general, this will typically consist of chemical gloves and eye protection if a splash hazard is present. Personnel coming out of the contaminated area may be tired, extremely hot and sweaty, and anxious to remove their PPE. Vision may also be obscured through facepiece fogging. Heat stress is a genuine concern. The decontamination team must take these problems into consideration, but they must not allow any shortcuts in the doffing procedures. Once individuals have doffed their PPE and moved out of the warm zone, they should be hydrated, medically evaluated, and debriefed, as appropriate.

Conclusion

The amount and type of protection required in any CBRNE incident depends upon the hazard and the duration of anticipated exposure. The NIOSH, NFPA, OSHA, and EPA classification system is often used to describe general areas of protection. Always use appropriate PPE when entering a potential CBRNE incident area (as determined by the IC or through local protocol). Without the appropriate PPE, responders will jeopardize their own safety, the safety of fellow responders, and delay the triage and/or evacuation of the victims.
References


General Description and Discussion of the Levels of Protection and Protective Gear, Appendix B to 29 C.F.R. § 1910.120 (2013).


Appendix: Donning and Doffing the PPE Level C

Checklist to Don PPE

- Each responder should obtain a Level C suit, APR, a pair of inner gloves, a pair of Silver Shield gloves, and a pair of boots
- Remove badges, cell phones, and anything else that should not get wet
- Check the oversuit for compromises; shake it out; check the zipper
- Sit on the stool and remove footgear
- Open the zipper of the suit
- Unfold the suit to reveal the leg openings. Place the right foot into the suit then the left foot
- Pull the suit up to remove the slack around the feet and legs
- Stand upright and pull the suit up to the waist
- Put chemical-resistant tape (Chem-Tape®) around the juncture of the boot and the oversuit (optional). If taping, tear an 18-inch piece of tape and tab it on one end. Apply half to the boot and half to the suit

**NOTE:** Follow local protocol regarding taping. Many jurisdictions may choose not to tape.

- If necessary, put on cooling vest
- Put arms into the suit and pull suit to shoulders
- Zip up the suit
- Put on the APR and adjust the straps
- Conduct an APR leak-seal test:
  - Place hand over the opening on the voicemitter of the facepiece
  - Exhale strongly one time (air should escape from the contact area between the sides of the face, forehead, and the facepiece)
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- Place hands over the filter-canister portal(s)
- Inhale and hold for five seconds (facepiece should collapse on face and remain collapsed for the duration of this step)

- Pull the hood on

- Team member: Tape seal team member’s suit
  - Place chemical-resistant tape on both of partner’s suit-boot junctions (center the tape at the junction)
  - Tear a 10- to 12-inch strip of tape. At each end, fold a tab approximately two inches long. Tear a three-inch strip of tape and place the sticky side to the center of the longer strip (sticky side). Place this bowtie under the chin, half on the suit and half on the facepiece. Tear another four pieces approximately four inches long each and fold a tab at one end. Put two strips on each side of the bowtie, tab down, overlapping, and leaving the top open. Place another strip of tape across the top (half on the facepiece and half on the hood) of the facepiece so it looks like a ridge cap
  - Place chemical-resistant tape along the zipper of partner’s suit attaching the top to the bowtie and taping down the zipper

- Put on the inner gloves, Silver Shield and outer butyl gloves
  - Place chemical-resistant tape on both of partner’s suit-glove junctions (center the tape at the junction)

- Reverse roles and repeat the procedure

Checklist to Doff PPE

- Remove tape, if used, on the gloves, boots, facepiece, and zipper
- Remove the butyl gloves and Silver Shield gloves (leave the inner gloves on) and place in the designated container

NOTE: The inner gloves should always be removed last to prevent recontamination.

- Reach inside the hood and roll it back touching only the inside of the suit
• Pull the suit off the shoulders (turning it inside-out) to ensure any residual contamination is kept away from the body
• Sitting on the stool, remove boots and place in the designated container

• Remove suit and place in the designated container

• Remove the APR

• Remove the inner glove, taking care not to spread contamination (follow local protocol for removal of gloves)
Emergency Treatment Area

Update: December 2013
Lesson Administrative Page

Summary: This module explains the principles of establishing, staffing, and safely operating an Emergency Treatment Area (ETA) at the healthcare facility in support of medical operations as the result of a Mass Casualty Incident (MCI).

Terminal Learning Objective:

At the conclusion of this module, the healthcare responder will be able to structure the healthcare facility’s ETA to support medical operations in response to an MCI.

Enabling Objectives:

At the conclusion of this module, the healthcare responder will be able to:

5-1 Recognize the criteria and requirements for establishing an ETA at a hospital as first receivers of patients during a disaster involving contamination

5-2 Identify the components and location criteria for an ETA used by a hospital in response to an MCI involving contamination

5-3 Outline procedures for establishing, staffing, and operating an ETA used by a hospital in response to an MCI involving contamination

Risk Assessment: Low

Duration: 1.0 Hour

Method of Instruction: Facilitated seminar in a classroom environment

Instructor Ratio: 1:40
Introduction

The ETA represents a complete system designed to receive, triage, and process contaminated patients by providing emergency medical treatment and admission into the hospital setting or facilitating their transportation to other medical facilities. The ETA is a complex system relying on team members to orchestrate emergency procedures using specialized equipment to decontaminate patients and provide medical treatment on short notice. Safety of the ETA staff and the hospital environment must be maintained during an incident. Hospital staff coordination in completing this important function is necessary for successful attainment of providing medical care to the injured while protecting both healthcare personnel and the hospital.

Enabling Objective 5-1: Recognize the criteria and requirements for establishing an ETA at a hospital as first receivers of patients during a disaster involving contamination

Requirements for an ETA

The ETA is possibly the most important area for patient care and hospital safety during emergency response. By determining priority of patient medical care and by keeping contamination outside the confines of the hospital environment, the ETA is able to protect the hospital and its staff while ensuring quick and efficient treatment of a large number of seriously injured individuals. It requires a large staff and significant amounts of equipment for successful operation. The ETA is established outside the hospital building, therefore, all necessary equipment must be moved into place when the response begins. Each ETA area requires trained individuals, however, these individuals do not have to be medically trained professionals. Due to the large number of personnel required to staff the ETA and the need to move equipment to the designated location, notification of the MCI must be received quickly. Often the hospital’s first notice of an MCI is the arrival of self-transported patients. The hospital must respond quickly and efficiently once it has identified that an MCI has occurred.

Event Notification

Notification of an incident that requires ETA establishment could come from outside the hospital or from a staff member identifying a problem. The local government 9-1-1 center will be
the first to know of an MCI, Hazardous Materials (HAZMAT), or Chemical, Biological, Radiological, Nuclear, or Explosives (CBRNE) event that will affect the healthcare facility and its ability to provide medical support to numerous patients. Depending on the working relationship with the 9-1-1 center, it may provide notification or it may leave that notification to others. The healthcare facility should create partnerships with 9-1-1 center supervisors to ensure quick notification of events requiring response. During a natural disaster, the government’s Emergency Operations Center (EOC) is activated and will provide notification as necessary to response organizations. Organizations provide notification of events to a predesignated section or department within the hospital. In a hospital with an emergency response section, calls would normally be sent to that office.

A hospital must establish a well-defined system of organizing and disseminating information received concerning an MCI—whether that information is received via a government agency or made known by self-presenting patients of the incident. Dissemination of collected information is a crucial task in establishing an ETA. A timely and concise briefing to the ETA members provides for a well-prepared and informed team. Throughout the prearrival timeframe, information should be collected and disseminated as it is received. Utilization of outside technical assistance agencies documents (e.g., the Centers for Disease Control and Prevention [CDC], Poison Control Center, Agency for Toxic Substances and Disease Registry [ATSDR], and Material Safety Data Sheet [MSDS]) can be helpful in providing technical advice and information concerning symptoms, hazards, and medical treatment. Information that should be obtained includes the following:

- Type of event—Allows the Hospital Emergency Response Team (HERT) and hospital to tailor their response to the situation. Specific event details should be solicited to provide an accurate picture of the current situation. This will aid in judging potential patient loading. Some important details may include the following:
  - Contaminating material—Is the release on-going or controlled?
  - Transport method—What means of transport are the patients utilizing: Emergency Medical Services (EMS), Personally Owned Vehicles (POV), or mass transit?
  - Responder status—Are first responders onscene?

Notes
• Location of event—Provides clues to substances that may be involved, the number of workers or citizens that may be in that particular area or location, and the surrounding population density.

• Number of patients—Includes possible numbers of patients and actual currently known numbers. Knowledge of patients currently assessed, their medical status, and triage are important information categories. A guide of questions to ask and information to obtain during prearrival notification is enclosed at the end of this module.

**ETA Trigger Events**

The hospital’s Emergency Operations Plan (EOP) will contain criteria for establishing the ETA within the basic plan and specific-incident annexes. Some standard incident annexes that include ETA establishment include MCI, HAZMAT, and CBRNE. There are two other incidents that should be addressed as requiring establishment of the ETA, which are as follows:

• Significant internal release of a chemical, biological, or radiological substance that warrants decontamination of personnel, patients, or visitors.

• Contractors working at the hospital introduce a hazardous substance that warrants evacuation and possible decontamination of personnel, patients, or visitors.

**Callout Procedures and Prearrival Actions**

Once notification has been received and the determination has been made to activate the ETA, the hospital will institute a callout and recall of required personnel. Prior planning and training ensure a timely and efficient establishment and operation of medical equipment. Personnel to staff the ETA must know where to respond and access the necessary equipment. All staff must be cross-trained for requirements necessary to establish the ETA. Factors that will impact ETA establishment include the time of day and number of staff.

Establishing the ETA is an involved and time-consuming process. As HERT members arrive onscene, they will stage equipment and supplies in the designated area. The HERT leader will initiate communication with the HICS center and the Incident Commander (IC). The IC will identify the required Personal Protective Equipment (PPE) protection level. As ETA establishment continues, receiving staff will don appropriate PPE. Prior to going fully
operational, the HERT leader should conduct a safety and situation briefing for staff and security personnel.

Upon initial notification or identification (including self-presented patients), the Emergency Department (ED) will lockdown to prevent outside entry and prepare to receive possibly contaminated patients prior to full ETA establishment. The ED will stock and drape the HAZMAT suite and establish patient and technical decontamination stations. Once established, the ED will control entry and begin operations until the ETA is ready to begin decontamination procedures. Once operational, the ETA takes over the decontamination process.

**Enabling Objective 5-2:** Identify the components and location criteria for an ETA used by a hospital in response to an MCI involving contamination

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**ETA Overview**

An ETA is designed to process contaminated patients from a HAZMAT, MCI, or CBRNE incident. Typically, an ETA is established as one area with three separate sections. The following sections are building blocks toward accepting patients, assessing their injuries, and processing them into the hospital system:

- The first section is the patient reception and receiving area. It accommodates triage and control procedures. As the patient entry point, it is considered a contaminated zone where staff self-protection is required.

- The second section is the decontamination corridor. This area accommodates contaminant removal from ambulatory and nonambulatory patients.
The third section is the clean treatment and transport area, which provides medical care, secondary triage, and transport functions.

The ETA should have one entrance and one exit to control contamination and patient flow through the area. The ETA is exclusively for contaminated patients. Uncontaminated patients are processed separately. By separating contaminated and uncontaminated patients, it is easier and faster to process them into the hospital system and uncontaminated patients do not risk contamination while awaiting care.

The footprint for such a system requires careful planning. Planning considerations include the following:

- **Utilities access**—The ETA requires electrical power and a water supply. It should be located adjacent to power and water access points if possible. Extensions must be provided if the ETA is remote from access points. Access cords and water lines must be protected, especially from vehicles.

- **Hospital and ED access**—The ETA requires ready access to the ED entrance. If conditions permit, it is best to have the clean treatment and transport area close to the ED while providing sufficient area for working with patients being triaged, treated and staged, or prepared for transport to other hospitals. Sometimes, the ETA cannot be located near the ED entrance. In this case, the clean treatment and transport area should be positioned with clear access to the ED entrance. The possibility of an attack on the ETA should be considered in the planning process. The ETA should be situated to protect the hospital from attack while allowing for the maximum protection in the event of an attack.

