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MIDWEST CONSORTIUM
FOR HAZARDOUS WASTE
WORKER TRAINING

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Hospital-Based Decontamination

Participant Guide

Acknowledgments

This curriculum has been developed by the Midwest Consortium for Hazardous Waste Worker Training under cooperative agreement U45 ES 06184 from the National Institute of Environmental Health Sciences (NIEHS).

We encourage you to comment on these materials. Please give your suggestions to those leading the program in which you are now enrolled or click on ‘contact us’ at https://mwc.umn.edu.

The material was prepared for use by experienced instructors in the training of persons who are or who anticipate being employed at a health care facility. Authors of this material have prepared it for the training of this category of workers as of the date specified on the title page. Users are cautioned that the subject is constantly evolving. Therefore, the material may require additions, deletions, or modifications to incorporate the effects of that evolution occurring after the date of this material preparation.

Preface

Hospital workers risk occupational exposures to chemical, biological or radiological materials when a hospital receives contaminated patients, especially during mass casualty incidents.

The Occupational Safety and Health Administration (OSHA) refers to these employees as First Receivers. First Receivers may become exposed to hazardous substances that are transported to the hospital on patients’ skin, hair, clothing, or personal effects. First Receivers may include hospital technicians, facilities and engineering, housekeeping, patient tracking, Emergency Room employees, and those who provide treatment to contaminated patients.

This course will provide participants with the knowledge and skills required to protect against exposure to hazardous substances and to provide decontamination of contaminated patients at