- **Heating Ventilating and Air Conditioning (HVAC) intake system**—With the possibility of patient and vapor contamination, responders must ensure the ETA is downwind of the HVAC intake system to avoid contaminating air entering the hospital. Even with prior planning, a shutdown plan is necessary for wind direction changes. A second location consideration is positioning the ETA so that wind does not carry contaminants toward the clean treatment and transport area or the ED entrance.

- **Ground area elevation and grade**—If at all possible, the ETA should be located on level ground or slightly uphill. Water runoff from the ETA must be taken into account when determining site location. EPA regulations require contaminated water to be contained.
If for some reason it cannot be contained during initial ETA operations, it must not run toward the main facility or enter storm drains. A second consideration is transportation of patients to the ED. An uphill struggle with stretchers will slow the transportation and eventually exhaust transport personnel. Many contaminant vapors are also heavier than air. Positioning the ETA in a low spot may allow vapors to collect, creating a serious problem for patients and staff.

- ETA equipment space requirements—The ETA must be large enough to accommodate all three area requirements to allow effective flow through the system. Though not a specific segment of the ETA, the HERT leader must consider locations for the noncontaminated patient seclusion area, green tag patient treatment and seclusion area, ambulance and vehicle receiving, staging area, and patient transportation area.

- Visibility—The ETA must be positioned to ensure the privacy of patients, especially from the media.

- Security support—Selected location must allow for both perimeter and patient control. This will enhance safety of the facility and staff. Lockdown procedures should address means of halting all patient access into the hospital through nondesignated entry points.

- Weather—Prior to establishing the ETA, weather conditions must be analyzed to determine precipitation probabilities and prevailing wind direction. The ETA should be established with prevailing wind blowing from the decontaminated (cold) area toward the contaminated (hot) area. Changes in weather conditions could significantly impact the ETA, especially changes in wind speed and direction. Obtaining weather information from the local jurisdiction EOC is critical during incidents involving contamination. Moving an operational ETA is difficult but could be mandated if conditions change significantly.

Once the ETA location is determined, there are other decisions to be made and issues to consider concerning the site. The following are some items to consider and requirements that must be met:

- Contamination containment—Containment materials (i.e., plastic sheeting with sandbags or some type of pools) must be installed to contain all contaminated material and runoff.
• ETA layout—HERT leader and ETA group supervisor must establish the ETA footprint to include the pre-entry area, patient reception area, decontamination area, and postdecontamination area. The leaders must have knowledge of the expected number of patients and an understanding of the space needed to perform necessary functions within each functional area. Area boundaries should be further delineated by ETA staff. When establishing proper boundaries, it is necessary to allow for the possibility of increasing one or more areas to handle changes in patient load.

• Vehicle entry—Controlled access points to restrict vehicles getting too close to the ETA. Controlled access points must restrict entry to one vehicle at a time and reduce vehicle speed. This reduces the possibility of a vehicle-borne attack. Reducing vehicle access could result in multiple vehicles waiting entrance to the vehicle reception area. Due to this restriction, HERT leader and ETA group supervisor must consider road layout when locating the ETA. Once vehicle entry methods are established, this information must be provided to organizations requiring access (e.g., EMS, FD, law enforcement, HAZMAT team, and public health).

• Media assembly and staging area—Media representatives will want unlimited access. However, they must be located elsewhere to ensure patient privacy and prevent the spread of contamination. The Public Information Officer (PIO) has the expertise to establish a suitable media area. In addition, the PIO understands the need to obtain a story but will also be able to convey to media representatives the need for patients’ privacy and contamination risks.

• Family member reception area—Family members of the injured and missing will arrive at the hospital to locate relatives and ensure the injured are receiving appropriate care. Family members must be provided a separate staging area to avoid spreading contamination. Contact the hospital family services or support department to determine needs for this area. This department has the staff and expertise to identify an appropriate area. This area must be separate from the ETA so that families cannot see patients being processed. This area should be physically separated from the patient noncontamination and green tag seclusion areas for the same reasons. A family member seeing a relative not being treated or going through decontamination could cause a problem by being disruptive or trying to become involved in the response process.
Hazard Control Zones

Hazard control zones are vital to the hospital as they ensure a safe environment for employees and provide a positive image of organization and effectiveness in patient care. The importance of maintaining control during major events cannot be overstated. Uncontrolled sites are open to situations that compromise the hospital, its patients, and employees. Hazard control zones are divided into the following three areas:

- Access to grounds and hospital
- Overall security
- Contamination containment

Many techniques can be utilized to create control zones from simple barricades to isolation areas and electronic security access control. The three control zones are separated to control access, provide security, and minimize contamination transfer. Control zones also help control bystanders. The number and type of systems utilized varies. A realistic review of a facility’s capabilities can provide a blueprint for improving and enhancing the control aspects during worst-case scenarios.

Though the area has been divided into three zones, only two zones are designated for the ETA. Designation of the two decontamination control zones is different for hospitals than for other organizations. OSHA’s Best Practices for the Protection of Hospital Based First Receivers provides the following decontamination zone designations:

- Hospital decontamination zone—Areas where the type and amount of contamination is unknown. This area includes triage, patient staging, decontamination, and postdecontamination inspection areas. This area is known as the warm zone by other organizations.

- Hospital postdecontamination zone—Includes uncontaminated areas such as the ED. This area is known as the cold zone for other organizations (OSHA, 2005).
Emergency Treatment Area

Hospital Emergency Response Training for Mass Casualty Incidents

Enabling Objective 5-3: Outline procedures for establishing, staffing, and operating an ETA used by a hospital in response to an MCI involving contamination

Hospital Decontamination Zone

The hospital decontamination zone begins where individuals and patients first enter the hospital grounds and extends to the postdecontamination patient inspection area. Hospital staff and first responders must wear appropriate PPE when working in this zone. Activities in this zone include: size-up, scene control, triage, patient assembly, treatment vs. decontamination issues, and ambulatory vs. nonambulatory designations. In the decontamination zone, the staff observes patients for exposure symptoms and communicates those findings. The ETA group supervisor reports findings to the HERT leader who forwards this information to the Hospital Incident Command System (HICS). The IC, through the HICS, forwards notification to other appropriate Incident Command Posts (ICP), EOC, and possible health department representatives. Normally, the hospital HICS forwards information to the EOC and representatives at the EOC notify public health and higher government-level authorities.

The hospital decontamination zone accommodates patient decontamination and acts as a buffer between contaminated patients and the hospital facility. Medical teams must assess the risk to life and safety issues. Expediting a patient through decontamination may place the entire hospital at further risk. There is no comprehensive doctrine that addresses this issue. Instead, a reasonable risk decision must be based upon the facts currently known at that point. Variables to consider include the following:

- Type of hazardous substance suspected or known to be involved
- Biological agent or radiological material suspected
- Length of exposure for each individual patient
- Patient age, history, and medical condition
- Has a gross decontamination been accomplished?
- Location of exposure

Notes
• Weather conditions—Wind direction, temperature, humidity, etc.

To ensure safety, complete decontamination is usually performed. In some situations, a modified decontamination procedure can reduce significant risk and allow rapid medical care to be provided. Techniques for such modified procedures should be logical and prudent and available as an alternative.

Activities within the decontamination zone include all patient-related actions. The initial phase is receiving patients for triage. After triage, all clothing is removed by the patient or, if necessary, with assistance. Personal items are collected and labeled. The sequence may include the rinse procedure, redressing, and basic medical care. The decontamination zone must include containment and control techniques for rinse and wash solutions, along with disposal of residual containments. Decontamination zone staff should practice routine glove changes and use splash shielding and other measures to ensure the decontamination system remains functional. The decontamination zone will provide a corridor for team members working in this zone. All personnel and equipment must be decontaminated before leaving this zone. The final process in the decontamination zone is redressing or covering of patients with clean, modest, and uncontaminated hospital garb.

Postdecontamination Zone

The postdecontamination zone is a clean, uncontaminated area where medical treatment and secondary triage occurs. This area is the ETA support zone and is also the last zone that patients process through prior to hospital admittance. The postdecontamination zone should be positioned near the ED. The ED may be able to provide medical assets for use in this area.

Two important issues for the ED and postdecontamination zone are security and control. Effective security controls are vital in this area. The ability to deliver medical care is paramount; any loss of perimeter security and access control is detrimental to patients and staff. The postdecontamination zone allows separation of patients into groups for general and lifesaving care. Finally, patients are transported from this zone to the appropriate designated location either within the hospital or another facility for continued or specialized care.

Some chemicals have delayed effects that could affect patients even after decontamination. It is recommended that all patients be admitted for an observation period of 18 hours.
Demobilizing the ETA

ETA demobilization is a complex operation. Proper removal of contaminated materials and equipment, and decontamination of reusable equipment are tedious processes. ETA demobilization plans should be addressed in the Standard Operating Procedure (SOP)/Standard Operating Guidance (SOG) written for ETA operation long before an incident occurs.

Proper technique must be utilized when samples are being collected to aid in diagnosis (e.g., sending to a Laboratory Response Network [LRN] facility for evidence purposes). Before demobilization can begin, contaminating substances must be identified and levels of contamination remaining onsite must be determined. This may require numerous samples from a large area with appropriate equipment. This is required to ensure the proper decontamination technique, including the correct decontaminating solution, is utilized and that all contaminated areas are identified and resolved.

Technical expertise is often necessary to create a site-specific remediation program to ensure that cleanup is thorough. Each contaminant must be documented, removed, and/or neutralized prior to resuming normal ETA functions. The final step is removal of contaminated waste to a certified disposal site. The hospital should consult with waste disposal experts to ensure proper disposal. Coordinating these activities through the EOC may help identify the appropriate contractor and avoid duplicating efforts.

Postevent Actions

Any event of this magnitude should have an After Action Review (AAR) created. The postactions need to encompass as much information as possible due to the impact of the event on the hospital and its staff. Postevent actions will concentrate on dismantling the ETA, providing postevaluations, and medical examinations for the HERT and other staff members that warrant the same.

An analysis of the hospital’s response to the event should be completed with recommendations incorporated as part of the review. EOP revisions or updates should be accomplished at this time to ensure a more effective plan will emerge for future events. Complete any final documentation that supports the event. Final notifications and waste disposal records should be completed and filed along with other event documentation in the appropriate place. The final step is to return the hospital to routine operations.

Notes
Conclusion

An ETA is a designated area that provides protection to the hospital and care for patients. This area with its designated zones and specialized equipment is the epicenter of the emergency event. Without it, the hospital and its staff are as much patients as anyone else and will face the disastrous effects associated with an MCI, HAZMAT, or CBRNE event. Highly trained staff and equipped facilities can avert the disaster by stopping the hazard from ever reaching its doors and ensuring medical care is provided as soon as possible.
### Information to Obtain during Notification of a HAZMAT, MCI, or CBRNE Event

<table>
<thead>
<tr>
<th>Required Information:</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Name of caller</td>
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<td>Date/time</td>
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<td>Location of incident</td>
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<td>Estimated number of patients</td>
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<td>Patient’s medical status</td>
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<td>Patient’s triage category</td>
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<td>Type of care already provided</td>
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<td>Radiation incidents:</td>
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<td>• Have patients been surveyed?</td>
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<tr>
<td>• Exposed vs. contamination</td>
<td></td>
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<tr>
<td>• Type of radiation (if known)</td>
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2. **Explosive Device:**
   - Type of weapon (vehicle, briefcase, etc.)
   - Number of patients
   - Secondary explosions?

3. **HAZMAT Incident/WMD Event:**
   - Identify of substance/containment (if known)
   - Liquid, solid, or gas/vapor
   - Signs & symptoms of exposure
   - Release ongoing or terminated
   - Potential crime scene

4. **Patient’s estimated arrival time**

5. **Means of transport vehicle(s):**
   - EMS
   - Privately owned vehicle

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**Notes**
### Information to Obtain during Notification of a HAZMAT, MCI, or CBRNE Event (continued)

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<td><strong>6. Any first responders at the scene?</strong></td>
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<td>FD, EMS, police, etc.</td>
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<td>Solicit reports:</td>
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<td>• Has initial decontamination been performed?</td>
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<td>• Nature of injuries</td>
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<td>• Identification of materials (labels, placards, etc.)</td>
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<td><strong>7. Call-back number for:</strong></td>
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<td>Verification and follow-up</td>
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<td>Actual incident vs. hoax</td>
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<td><strong>8. Information to:</strong></td>
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<td>ED</td>
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<tr>
<td>Hospital safety/security officer</td>
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<td>HERT/decontamination team members</td>
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<td>Hospital Staff</td>
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<tr>
<td>Administrator</td>
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<td>Public Information Officer (PIO)</td>
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**Notes**
References

Hospital Emergency Response Team Exercise

Update: December 2013
Lesson Administrative Page

Summary: This module uses a tabletop exercise venue to provide the healthcare responder with an opportunity to gain a better understanding of the complexities involved in establishing and managing a Hospital Emergency Response Team (HERT) in response to a Mass Casualty Incident (MCI) involving contamination.

Terminal Learning Objective:

At the conclusion of this module, the healthcare responder will be able to establish a HERT that meets all safety requirements, provides security to the hospital, and efficiently handles victims for processing into the hospital facility for follow-up treatment.

Enabling Objectives:

At the conclusion of this module, the healthcare responder will be able to:

6-1 Analyze environmental and topographical conditions to determine appropriate locations for sections of the HERT in response to an MCI involving contamination

6-2 Determine the appropriate size and location for the various sections involved in HERT response to an MCI involving contamination

6-3 Determine the appropriate size and personnel strength for an Emergency Treatment Area (ETA) in response to an MCI involving contamination

6-4 Determine the appropriate layout to include decontamination lane types and sizes for an ETA in response to an MCI involving contamination

6-5 Determine appropriate locations, restrictions, and size for security areas necessary during a response to an MCI involving contamination

Risk Assessment: Low

Duration: 1.0 Hour

Method of Instruction: Facilitated small-group exercise

Instructor Ratio: 1:10
Scenario

8:00 a.m.: Your hospital has just received notification from the 9-1-1 operator that all emergency services organizations (e.g., police department, fire department, Emergency Medical Systems [EMS]), and Hazardous Materials [HAZMAT]) are responding to an incident at the local post office. Numerous individuals are said to be lying on the floor while others have been seen running from the building. Outside there are more than 15 individuals laying on the ground in obvious distress. The post office was in the middle of the April 15 tax rush mailing at the time of the incident.

8:15 a.m.: 9-1-1 calls again. Mutual aid from the local police department and fire department has been requested. Police and firefighters that rushed into the building are unconscious within and outside the building.

8:25 a.m.: HAZMAT personnel in full Personal Protective Equipment (PPE), not medical EMS, are arriving with victims in the back of a pick up truck.

9:00 a.m.: HAZMAT has tentatively identified the incident as an intentional release of some type of nerve agent. The agent is suspected to be sarin.

Scenario Update

The Emergency Department (ED) charge nurse has taken control of the response as Incident Commander (IC) and has had the hospital administration department effect a recall of all employees. The IC has directed all hospital entrances to be locked and guarded by hospital security and has ordered HERT activation. The IC has requested that the HERT leader report to the HICS and provide recommendations for ETA establishment and other necessary response locations. The IC is definitely under stress as there are victims attempting to breach the ED door to gain care for the injured. In response to actions ongoing outside the hospital, the IC has also requested PIO representation immediately.

When the HERT leader arrives at the Hospital Incident Command System (HICS) to liaison with the IC, there is a crowd of people at the ED door. Three ambulances are outside calling for entry along with 15 self arriving victims. The EMT ambulances are saturating the radio with angry desires to gain entrance and also with calls to other ambulances and their superiors about the situation.

Notes
Scenario Update

The Public Information Officer (PIO) has requested a meeting with the HERT leader. There is an increasing media demand for information concerning the situation and what is being done to take care of the victims. The PIO says there are already television trucks everywhere with cameras and satellite dishes. National coverage is expected with 10 to 20 different organizations involved. Recommendations as to where the media can set up their cameras and information on when the HERT leader will be ready to give an interview are requested by the PIO.

Scenario Update

The onscene IC has just contacted the HICS to inform them that two tour size busses have just been loaded with victims and will be on the way to the hospital within five minutes. The onscene IC now estimates there are well over 200 victims. Gross decontamination is continuing onscene, but victims are not being cut out before transportation. The number of victims is considered overwhelming.

School Solution

The given school solution is one possible answer, but not the only answer or possibly even the best answer to the situation. It is provided as a guide for how the situation could have been successfully handled.

Establish the ETA in the parking garage located west of the hospital, on the corners of Bleeker and Broadway. This location provides a relatively private area that can be easily secured, and can be closed off using tarps or other materials. The garage also provides ready access for ambulances, which can be routed north along Broadway to deliver patients, and ambulances can then turn west at the corner of Broadway and Bleeker to return to the incident scene. The opposite side of the parking garage provides straight access across Hospital Drive into the ED.

Secure the hospital grounds including the entire block along the edges of Broadway, Bleeker, and Park streets, and east of the tennis courts and the “various offices” building. This will close off entrance to all areas of the hospital. Additional security will be necessary, which will require the HERT leader identifying to the HICS the need for additional security personnel. The HICS will have to go to the local EOC to request support. Security will also have to barricade the parking garage perimeter to keep anyone who may gain or need access to the hospital grounds out of the ETA.
A media area can be established by the PIO outside in the parking area north of the actual hospital facility or within the Physician’s Center. Either area will allow control of the media and also allow the media to view some aspects of the response without being in the way or being able to get pictures within the ETA. Keeping the media in the Physician’s Center could pose a problem as contamination will be from the parking garage towards the center, but if sheltered inside and not allowed to exit, this would provide acceptable protection. The best probable location would be the parking lot, which gives the media a clean location with some picture access.

A family center could be established in the “various offices” building. This building would provide sufficient space to house the families and it is located within the clean zone. Families would have extremely limited view of the victims being moved from the ETA to the ED, but this view would be far enough away as to not allow them to identify victims. Their only opportunity to view the decontamination process would be if they were allowed outside on the west side of the structure.

The parking garage is a multilevel structure, so the higher floors could conceivably be used to treat walking wounded and the uncontaminated. Victims could be moved to the upper levels directly as they were registered into the ETA. The parking garage is sufficiently large also to be used for various sites if barricades are established using tarps and such. In this manner the north end could be used for the uncontaminated victims with the southern portion used for the ETA.

Conclusion

Operations outside the hospital in response to an incident involving contamination involve difficult decisions and complex questions. Those individuals assigned to and in charge of the HERT must be able to analyze multiple possibilities to establish operations in location that will meet incident requirements, ensure the safety of the hospital, and ensure the safety and privacy of patients.
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Hospital Decontamination Procedures

Update: December 2013
Lesson Administrative Page

**Summary:** This module provides an overview of the decontamination corridor, decontamination methods, and procedures for decontamination of both ambulatory and nonambulatory patients.

**Terminal Learning Objective**

At the conclusion of this module, the healthcare responder will be able to compare decontamination methods and procedures.

**Enabling Objectives:**

At the conclusion of this module, the healthcare responder will be able to:

7-1 Identify the methods of decontamination appropriate for hospital operations during a Mass Casualty Incident (MCI) involving patient contamination

7-2 Structure a decontamination corridor for use in a hospital’s Emergency Treatment Area (ETA) established in response to an MCI involving patient contamination

7-3 Recognize the step-by-step procedures for ambulatory and nonambulatory decontamination performed in response to an MCI involving patient contamination

**Risk Assessment:** Low

**Duration:** 1.0 Hour

**Method of Instruction:** Facilitated seminar in a classroom environment

**Instructor Ratio:** 1:40
Enabling Objective 7-1: Identify the methods of decontamination appropriate for hospital operations during an MCI involving patient contamination

Decontamination Methods for Hospital Operations

To understand methods of decontaminating a patient or responder, one must first understand contamination. Contamination is exposure to a hazardous substance that may result in adverse effects on the health or safety of an individual. The substance may be liquid, solid, or vapor and may be in the area around the person or on equipment, the person’s body, or clothes. Contamination can be caused by exposure to chemicals or radioactive materials. Hazardous Waste Operations and Emergency Response (HAZWOPER), 29 Code of Federal Regulations (C.F.R.) § 1910.120(a)(3) considers the following another form of contamination:

Any biological agent and other disease causing agent which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any person, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations in such persons or their offspring. (2013)

Decontamination

Decontamination remains a focus of any response involving hazardous substances. It is the first process established and one of the last activities in operation during an incident response. As insurance against mishap, a decontamination station is the first area established during an MCI response. Decontamination operations continue until all personnel and equipment, including the decontamination equipment itself, has been cleaned.

Decontamination is defined by OSHA in Federal regulation HAZWOPER, 29 C.F.R. § 1910.120(a)(3) as “the removal of hazardous substances from employees and their equipment to the extent necessary to preclude the occurrence of foreseeable adverse health effects” (2013). For hospital personnel receiving contaminated patients, this means removal of the hazardous substance from patients before they are processed into the hospital facility, ensuring safety of the staff, hospital and other uncontaminated patients. Removing contamination quickly protects the patient from possible damaging health effects that may result from the contaminant.

Notes
Patients may be decontaminated at the incident site, or they may arrive contaminated at the hospital and, therefore, must be decontaminated upon arrival. Normally, gross decontamination takes place at the incident site. This procedure removes the majority of contaminant on the patient so that responders can provide immediate care and transport the patient to the hospital. Once arriving at the hospital, the patient requires further decontamination before being admitted into the hospital for follow-up care. Gross decontamination at the incident site typically consists of a low-pressure wash down with a fire hose or other available water system.

The ETA provides the capability to decontaminate patients before entry into the hospital setting. Once received at the ETA, a patient enters the system beginning with triage and labeling. If a patient is determined to be contaminated, he or she will enter the decontamination line.

Survey and Monitoring

Determination of the patient’s status is accomplished visually and with specialized equipment. The first step is to look at the patient to determine if there is visible contamination on the patient’s body and clothes. Second, the patient is observed to detect any reactions and symptoms of contamination. Finally, survey equipment is used to detect contamination and tentatively identify the contaminant present. For some agents or materials, symptoms might not be specific enough. Healthcare responders use survey and monitoring equipment to confirm contaminant location, type, and concentration. This confirmation helps to determine the necessary level of protection, first aid, and decontamination measures. Survey equipment will also provide information to the decontamination team, ensuring that there is little to no residual contamination on patients prior to their leaving the warm zone and entering the cold zone.

No single system is capable of detecting all hazardous materials or chemical agents. Healthcare responders must use a number of tools, each serving a specific role during a response. There are many different types of systems, from very simple chemical-reactive papers (that work in seconds) to very sophisticated laboratory instruments (that can take from minutes to hours to give results). Simple systems provide broad information, while complex systems provide detailed information.

Some devices only respond specifically to liquids (e.g., M8/C8/M9 paper) or vapors (e.g., M256A1 sampler). In order to determine the presence of contamination prior to entry and exit of the ETA, healthcare response teams should use the information provided by several different systems.
The Ludlum Model 2241 is used to detect radiological material. It is a portable general-purpose survey meter equipped with a Geiger-Mueller probe capable of measuring alpha, beta, and gamma radiation.

The MultiRAE Plus is a monitor used to detect multiple hazardous gases within a small area. It combines a Photoionization Detector (PID) with a monitor that measures four gases, including Dioxide, Lower Explosive Limit, and two additional toxic gas sensors. It has a sampling pump that can draw up to 100 feet horizontally or vertically and it can be used as a personal monitor, a handheld sniffer, or as an area monitor operating continuously to detect chemical hazards (RAE Systems, 2010).

Each Hospital Emergency Response Team (HERT) must purchase and have available portable chemical agent and radiation detectors to survey and monitor patients for contamination. Sufficient equipment with trained personnel must be available to survey and monitor patients arriving at the ETA and to check patients after decontamination and before entry into the hospital.

Decontamination Methods

There are two major decontamination processes—physical and chemical. Each major process is further defined into wet and dry decontamination.

- Physical decontamination—Physical decontamination is removal of the contaminant either by removing the clothes or by wiping and briefly washing the skin. When contaminated by vapor, removing the clothes will effectively decontaminate the individual. For liquids or solids, it is estimated that 60–80% of the contaminant can be removed by discarding outer clothing.

Removal of the contaminating substance using soap and water is the method of choice for all substances not specifically known to react with water. Contamination should be washed from the skin using soap and a shower with free-flowing water for five-to-eight minutes.

A mild liquid soap with good surfactant (i.e., surface-active substance) qualities, (e.g., liquid soap, hard soap, or dishwashing soap) is the best choice. This type of soap removes oily chemical agents but will not irritate the skin. If soap is not available, do not delay the decontamination process. Soap helps the process, but rapid removal of the hazardous
substance is more important. Lightly scrub the skin to remove contamination. Scrubbing too hard will possibly damage the skin and provide a contaminant entry point.

A second method of physical decontamination is dry decontamination. During dry decontamination, the hazardous substance is removed by brushing, vacuuming, or adsorbing the substance with powders (e.g., talcum powder, flour, or baking soda).

- Chemical decontamination—Chemical decontamination is the use of appropriate agents to remove or deactivate harmful contamination. Chemical decontamination can be a wet, technical, or dry process. The type of process refers to the decontaminating material. Wet decontamination usually refers to soap and water while technical decontamination uses alkaline solutions or solvents to remove the hazardous substance. Dry decontamination uses dry substances to adsorb or neutralize the contaminating substance. Within the ETA, physical decontamination is normally used. Soap and water are the preferred decontamination method.

Types of Decontamination

Decontamination types are divided into groups according to where the process takes place and how much contamination is removed. The type used will depend on the identity and amount of contaminating substance and the ability of the patient to perform decontamination procedures.

- Gross or hasty decontamination—Normally, at the incident site, gross or hasty decontamination is used. Gross or hasty decontamination removes loose contamination from skin and clothes. Gross decontamination is the initial phase of the process during which the amount of surface contaminant is significantly reduced (NFPA 472, 2008). According to local decontamination plans, this phase can include mechanical removal of agent or initial rinsing to remove agent. Gross decontamination must be performed as quickly as possible. OSHA recommends a low-pressure, high-volume water system as the default standard for gross decontamination. High-pressure water systems are discouraged because they may force contaminant through the patient’s skin, increasing contamination of the patient and spreading contamination throughout the environment.

Other field-expedient gross decontamination methods may make use of other facilities (e.g., fog streams, school shower facilities, car washes, YMCA/YWCA) available for rapid decontamination and accommodation of the largest number of patients.
• Secondary decontamination—Secondary decontamination is performed following gross decontamination and after a patient has been removed from the hot zone. The ETA may perform secondary decontamination of patients who have undergone gross decontamination at the incident site. Secondary decontamination is performed on an as-needed basis and may be limited to specific areas of the body. However, complete decontamination should be performed in the ETA. Secondary decontamination is more thorough than gross decontamination.

• Technical decontamination—Technical decontamination refers to the removal of contamination from responders and equipment in a very deliberate and time-consuming fashion. This process is used especially for responders in Personal Protective Equipment (PPE) and for equipment—it is not used on patients. Technical decontamination uses solvents or alkaline solutions to neutralize or inactivate the contaminating substance. Healthcare responders should conduct technical decontamination in a location separated visually from patient decontamination for psychological reasons. PPE should be carefully and thoroughly cleaned. Speed is not the goal of technical decontamination. Technical decontamination concentrates more on completely removing the contaminant from PPE. The technical decontamination line is the first line established in the ETA. Safety of the healthcare responders is paramount because, without the ETA staff, patients cannot be helped. Healthcare responders who become patients add to the problem rather than alleviate the situation.

• Spot decontamination—When the contaminating substance is known, can be seen, and does not cover the entire person or piece of equipment, spot decontamination is appropriate. This method targets the contaminant by removing, deactivating, or neutralizing it. Removal of blister agent from the skin is an example of spot decontamination. Patients may be spot decontaminated if the contaminant amount is insufficient to warrant going through the normal decontamination corridor.

**Emergency Treatment Area**

At the ETA, decontamination lines are either temporary facilities (e.g., tents), or facilities designed specifically for the purpose (e.g., trailers or permanent structures) of decontamination sites. Within these structures, either self-decontamination or assisted decontamination takes place. If the patient is ambulatory, he or she would be assisted by staff members to remove clothing, enter a shower, and wash completely. The first step in any decontamination process is clothing removal. This step removes 60–80% of all contamination.
Enabling Objective 7-2: Structure a decontamination corridor for use in a hospital’s ETA established in response to an MCI involving patient contamination

Decontamination Corridor

During any MCI, an ETA should be established outside the hospital. The ETA should be established downwind from the hospital with the receiving area farthest from the Emergency Department (ED). The ETA must contain a decontamination corridor to process and decontaminate patients quickly before they move into the hospital for further medical treatment. Ingenuity and current technologies can be used to handle large numbers of contaminated casualties. Examples of improvised decontamination tools include mobile trailers designed for mass decontamination, portable showers, and children’s wading pools. Hoses can be positioned overhead (in corridors) to provide a fine spray through which patients walk.

Four separate decontamination lines may be established within the decontamination corridor. The separate lines include wet nonambulatory, dry decontamination, wet ambulatory, and staff members’ technical decontamination.

The decontamination corridor begins at the patient receiving area. All individuals are triaged using the Simple Triage and Rapid Treatment (START) protocol. Patients are initially divided into contaminated and noncontaminated, ambulatory and nonambulatory patients. Contaminated patients are processed through the decontamination corridor while noncontaminated patients are processed in another area where a second triage and treatment area has been established. This second area processes patients into the hospital or to other facilities for further evaluation.

Three general categories or lines may be established for contaminated patients—wet ambulatory, dry decontamination, and wet nonambulatory decontamination. The dry decontamination line is used if the contaminating substance is known to be a powder or other material that can be removed by vacuuming or brushing. Dry decontamination is used as an initial method of removing particles from the clothes and skin, but it must be followed by wet decontamination unless the identified hazardous substance will react with water.

Positioning of each line is determined by Standard Operating Procedure (SOP), size of the ETA, and the hospital’s capability. Privacy considerations must be considered for ambulatory
and nonambulatory lines. The ambulatory line is further divided into a male and female line. All three decontamination lines use the same patient decontamination steps.

Decontamination Stations

A decontamination corridor consists of six stations moving from the hot zone toward the cold zone. The six stations along the corridor are as follows:

1. **Patient registration**—Every patient is logged into the system and given two identically numbered tags. This identifies the patient and his or her clothing and valuables. The tag number also relates the patient to all further records of treatment. One tag is placed around the patient’s neck, and the other is attached to a clothing bag.

2. **Clothing removal**—This area must be enclosed for modesty and privacy. It does not require individual stalls. However, if equipment is available, stalls could provide further privacy. Staff members of the same gender as those processing through the line should be available to assist individuals in each station along the corridor. At the clothing removal station, patients remove all clothing and personal property. Clothing is placed in a plastic bag and sealed. Personal property (e.g., jewelry, wallets, etc.) is placed in a separate plastic bag and sealed. Both bags are then placed in a third plastic bag, which is also sealed. The person’s second number tag is attached to the sealed bag. This bag is then turned into a staff member. The staff member logs the bag and stores it in the designated area. All clothing and personal possessions will be processed through a separate line.

3. **Rinse station**—This station includes a quick overhead shower rinse to remove gross contamination. It is followed by a complete wash. All water must come from above the patients to wash contamination away from the head and toward the floor.

4. **Wash station**—In the wash station, the patient will wash and scrub with soap and water, for a designated length of time. This station must ensure free-flowing overhead water to remove all soap and residual contamination. Wash time should be a minimum of five to eight minutes.

5. **Survey and inspection station**—After washing and rinsing, the patient must be checked for residual contamination. This station is staffed by personnel utilizing contamination detection equipment. In this section, the patient is checked to verify that any residual...
contamination is eliminated. Clean patients move to the dressing area while those found to be contaminated return to the wash station.

6. Dressing station—Hospital gowns or other hospital-provided clothing is given to each patient. The clothing should protect the modesty of the individual as the patient moves from the exterior of the hospital into the ED for follow-up treatment.

Enabling Objective 7-3: Recognize the step-by-step procedures for ambulatory and nonambulatory decontamination performed in response to an MCI involving patient contamination

Decontamination Procedures

Ambulatory and nonambulatory decontamination require different processes for patients to follow and different responsibilities of the healthcare responders. The following sections identify what the differences between the different processes.

Ambulatory Decontamination

An ambulatory decontamination corridor is established for use by patients who are injured but are able to move through the ETA without assistance. A separate decontamination corridor is established away from the ETA for patients who have been identified as contaminated but do not need medical attention. OSHA’s Best Practices for First Receivers of Patients of Mass Casualty Incidents Involving Release of Hazardous Substances Appendix J, provides an excellent guide for decontaminating patients.

Patients identified as ambulatory during the START protocol triage are sent to the patient registration area. Once registered and given tags, the patients are prioritized according to their injuries. Patients are processed in order by triage status. Some patients may be routed to a holding area to await decontamination; this is especially true in incidents with large numbers of ambulatory patients. Symptomatic (showing symptoms of a medical problem) patients are processed before patients who are asymptomatic (not showing symptoms of a medical problem). Patients who cannot be processed immediately through the decontamination line are sent to a designated holding area. Healthcare responders must reassure the patients that they understand
their need for help. However, they must also make clear that the patients must be isolated and organized.

Clear and simple instructions on decontamination should be provided. A decontamination kit is recommended by OSHA for issue to each contaminated individual. The kit is issued at the registration area and stays with the patient as he or she proceeds through the process. It consists of the following: two numbered tags, three plastic bags, soap, and a washcloth. When moving to the decontamination line, men and women are separated into separate lines. Special consideration for families, small children, the elderly, and people with special needs (e.g., visually, mentally, or physically challenged individuals) should be provided. Children should not be separated from a parent, if at all possible.

As detailed previously, the patient removes all clothes, double- and triple-bagging all items. The clothing bag should be set aside in a secure location. Staff members should be available to assist patients who need help while undressing. Patients should be told to remove all clothing. The triage tag remains on the patient through the decontamination and treatment process. If staff is available, patients’ names and triage tag numbers should be recorded on the decontamination record. Patients should avoid touching the outer layers of the clothing while removing them. Patients should not allow the clothing to come in contact with their face, which will reduce the spread of contamination. If biological or radiological contamination is suspected, continue wetting the patient’s clothing during removal to prevent reaerosolizing the agent.

The next step in the process is wash down, which can consist of a cold water rinse followed by a warm water wash and rinse. However, one can combine the process into a single warm water wash if facilities are not available for separate stations. The cold water rinse removes gross contamination before the patient begins scrubbing the skin. This reduces the possibility of scrubbing contamination into the skin’s pores. A member of the decontamination team should closely observe each patient to ensure he or she is thorough in washing himself or herself. Size of the facility and number of casualties will determine the decontamination areas needed. Performing a cold water rinse followed by a wash and rinse also allows for faster processing of patients. At the warm water washing station, patients must wash for five minutes if the chemical is nonpersistent or eight minutes if the chemical is unknown or persistent. Decontamination soap, washcloths, brushes, and sponges should be put into a nearby trashcan and not carried into the noncontaminated zone.

The wash is followed by movement to the survey and monitoring area where patients are checked by a staff member. Clean patients are sent to the dressing area, while those who
contamination residue are sent back to the shower. In the dressing area, patients will dress in hospital-provided clothes and proceed into the ED for further care. Provided clothing would normally be a hospital gown, but other modest covering will suffice.

Decontamination team members should be alert to the possibility that an ambulatory patient may clinically deteriorate and require immediate removal to the nonambulatory sector via backboard, stretcher, or wheelchair.

Nonambulatory Decontamination

Nonambulatory patient decontamination requires more time and staff since a nonambulatory patient cannot assist in decontamination. Special considerations must be given when decontaminating a nonambulatory patient. Healthcare responders should perform decontamination as follows:

- Wear appropriate PPE.
- Limit the number of healthcare responders in contact with the patient.
- Remove clothing, keeping clothing away from the patient’s face during removal to prevent patient from inhaling or ingesting contaminants.

Nonambulatory patients are moved to the decontamination area where each is then attended by a minimum of three team members as he or she is moved through the decontamination corridor. The procedure for nonambulatory decontamination is as follows:

- Place the patient on a backboard or Emergency Medical Services (EMS) gurney with the pad removed. Removing the pad ensures that contamination will not spread to the padding where it is very difficult or impossible to remove.
- Staff members remove the patient’s clothing and valuables and bag those items with an identification tag. Particular attention should be paid to minimizing the aerosolization of contamination by folding the patients clothing inside out as it is removed. Clothing should be cut away as necessary. The procedure for cutting away the clothing is as follows:
  - Place the patient (on the backboard) between buckets containing diluted bleach.

Notes
NOTE: The bleach is for cutout tools only, including gloves and scissors. Bleach should not touch human skin, as it may cause severe burning and/or damage.

− One or, ideally, two healthcare responders will cut the clothing, while one responder maintains the patient’s airway, and controls the operation. Another responder will communicate any change in the condition of the patient and provide support as needed.

− Healthcare responders should not straddle patients or kneel on the floor to avoid cross-contamination.

− Decontaminate scissors and gloves after each cut and before touching skin.

− Because most serious injuries and death from HAZMAT result from airway and breathing problems, remove clothing nearest the airway first.

− Remove the shirt by cutting up the front to the neck area, and then cut the sleeves to the neck area. Peel the shirt back from the patient and use the inside of the shirt as a barrier for the patient. If present, remove the bra at this time.

− Remove pants starting at the cuff. A cut is made upward from the bottom of both legs to the waist. Peel the pants away from the patient and use the inside of the pants as a barrier for the patient; remove underwear.
Cut shoestrings and remove the shoes. Use the inside of the shoe as a barrier for the patient’s foot.

Remove the socks by gently pulling up on the sock. If a sock does not pull off, use shears to cut a small hole in the sock’s toe and cut up to remove the sock.

After the clothing has been removed, the patient is moved to the wash station. The first step is a quick rinse from head-to-toe with free-flowing water. A well-wrung out sponge is used to wipe the patient’s face from nose to ear. A team member on each side of the patient performs this procedure. Be careful not to allow water into the patient’s mouth. After a quick rinse, wash the patient with soap and water for five to eight minutes. Use soap and warm water (or
appropriate decontaminant based on local protocols) to decontaminate nonambulatory patients. The patient’s airway is cleaned first, followed by all open wounds and, finally, the remainder of the body. Healthcare responders should concentrate on cleaning all of the patient’s body. Pay strict attention to all body orifices. Dressings and bandages must be removed.

Decontamination team members should be alert to the probability that the nonambulatory patient may require Active Breathing Control (ABC) support and administration of lifesaving antidote administration by intramuscular (IM) injection. If IV therapy is needed, the extremity site for the IV should be decontaminated before the IV is started. If IV therapy is needed, the patient should be pulled out of line in the decontamination corridor but remain in the decontamination sector. This will require dedicated medical personnel in addition to decontamination line staff.

Once decontamination is complete, the patient is transferred to a clean backboard, dressed in hospital garb, and triaged for further treatment. Make note that all medical treatment items including bandages, backboard, collar, and ventilation equipment must be decontaminated or replaced with clean materials before the patient can be transported.

**Access and Functional Needs**

Patients with access and functional needs (e.g., those who are handicapped, sensory impaired, or cognitively impaired; children or infants; elderly; those with service animals or pets; or non-English speaking) may slow down the decontamination process. Instructions should be multilingual and easy to understand. Signs should be in large print. Handrails, shower chairs, and walkers assist patients with mobility issues.

The HERT may want to consider a designated area in the ETA with temperature-controlled water and nonirritating soap for decontaminating service animals. While this area should be separate from the general population being decontaminated, service animals may need to be decontaminated with their owners.

Contact lenses should be removed and placed in the personal property bag. Contact lenses cannot be worn during decontamination. Eyeglasses should be placed in the personal property bag if the patient can see sufficiently to continue through the decontamination line. If not, the glasses must be decontaminated thoroughly.
Patients who use walking assistance devices may retain them, but the device must be washed with soap and water during the decontamination process before being allowed into the transport or treatment sector.

Patients who are unsteady standing or walking should be given a walker upon entry into the decontamination corridor. The walker should be used to assist with ambulation until victims get to the end of the line when it should be retrieved, decontaminated, and returned to the front of the decontamination corridor for the next patient who needs it.

Hearing aids cannot be immersed or otherwise soaked with water. They should, therefore, either be removed and placed in the valuables portion of the patient’s clothing bag. If they must be used by the patient they should be carefully wiped with a saline-moistened 4x4 gauze, dried, placed into a clear plastic bag, and handed to the patient. The cleaned hearing aid is not to be worn until the patient has completed the decontamination process (including washing the ears) and is in the transport or treatment sector.

Unless the oral cavity is contaminated, dentures should remain in place and no decontamination is necessary. If the oral cavity is contaminated, then the dentures should be removed, placed in a clear plastic bag with the patient’s name or triage tag number placed on it. The dentures should later be decontaminated in accordance with instructions received from the poison center and/or a dentist. The patient’s mouth should be decontaminated with mouthwash or saline that is gargled and safely spit out into a biohazard bag. Note that, depending on the contaminant, it may not be possible to decontaminate plastic items, such as dentures.

Special considerations for the decontamination of children could include issues such as the following:

- The decontamination should include handheld carriers for decontamination of infants.
- Bathtub toys to comfort small children.
- Child-friendly stickers on PPE to reduce fear.
- Special areas for decontamination of families to avoid separation.
Children may also require immediate decontamination or a more thorough decontamination. Children may react differently to chemicals than adults and may be more vulnerable because of relatively higher per minute ventilation per kilogram. Children also have a relatively larger surface area to body weight ratio, making them more vulnerable to skin hazards.

**Law Enforcement Officers with Weapons**

In most cases, law enforcement officers who have been injured on scene will have had their gun(s) removed and given to a fellow officer before arrival. However, if that is not the case, the weapon should be left in the holster and the gun belt removed by a decontamination team member and placed in a clear plastic bag labeled with the patient’s name and/or triage tag number. The bag should then be passed to the treatment sector where it should be given to a fellow officer or hospital security officer for safekeeping until it can be given to a representative of the injured officer’s department. The gun should be left in the holster, if at all possible. If the gun must be removed, it should be handled by a decontamination team member familiar with firearms, rendered safe, placed in a clear plastic bag marked with the patient’s name and/or triage tag number, and given to a fellow officer or hospital security officer in the treatment sector.

Decontamination team personnel should be aware that an officer may have a backup weapon usually found in a holster near the ankle, in his or her pocket, in a ballistic vest, or near an armpit. The holster with the weapon in place should be removed and secured as described above. An officer’s gun belt may also contain items that could prove dangerous if in the wrong hands. The belt should be collected and separately bagged and passed to a fellow officer or hospital security officer in the treatment sector. Decontamination of an officer’s weapon and/or gun belt will be the responsibility of the police department. If the officer is wearing a ballistic vest, it must be removed prior to undergoing decontamination. The vest is usually easily removed by loosening the Velcro® straps, pulling the vest apart, and taking it off the patient. It should then be placed in a large plastic bag.

**Technical Decontamination Corridor**

Healthcare responders must undergo thorough decontamination when their shifts have been completed or when the ETA is being dismantled. The healthcare responder decontamination station is established off to the side of the patient decontamination corridor. This corridor allows for removal and decontamination of PPE and equipment.
The healthcare responder enters the corridor in full PPE and immediately rinses. Care must be taken to not allow water into the filters of the facemask. If water enters the filter, it will clog, and the individual will not be able to breath. After the rinse, the individual moves to the wash station. At this station, an assistant will scrub the outside of the PPE with decontamination solution. After washing, the individual is rinsed at the same station. Finally, the individual moves to a second rinse station where he or she is again rinsed from head to toe. At the wash and second rinse station, the bottom of the boot is cleaned last and the individual puts the foot outside the station after which the second boot is cleaned. Once rinsed, the individual can move through the undressing stations of the decontamination corridor for normal doffing of the PPE.

Responders are assigned to each station to assist in the decontamination and removal process.

All equipment, cleaning supplies, used equipment, and other items must be either decontaminated or double-bagged and prepared for disposal when the site is no longer needed. Nothing used within the corridor can be allowed out of the area before decontamination.

**Conclusion**

Decontamination remains a focus of any response concerning hazardous substances. It is the first process established and one of the last activities in operation during an incident response. As insurance against mishap, the decontamination station is the first area to be established prior to arrival or treatment of patients. The decontamination corridor is a major portion of the ETA. It is divided into separate lines for ambulatory and nonambulatory patients. The ambulatory decontamination corridor is again divided to provide for modesty and privacy into male and female lines. Everyone who is contaminated must go through the decontamination process. The ambulatory and nonambulatory decontamination lines contain the same stations and patients go through the same processes. The only difference in the lines is the number of HERT members who must assist patients during decontamination.
Decontamination Area

- Receiving Point
- Triage
  - Wet Non-Ambulatory
  - Dry Decon
  - Wet Ambulatory
- Hospital & Secondary Treatment Facility
Decontamination Stations

HOT ZONE

Casualty Control Point

Log-in

Contaminated Waste

Wind Direction

Responders

WARM ZONE

Ambulatory — Female

- Clothing Removal
- Cold Wash/Rinse
- Soapy Wash/Warm Water Rinse
- Survey
- Clothing

Ambulatory — Male

- Clothing Removal
- Cold Wash/Rinse
- Soapy Wash/Warm Water Rinse
- Survey
- Clothing

Nonambulatory

Personal Property Decontamination

COLD ZONE

Debrief

Triage

Medical Treatment

Technical Decontamination - Sheltered Area
References


Triage

Update: December 2013
Lesson Administrative Page

Module: Triage

Summary: This module explains the need for triage and methods used during mass casualty triage operations including Simple Triage and Rapid Treatment© (START) and JumpSTART© triage protocols. A demonstration of these procedures is included.

Terminal Learning Objective:

At the conclusion of this module, the healthcare responder will be able to perform START and JumpSTART procedures within the Emergency Treatment Area (ETA) during a hospital response to a Mass Casualty Incident (MCI) involving contamination.

Enabling Objectives:

At the conclusion of this module, the healthcare responder will be able to:

8-1 Recognize triage requirements for a hospital response to an MCI

8-2 Identify the criteria used for assessing patient medical attention priority using START during hospital response to an MCI

8-3 Recognize the criteria used for assessing small-child patient medical attention priority using JumpSTART during hospital response to an MCI

8-4 Identify triage tags and criteria used to classify medical requirements of patients for hospital care during response to an MCI

Risk Assessment: Low

Duration: 1.0 Hour

Method of Instruction: Facilitated seminar in a classroom environment

Instructor Ratio: 1:40
Enabling Objective 8-1: Recognize triage requirements for a hospital response to an MCI

Triage

Triage is a system used by medical or emergency personnel to allocate limited medical resources when the number of injured needing care exceeds the resources available. The goal of the emergency medical responder is to treat the greatest number of patients possible and to continue until all viable patients receive definitive medical care. Jonsen and Edwards state, “This is one of the few places where a ‘utilitarian rule’ governs medicine: the greater good of the greater number rather than the particular good of the patient at hand. This rule is justified only because of the clear necessity of general public welfare in a crisis” (1998).

Emergency medical responders normally utilize all possible resources, abilities, and activities to save lives. However, in an MCI, time limitations become a challenge. An MCI requires the responder to quickly assess patients, making it impossible to spend unlimited time on individual patients. The goal is to do the most good for the largest number of people.

Efficient triage and treatment activities may be challenged by the numbers of worried well seeking treatment from emergency medical responders onsite, as well as at the hospital Emergency Department (ED). Healthcare responders must manage the worried well quickly and efficiently, while maintaining an understanding of their concern. In planning scenarios and responses, many experts approximate that the number of worried well will be 10 times greater than those actually requiring treatment (Homeland Security Council, 2004).

NOTE: During an MCI, anyone may be called upon to conduct triage activities and resources, including time, become an issue.

MASS Triage™

Most triage tools function as individual patient assessment tools. MASS Triage—Move, Assess, Sort, and Send—is a simple technique for rapidly sorting patients into their initial triage category before an individual assessment is performed (National Disaster Life Support Foundation, 2005).

Notes
MASS Triage is utilized in the hot zone by responders trained and equipped to enter that area. However, emergency medical responders should be aware of MASS Triage because they support hot zone responders. MASS Triage is a simple triage system that rapidly divides patients into triage categories initially based on whether the patients are ambulatory or nonambulatory.

Coule, Schwartz, and Sweinton cite use of the MASS Triage model in *Advanced Disaster Life Support* (2003). MASS Triage utilizes U.S. military triage categories with a proven means of handling large numbers of casualties in an MCI.

- **Move**—Responders verbally direct ambulatory patients to move to a designated area where these walking wounded patients are then categorized and taped as Minimal (Green). Responders then ask the nonambulatory patients to move an arm or leg, and these patients become categorized and taped as Delayed (Yellow). Those patients not moving or responding receive the first priority and are categorized and taped as Immediate (Red). Nonviable patients are classified Expectant (Black) and are not removed. Those classified as Immediate are the first priority.

**NOTE:** In the hot zone where MASS Triage is performed, various types of tape (e.g., chemical, engineer, or triage tape) may be used to categorize patients. There is also a commercially available tape that uses yellow stripes that glow in the dark to enhance night vision for the Black or Expectant category.

- **Assess**—Respiration, Perfusion/Pulse, and Mental (RPM) status rapid assessment is completed if time permits

- **Sort**—Patients are sorted into the following triage categories:
  - Minimal (Green)
  - Delayed (Yellow)
  - Immediate (Red)
  - Deceased or Expectant (Black)
Hospital Emergency Response Training for Mass Casualty Incidents

- Send—Patients are sent (evacuated) safely and promptly to the decontamination areas. Extrication is a rescue function involving the safe and rapid removal of entrapped patients and their prompt delivery to a treatment area.

**NOTE:** In some instances, steps must be skipped to move patients through more quickly. In this situation, responders focus on ambulatory and nonambulatory.

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**Enabling Objective 8-2:** Identify the criteria used for assessing patient medical attention priority using START during hospital response to an MCI

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**Simple Triage and Rapid Treatment**

START is a form of triage that relies on an assessment consisting of RPM. Actual care is limited to airway support (ensuring an open airway) and perfusion support (controlling bleeding), as well as by placing the patient in shock position (American Medical Response of Massachusetts, n.d.).

The START triage system assists healthcare responders in identifying the most seriously injured patients when there are a large number of patients needing help and a limited number of responders. The diagram on the following page illustrates the steps to follow when triaging patients. As more healthcare responders become available, retriage of patients may allow for further evaluation, treatment, stabilization, and transportation. This system allows healthcare responders to quickly move through a large number of patients providing immediate lifesaving support when necessary by opening blocked airways and stopping severe bleeding. This system is not designed to treat wounds or care for the injured in other ways. During an MCI time is of the essence, therefore, healthcare responders must work quickly to help the most patients possible rather than concentrate on any single individual.
International Triage Color Code System—The most widely accepted international code for triage uses the following colors:

- **GREEN**—Minimal or ambulatory patients (will require a doctor’s care in several hours or days, but not immediately)

- **YELLOW**—Delayed; can wait for care after simple first aid (e.g., wounds dressed, splints applied) but need to be reassessed frequently

- **RED**—Immediate or critical (seriously injured, but have a reasonable chance of survival)

- **BLACK**—Expectant; make comfortable. This patient shows obvious signs of death. Included in this category are unresponsive patients with no signs of breathing or with catastrophic trauma, including head injuries and/or chest injuries

The International Triage Color Code System, utilized to color-code patients, expedites triage according to priority for treatment and transport, based on severity of injury. Local protocol for prioritizing patients should be used.

### Rapid Assessment Using RPM

The three START system clinical objectives are assessment of the following:

- **Respiratory status**—This critical objective evaluates respirations (breathing) of the patient.
  - Greater than 30 breaths per minute (>30/min) requires assistance to maintain airway
  - Fewer than 30 breaths per minute (<30/min), go to next assessment

- **Perfusion (pulse and blood flow)**—This critical objective evaluates pulse and/or perfusion. When the responder finds the pulse present, the patient most likely has a systolic blood pressure of at least 80mmHg. A blood pressure lower than 80mmHg most likely could not be felt at distal (far from the heart) pulse points. Perfusion is checked by pressing the fleshy part of an arm or the nail bed (finger or toe). Normal capillary refill
Triage Hospital Emergency Response Training for Mass Casualty Incidents

(shown by a return of color) requires two seconds or less. Capillary refill time is a more reliable indicator of perfusion in infants or young children than in adults (Bledsoe, Porter, & Cherry, 2003).

- Mental status—This critical objective determines possible brain damage by determining if the patient is lucid (mentally clear) in addition to being responsive. One way to determine this critical objective is by AVPU (see sidebar). A truly unresponsive patient will not respond to verbal or painful stimuli (Bledsoe, et al., 2003). Mental status is also determined by asking very simple questions. (Questions such as: “what day is it?”, not “Who won the 1947 world series?”).

**NOTE:** Be sensitive to those who usually cannot follow simple commands (e.g., speak different language, hearing impaired, or are cognitively or mentally impaired). Remember that confusion and irritability can also indicate shock.

**Respiratory Status**

If the patient is breathing adequately (maintaining an airway and under 30 respirations per minute), the healthcare responder moves on to the next step. If, however, breathing is inadequate, attempt to clear the airway by repositioning the patient. If these attempts are unsuccessful, the classification is as follows:

- Expectant (Black)—No respiratory effort
- Immediate (Red)—Respirations greater than 30
- Immediate (Red)—Needs help maintaining an airway

**Perfusion (Blood Flow and Pulse)**

Blood flow (perfusion) is initially evaluated by measuring capillary refill. If unable to obtain capillary refill due to either the patient’s color or poor lighting conditions, then check the radial (wrist) pulse. Using the index and middle finger, locate the radial pulse on the patient’s wrist. If a
radial pulse is present, assume the blood pressure is adequate. Each patient falls into one of the following categories:

- Immediate (Red)—Capillary refill noted to be more than two seconds or absence of radial pulse.
- Capillary refill noted to be less than two seconds or palpable radial pulse—go to next triage step.

**NOTE:** Detecting a radial pulse while in Personal Protective Equipment (PPE) Levels A through C may be difficult, or impossible, because layers of gloves worn by the responder make it difficult to feel a pulse.

Remember that capillary refill is not always an accurate indicator of a patient’s circulatory perfusion. Recent research shows that the presence of a radial pulse is much more accurate, representing a blood pressure of 80–90mmHg systolic (Bledsoe, et al., 2003). Cold weather conditions may cause peripheral vasoconstriction (blood vessel constriction) that will diminish palpable (easily felt) pulses or capillary refill.

**NOTE:** Amidst the chaos of triage actions, the healthcare responder will provide emergency care to patients in an effort to save as many lives as possible. With a sense of urgency, the responder must limit those measures to the most critical. The START technique recommends performance of the following lifesaving measures:

- Opening the airway
- Stopping profuse bleeding
- Elevating extremities to mitigate or treat for shock

**NOTE:** If permitted by local protocol, treatment for nerve agent poisoning may begin at this stage as well.
Mental Status

The third and final level of assessment is the patient’s mental status. Depending on the level of consciousness, use the following classifications:

- Immediate (Red)—Unconscious
- Immediate (Red)—Change in mental status or cannot follow simple commands
- Delayed (Yellow)—Normal mental responses (then move to next patient)

**NOTE:** Be sensitive to those who usually cannot follow simple commands:

- Access and functional needs individuals (i.e., mentally or cognitively impaired)
- Hearing impaired
- Language barrier (do not speak primary language being used)

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**Enabling Objective 8-3:** Recognize the criteria used for assessing small-child patient medical attention priority using JumpSTART during hospital response to an MCI

**JumpSTART Pediatric Multiple Casualty Incident Triage©**

The JumpSTART Pediatric Multiple Casualty Incident Triage tool was developed in 1995 by Dr. Lou Romig, a pediatric emergency physician and Medical Director for the South Florida Regional Disaster Medical Assistance Team. JumpSTART parallels the START Triage system, but utilizes decision points appropriate to the variations of normal physiology within the pediatric age group. JumpSTART recognizes that children have key physiologic differences not recognized by adult-based triage tools. This method should be used with patients who appear to be young children ages one to eight or children but under 100 pounds.

**NOTE:** More information on JumpSTART, including training tools, may be found at http://www.jumpstarttriage.com.

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**Notes**
Using JumpSTART instead of START Triage on children eliminates the following problems:

- An apneic (temporary absence or cessation of breathing) child is more likely to have a primary respiratory problem than an adult. Perfusion may be maintained for a short time and the child may be saved.

- Respirations of less than or greater than 30 per minute may either over-triage or under-triage a child, depending upon age.

- Perfusion may not adequately reflect status in a cool environment.

- Obeying commands may not be an appropriate gauge of mental status for younger children.

The diagram on the following page illustrates the steps to follow when using JumpSTART on children.
JumpSTART Pediatric MCI Triage

Able to walk? 

- YES → MINOR → Secondary Triage
- NO → Breathing

Breathing? 

- NO → Position upper airway
  - APNEIC → BREATHING
  - NO → DECEASED
  - YES → Palpable pulse?
    - NO → DECEASED
    - YES → 5 rescue breaths
      - APNEIC → DECEASED
      - BREATHING → IMMEDIATE

Respiratory Rate 

- <15 OR >45 → IMMEDIATE
- 16-45
  - Palpable Pulse? 
    - NO → IMMEDIATE
    - YES → AVPU
      - "P" (appropriate), POSTURING or "V" → IMMEDIATE
      - "K" or "V" (appropriate) → DELAYED

Evaluate infants first in secondary triage using the entire 5-step algorithm.
The JumpSTART process is as follows:

- Identify all ambulatory patients, directing them to the Green area for secondary triage and treatment.

- Assess nonambulatory patients.

**NOTE:** Healthcare responders must be watchful for nonambulatory children who are carried to the Green area by other ambulatory patients, normally parents or other close relatives. These children should be the first assessed by medical personnel in that area.

- Respiratory status
  - If the patient is breathing spontaneously, assess respiratory rate.
  - If the patient is apneic or has very irregular breathing, open the airway using standard positioning techniques.
  - If positioning results in resumption of spontaneous respirations, tag the patient Immediate (Red) and move to the next patient.
  - If the patient is not breathing after opening the airway, check for a peripheral pulse. If there is no pulse, tag the patient as Expectant (Black).
  - If there is a peripheral pulse, give five mouth-to-barrier ventilations. If apnea persists, tag the patient as Expectant (Black).
  - If breathing resumes, tag the patient as Immediate (Red).
  - If the respiratory rate is 15–45 per minute, assess perfusion.
  - If the respiratory rate is <15 or >45 per minute or irregular, tag the patient as Immediate (Red).
• Perfusion
  – If a peripheral pulse is palpable, assess mental status.
  – If no peripheral pulse is present (in the least injured limb), tag patient as Immediate (Red).

• Mental status
  – Use the Alert, Verbal, Pain, Unresponsive (AVPU) scale to assess mental status.
  – If Alert, responsive to verbal, or appropriately responsive to pain, tag as Delayed (Yellow).
  – If inappropriately responsive to pain or unresponsive, tag as Immediate (Red).

Nonambulatory children include infants who cannot walk, children with developmental delays, children with acute injuries preventing them from walking prior to the incident, and children with chronic disabilities. Modifications for nonambulatory children include the following:

• Evaluate using the JumpSTART criteria.
• If there are any Immediate (Red) criteria, tag as Immediate.
• If the patient satisfies Delayed (Yellow) criteria, tag as:
  – Delayed (Yellow) if there are significant external signs of injury (e.g., deep penetrating wounds, severe bleeding, severe burns, amputations, distended tender abdomen).
  – Minor (Green) if there are no significant external injuries.

**NOTE:** Unless clearly suffering from injuries incompatible with life, patients tagged as Expectant (Black) should be reassessed once critical interventions have been completed for Immediate (Red) and Delayed (Yellow) patients.
The following is a combined START/JumpSTART Triage flow chart that can be applied in an MCI involving both adults and children.

**Combined START/JumpSTART Triage Algorithm**

1. **Able to walk?**
   - Yes: **MINOR**, then **SECONDARY TRIAGE**
   - No: **BREATHING**
2. **Breathing?**
   - No: **APNEIC**, then **IMMEDIATE**
   - Yes: **RESUSCITATION**
3. **Respiratory Rate**
   - >30 ADULT
   - <30 ADULT & 16-45 PEDI
   - <16 OR >45 PEDI
4. **Perfusion**
   - Yes: **IMMEDIATE**
   - No: **APNEIC**, then **IMMEDIATE**
5. **Mental status**
   - Doesn't obey commands (ADULT): **IMMEDIATE**
   - Obey's commands (ADULT): **APPEARS APPROPRIATE**

*Using the JS algorithm, evaluate first all children who did not walk under their own power.*
Enabling Objective 8-4: Identify triage tags and criteria used to classify medical requirements of patients for hospital care during response to an MCI

MCI Triage Tags

Use of triage tags allows healthcare responders to communicate to others the status of patients who have been through the triage process. Patients are tagged for easy recognition by other rescuers arriving on the scene. Proper tag completion rapidly communicates patient history information to other healthcare responders as the patients arrive in treatment areas. The following information should be completed as time, availability, and circumstances permit:

- Identify major injuries (priority).
- Determine status (priority).
  - Minimal (Green)
  - Delayed (Yellow)
  - Immediate (Red)
  - Deceased or Expectant (Black)
- Record vital signs.
- Complete the patient identification information. Use the system indicated for use by the local emergency services system.

Notes
Triage

Hospital Emergency Response Training for Mass Casualty Incidents

Notes

Four Color Triage Tag
calchiefs.org
Once triage and tagging are performed, the triage team leader will supervise movement of all patients to proper treatment areas. Reporting to the HERT leader and ETA group supervisor and keeping them informed of patient numbers will assist in maximizing available resources.

Conclusion

Triage operations may be conducted by any onscene responder. The START triage method is used to quickly assess patients based on their level of injuries. Triage is used to determine the order in which patients need to proceed through the decontamination corridor. A triage system similar to START but designed for pediatric patients is JumpSTART Triage. Some modifications should be made to accommodate triage activities of children. The two systems can be combined in a situation involving both adult and pediatric patients. By using the triage tagging process, the healthcare responder can communicate to others what has been observed during triage.
References


Lesson Administrative Page

Module: Lanes Training

Summary: This hands-on module provides the healthcare responder with the opportunity to practice donning and doffing Personal Protective Equipment (PPE) along with performing triage, treatment, decontamination, and transport activities in the Emergency Treatment Area (ETA).

Terminal Learning Objective:

At the conclusion of this module, the healthcare responder will be able to conduct operations in an ETA while wearing appropriate PPE in response to a Mass Casualty Incident (MCI) involving contamination.

Enabling Objectives:

At the conclusion of this module, the healthcare responder will be able to:

9-1 Execute proper donning procedures for Level C PPE prior to conducting activities in an ETA in response to an MCI involving contamination

9-2 Execute proper predecontamination Simple Triage and Rapid Treatment (START) and JumpSTART procedures while in PPE

9-3 Demonstrate proper clothing and personal effects collection, bagging, and tagging techniques to preserve evidence and eliminate the spread of contamination

9-4 Demonstrate proper techniques using selected items of equipment to monitor or survey patients for chemical or radiological contamination

9-5 Demonstrate proper nonambulatory decontamination techniques including cutout

9-6 Execute proper technical decontamination of ETA staff personnel prior to doffing of PPE

9-7 Execute proper doffing of PPE following technical decontamination after conducting operations in the ETA in response to an MCI involving contamination

Risk Assessment: Low

Duration: 4.0 Hours

Method of Instruction: Small-group, instructor-facilitated exercise

Instructor Ratio: 1:10
Lanes Training

For lanes training, instructors will break the healthcare responders into their four groups for specific training on technical areas used within the ETA. Healthcare responders will be trained in the following lanes:

- **Nonambulatory decontamination**—Uses mannequins as patients. Healthcare responders will perform cutout procedures to remove clothing, transfer patients to the nonambulatory decontamination line, and decontaminate patients.

- **Technical decontamination**—Healthcare responders will learn the techniques and perform operations as the support team operating a technical support line within an ETA. This will include practicing decontamination techniques on other members of the group. Each member of the group will perform as a support team member and as the staff member moving through technical decontamination.

- **Evidence collection/monitoring**—Healthcare responders will learn proper techniques for gathering patient clothing and double bagging personal items while ensuring proper tagging and chain of custody for evidence collection. Healthcare responders will learn proper detection techniques using M8 paper, MultiRae Plus, and Ludlum 2241 radiation detector.

- **Triage and clinical skills**—Healthcare responders will perform START and JumpSTART using a mannequin and a Human Patient Simulator (HPS) or Emergency Care Simulator (ECS). Respiration and perfusion determination will be determined using cards and HPS or ECS first without respirator and chemical-protective gloves and then in full PPE. Healthcare responders already certified to administer IV and intubation will perform these techniques using the simulators while in PPE. This lane does not teach IV and intubation, but allows those already qualified to understand the problems of performing these techniques while in PPE.
**Lane 1—Nonambulatory Decontamination**

The purpose of decontamination is to remove or neutralize harmful materials that have collected on personnel and/or equipment and to prevent secondary contamination to healthcare workers and the facility. Decontamination is a systematic process determined by the nature and degree of contamination. Effective decontamination consists of making the patient as clean as possible, meaning that contamination has been reduced to a level that is no longer a threat to the patient or healthcare provider.

**Nonambulatory Patient Decontamination**

Healthcare responders must perform cutout procedures efficiently to accommodate the numerous patients needing immediate decontamination and medical attention. Additionally, they must take precautions to prevent the spread of contamination to other healthcare responders, patients, and uncontaminated hospital grounds.

**NOTE:** When removing clothing from patients, do not cut through holes or tears. These may be of evidentiary value and prove useful during postincident investigation and prosecution.

- Bring patient to the decontamination sector. The patient should be tended by a minimum of six decontamination personnel.

- Place each patient onto a backboard or Emergency Medical Services (EMS) stretcher with the pad removed.

- Remove all of the patient’s clothing and place valuables into the clear, plastic bag. Place clothing into the large bag. Finally, place both bags into the third bag and cinch tight with the number tag number in pack. Ensure that the triage tag number is visible through the bag.

- Minimize the aerosolization spread of particulate matter (i.e., radiation contamination) by folding clothing inside during removal and dabbing the skin with sticky tape and/or vacuuming.

**Notes**
• Patient should have their triage tag around their neck and wear it through decontamination and treatment.

• Set the clothing bag aside in a secure area. If staff is available, record the patient’s name and triage tag number on the Patient Decontamination Record.

• While resting the backboard on sawhorses, other devices, or with the patient on an EMS stretcher, quickly rinse the patient from head-to-toe with water using either the handheld sprayer, garden hose, or shower head. Ensure the patient is protected from aspiration from the rinse water.

• Next, wash the patient with soap using either a brush or washcloth in a systematic fashion, cleaning airway first, followed by open wounds, then in a head-to-toe fashion for five minutes when the agent is nonpersistent and eight minutes when a persistent or unknown agent is involved. Avoid rubbing too vigorously.

• Roll the patient onto their side so that two to four personnel can wash the posterior head, neck, back, buttocks, and lower extremities—be attentive to possible neck injuries.

• Give particular attention to washing the folds and creases (e.g., the ears, eyes, axilla, and groin).

• Topical eye anesthetic may be required for effective eye irrigation to be performed.

• Rinse the patient for about one minute in a head-to-toe fashion that minimizes contamination spread. Avoid overspraying or holding the rinsing device too close to the skin as the skin may become irritated.

• Decontamination team members remain aware that the nonambulatory patient may require Active Breathing Control (ABC) support (e.g., airway positioning, suctioning, O₂ administration, spinal stabilization, etc.) and administration of lifesaving antidote administration by intramuscular (IM) injection. If IV therapy is needed, quickly decontaminate the IV extremity site before starting the IV. If IV therapy is needed, remove the patient from the decontamination corridor but remain in the decontamination sector. If a patient requires an IV, dedicated medical personnel will be required in addition to decontamination line staff.
The patient should be dried off, placed into a hospital gown, and transferred to a clean backboard (or clean off and dry the board they are on, if additional boards are not available). Transfer patients on an EMS stretcher to a clean backboard. Any medical materials applied in the decontamination corridor must be removed and replaced with clean items prior to movement to the postdecontamination area.

Dispose of used decontamination soap, brushes, and sponges. These materials must not be carried into the cold zone. Other material should remain in the decontamination sector.

Take the patient to the triage officer for reassessment and assignment to either the treatment or transport sector.

**Cutout and Decontamination Procedures**

**NOTE:** Healthcare responders should exercise appropriate safety precautions when lifting and transporting patients.

- Place the patient between the buckets containing diluted bleach. **WARNING:** The bleach is only for cutout tools, including gloves and scissors. Bleach should not touch human skin, as it may cause severe burning and/or damage.

- One or, ideally, two healthcare responders will cut the clothing, while one person maintains the patient’s airway and controls the operation. Another person will communicate any change in the condition of the patient and provide support as needed.

- Healthcare responders should not straddle patients or kneel on the ground (to avoid cross-contamination or damaging their protective garment).

- Decontaminate scissors and gloves after each cut and before touching skin.

- Since most serious injuries and death from Chemical, Biological, Radiological, or Nuclear (CBRN) incidents result from airway and breathing problems, remove clothing nearest the airway first.
• Remove the shirt by cutting up the front to the neck area, and then cut the sleeves to the neck area. Peel the shirt back from the patient and use the inside of the shirt as a barrier for the patient. If present, remove the bra at this time.

• Remove pants starting at the cuff. A cut is made upward from the bottom of both legs to the waist. Peel the pants away from the patient and use the inside of the pants as a barrier for the patient; remove underwear.

Lane 2—Technical Decontamination

Technical decontamination is used to decontaminate the ETA staff prior to an individual moving from the ETA warm zone into the cold zone. Set procedures must be followed to ensure complete decontamination of the staff member. Staff members may become contaminated either by touching a contaminated patient or through reaerosolization or off-gassing of contaminants. All staff members working within the warm zone must be considered contaminated and are required to move through the technical decontamination corridor.

A minimum of one support team member is assigned to each technical decontamination corridor station. Technical decontamination stations are as follows:

• Initial rinse/gross decontamination station—Support team member points out the hand support or holds a dowel to help the staff member enter the shower tub. The support team member should not touch the staff member. If available, a decontamination shower is installed at this station. Water is sprayed from above the staff member who must protect the respirator filters while rinsing the head. Once the staff member has been completely rinsed, he or she steps out of the tub and moves down the line to the initial wash station.

• Wash station—Support team member points out the hand support or holds a dowel to help the staff member enter the wash tub. The support team member should not touch the staff member. The support team member motions for the staff member to cover the respirator filter. Wash the head then motion for the staff member to spread arms and legs. Wash the front of the body then motion for the staff member to turn around and wash the back side of the body. Rinse the individual using the same techniques. Finally, motion or ask the individual to lift one foot and wash the bottom of the foot. The individual places that foot outside the wash tub then lifts the other foot for washing. Once washed, the
individual moves on to the final wash and rinse station. This process is done using walkers as balance support for the individual.

- Rinse station—Using the same techniques as described above, the support team member washes and rinses the staff member. When exiting the final rinse station, the staff member is checked by a monitoring person for residual contamination. If the person is considered clean, the individual moves to the doffing corridor.

Lane 3—Evidence Collection and Monitoring

Clothing/Evidence Collection

After the team has cut the clothing from a nonambulatory patient or an ambulatory patient has removed their clothing, the items must be bagged and tagged. The following steps are used to collect clothing and personal effects:

- Take a large, clear trash bag and place hands inside the bag. Using the outside of the trash bag, gather clothing together into a small pile or roll. (Not used for blood evidence.)

- Spread the arms making the trash bag fall over the clothing as the hands are worked inward. The effect is to invert the trashbag over the clothing, containing the clothing without the staff member touching the contaminated items.

- Twist the top of the trash bag to close the bag, then twist a twist tie, string, or other containment closure item around the twisted bag. Fold the bag over to create a loop, and attach this section of the bag to the closure item.

- A second member of the team is helpful in placing the contaminated clothing into a second clear trash bag.

- A second member of the decontamination team collects personal effects using the same procedures as for contaminated clothing. Do not place hands into the pockets or other areas of contaminated clothing in which something might be secluded since items in these area could puncture the gloves of the decontamination team member. If something is secured in secluded areas, it will be in the bag for later identification.
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- Place the personal effects bag into the second bag already containing the patient’s clothing.

- Place the evidence tag portion of the triage tag into the second clear trash bag, ensuring that the scanner code can be read through the bag.

- Secure the second trash bag in the same manner as the first and deposit the patient’s clothing into the designated container.

**Monitoring**

- M8 paper—Used to identify liquid nerve (G and V agents) and blister (H agents) agents. The paper is used to touch wet spots on the patient’s body after the patient has processed through the decontamination line to determine if the individual is free of contamination. To monitor the patient with M8 paper, perform the following steps:
  - Remove a piece of M8 paper from the book and attach this piece to a dowel with an alligator clip or other holding device on the end.
  - Dab the paper on a wet spot on the patient. Pay particular attention to constricted areas of the body (e.g., the arm pit and groin).
  - After dabbing the patient, check the paper for change in color. Remember that it may take up to 30 seconds for the paper to change color with V agent.
  - The paper can be used more than once on the patient if it has not changed color. If the paper changes color, send the patient back to the decontamination line and identify to the staff where contamination was found.

**MultiRAE Plus**

The MultiRAE Plus is a monitor used to detect multiple hazardous gases within a small area. It combines a Photoionization Detector (PID) with a monitor that measures four gases, including Dioxide, Lower Explosive Limit, and two additional toxic gas sensors. It has a sampling pump that can draw up to 100 feet horizontally or vertically and it can be used as a personal monitor, a handheld sniffer, or as an area monitor operating continuously to detect chemical hazards.

**Notes**
The Ludlum 2241-3 is a highly versatile radiac meter that can be coupled with three different detectors for use in surveying. An additional detector head used for detecting contamination will be discussed below. The base unit has a five-position, rotating switch for changing between the different detector heads, an audible tone alert alarm with an enunciator on the display, and a backlit digital readout. A push button turns on the backlight for reading in low-light situations. The operational temperature range is -4 to 122° Fahrenheit. The meter is accurate to 10% of true value with a detector head connected. Battery life is typically 200 hours when using alkaline batteries with 24 hours remaining when the low battery light first turns on. The meter provides readings in counts per minute (cpm) and thousands of counts per minute (kcpm) in addition to reading milliRoentgen (mR) per hour.

Recalibration should be done after any maintenance or adjustment has been made to the instrument. In addition, the instrument should be sent in to a laboratory annually for calibration. Before using the machine, the calibration date must always be checked to ensure the unit has not expired. Standard maintenance consists of cleaning the instrument with a damp cloth. Though the unit is sealed when closed, it cannot be immersed in water. Prior to cleaning, remove the batteries and let the instrument sit for one minute. To prepare the instrument for use, ensure that the machine is turned off and remove the battery cover. Insert two D-cell batteries, checking to ensure the batteries are installed with proper polarity as shown on the battery cover and reclose the battery cover. Further operational preparation and use will depend on the detector being used. The following detectors can be used with the Ludlum 2241-3 radiac:

- Detector 44-2—The 44-2 is a 1"x 1" sodium iodide (NaI) high-energy gamma scintillation detector with a range of 1 µR/hr to 25 mR/hr. The detector head is very fragile; do not subject it to mechanical or thermal shock. When detectors are used in radiation fields higher than their designed intent, the meter will indicate “Overload” or “0.” To use the 2241-3 with a 44-2 detector head perform the following steps:
Ensure the machine is turned off before installing the cable and detector.

Turn the selector to detector position 2. The display will go through an initialization sequence. Each switch setting is color-coded to match the color-coding on the appropriate detector.

Place the detector directly on the check source mounted on the side of the 2241-3 body. The reading should be within 20% of the reading from the last calibration. When taken away from the source, typical background readings should be 1.4 to 2.6 kcpm or 8 to 15 µR/hr.

Toggle “Aud” to “On”—Audible output should be heard.

Toggle response from “F” to “S”—Display should respond five times slower at the “S” setting.

Press the reset button. The display should shortly indicate “0.” If no response occurs during the operational check, replace the batteries and repeat the steps. If still no response is observed, the machine should be marked and sent for maintenance.

The instrument is now ready for use. Before going into the hot area, remember to protect the machine and detector with plastic covers.

- Detector 44-38—The 44-38 is a medium-range, energy-compensated Geiger-Mueller (GM) probe with a rotary beta shield. When the window is closed, only high-energy protons are detected and the useful range is 1 to 500 mR/hr. The head is accurate to within ±10% of true value. When the window is open, energetic beta (>200 KeV) and low-energy photons can be detected. The open window reading should not be interpreted as the true exposure rate, but it is a useful indication of the presence of beta radiation.

- Detector 133-8—The 133-8 is a high-range, energy-compensated GM probe with a range of 150 mR/hr to 1000 r/hr. The energy response is accurate within ±25% of true value.

- Detector 44-9—The 44-9 detector/frisker probe is a low-range, 0 to 999,000 cpm, GM detector for alpha (>3 MeV), beta (>35 KeV), and gamma (>6 KeV) when the window of the detector probe faces the surface being checked. When the window of the detector
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probe faces away, only high-energy photons are detected. The window of the 44-9 is made of very thin Mylar®, which is easily punctured. Disposable probe covers are available and recommended for use when beta/gamma contamination surveys are being conducted. However, the disposable cover must be removed for alpha contamination surveys. The red probe cover protects the probe window when it is not in use. If the 44-9 detector is taken into radiation fields exceeding 1,000 mR/hr, the meter will saturate and indicate 0 cpm.

The Ludlum 2241-3, coupled with the 44-9 detector/frisker probe, is a low-range survey instrument for detecting alpha, beta, and gamma radiation. It uses the 44-9 probe to detect 0 to 60,000 cpm.

With the probe window facing the surface, the instrument will detect alpha, beta, and gamma contamination within one-half inch from the surface reading in cpm. Start with the range selector on the lowest setting permitting an on-scale reading. The 202-608 meter face has three arcs—top reflecting cpm, middle providing mR/hr, and the lower mR/hr x 100. With the 44-9 detector probe, only the top arc is used. The useable range selections are “x0.1,” “x1,” and “x10.” Listen for increases in the audible signal. Note that the response delay is four seconds when set on “F” and 22 seconds when set on “S.” The slow response position is normally used when the instrument is displaying low numbers that require a more stable meter movement. The fast response position is used for high-rate levels.

Ludlum 2241-3 operational check procedures are as follows:

- Verify calibration due date has not expired.
- Check for any obvious damage (e.g., frayed cable, punctured detector).
- Ensure detector selector knob is on the “OFF” position.
- Open battery compartment beneath handle.
- Install 2 D-cell batteries, paying attention to polarity. Close battery door.
- Attach cable and 44-2 detector, and turn selector to detector position 2.

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- Display goes through initialization sequence.
- After the initialization sequence, place detector directly on check source mounted to meter side.
- Toggle “AUD” to “ON”—Audible output should be noted on the speaker.
- Toggle response from “F” to “S”—Display should respond 5× slower at “S.”
- Depress “RESET” button—Display should shortly indicate “0.”
- If no response occurs, turn off, replace batteries, and repeat above steps.
- Attach carrying straps, if desired.
- Place instrument in bag. Place disposable covering over probes (beta, gamma only).

Whenever personnel or equipment are to leave the hot zone, they must be frisked for the presence of contamination. Frisking is the process of checking for alpha and beta contamination using low-level alpha and beta instruments. Frisking is performed at the beginning of or within the warm zone in designated areas. Each of these procedures will be discussed in turn.

- Direct frisk of personnel—For best results while performing a direct frisk, the detector should be held no further than 1” for beta/gamma and ½” for alpha from the surface being surveyed. Move the detector slowly, approximately 1” to 2” per second over the surface, systematically scanning the individual.
  - Enable the instrument speaker, or wear a headset while surveying. Do not rely on the machine readout. It is not possible to maintain the necessary distance and ensure a systematic survey without constantly watching the probe location on the body. After locating a surface that yields an increase in audible signal, hold the probe steady and look at the meter.
  - To systematically scan the individual, start with the front of the body and at the head moving in a Z pattern left to right or right to left. Move from the head to the torso,
weaving back and forth as moving down toward the waist. Next, sweep shoulder to fingers and back up. Finally, scan from waist to ankle for each foot. Perform the same procedure on the back of the body once the front is complete; check also the sides of the body, having the individual raise their arms to ensure a full body check.

When frisking, pay particular attention to the breathing zone (i.e., nose and mouth), hands, and feet. These are the likely contamination locations. The healthcare responder holding the monitor should stand in one place, giving instructions to the individual to turn around, raise arms, etc. Check the bottom of the feet last. If the person is uncontaminated and the shoe sole is clean, have the person place a foot onto a clean surface; repeat for the other foot.
Lane 4—Triage/Clinical Skills

A full discussion of START and JumpSTART is provided within the triage module. Immobilization is conducted to reduce the possibility of further injury to a patient with spinal cord injury. When conducting immobilization of a patient, the healthcare responder must be mindful of their PPE, making sure not to compromise the suit or glove integrity.

Immobilization is conducted in the following manner:

- Have at least four individuals line up on one side of the patient and have another person on the opposite side with a backboard.
- The four individuals grasp the far side of the patient and in unison, “log roll” or pull the patient towards themselves, rolling the patient onto their side just enough for the person with the back board to place the board under the patient.
- Simultaneously roll the patient back onto the back board.
- Secure the head with a padded V-shaped head brace if available or secure the head with a strap attached to the sides of the back board and extended over the forehead.
- Using straps attached to the sides of the back board, secure the patient’s torso in place such that it will not shift during movement of the patient. Once the torso is strapped in place, do the same for the legs. The arms must be included in the torso straps.
JumpSTART Pediatric MCI Triage

Able to walk? 

YES → MINOR → Secondary Triage

NO → Breathing?

NO → Position Nonrespiratory 

Breathing → APNEIC → IMMEDIATE

YES → Palpable pulse?

NO → DECEASED

YES → 5 rescue breaths

APNEIC → DECEASED

BREATHING → IMMEDIATE

Respiratory Rate

<15 OR >45 → IMMEDIATE

15-45 → Palpable Pulse?

NO → IMMEDIATE

YES → AVPU

L → IMMEDIATE

A, V, P → DELAYED

Evaluation infants first in secondary triage using the entire JS algorithm

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Notes
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Conclusion

This training has provided an opportunity to practice the techniques that will be used within the ETA during response to a MCI. All healthcare workers and staff within a healthcare facility must be able to triage MCI patients along with being able to process patients through the decontamination corridor. Most nurses and doctors will be needed within the hospital to treat the patients as they enter the ED, therefore, they will not be available to perform many of the ETA procedures in the ETA. During this module, training has been conducted in the donning of PPE, triage, cutout, decontamination, contamination monitoring, and, finally, the techniques to decontaminate the staff and properly doff PPE. During a MCI, all individuals will perform exactly as they have trained.
After Action Review

Update: December 2013
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End-of-Course Critiques

Explain to healthcare responders the purpose of the end-of-course critiques as follows:

- The end-of-course critiques and DHS’ Level 1 Evaluations provide you an opportunity to give feedback to the Center for Domestic Preparedness (CDP) about your experience here and the training received. Please provide responses that reflect your reaction to the services, course materials, instruction, and your overall experience. We will use the responses to ensure that we continue to deliver top-quality training. Following the completion of the forms, we will conduct an After Action Review (AAR) to receive any other comments.

- Pass out the end-of-course critique and the DHS’ Level 1 Evaluations. Allow healthcare responders 10 minutes to complete the forms. Collect them and return them to the Evaluations department.

After Action Review

Begin the AAR by providing healthcare responders with the primary discussion points:

- What were the strongest elements of the training?

- What elements of the training could be improved?

- How can the CDP improve the overall training experience?

- Are there any suggestions to improve the subject matter?

- Is the training appropriate for your level of experience?

- Do you feel that the knowledge, skills, and attitudes gained during the training is useful to you on the job?

- Is this course helpful in providing training to others in your community?
Graduation

Update: December 2013
Graduation

Hospital Emergency Response Training for Mass Casualty Incidents

Collect the Controlled Portion of the Student Badge

Collect the controlled portion of the student badge (hard card).

Graduation Folders

The graduation folder contains the following items:

- Course completion certificates
- Continuing Education Unit (CEU) certificates
- Center for Domestic Preparedness (CDP) fact sheet
- Class email roster
- Social media page
- Press release
- Class photo (if purchased)

Conclusion

- Review the courses offered by the CDP.
- For more information regarding the available resident, nonresident, and indirect courses offered by the CDP, please visit https://cdp.dhs.gov/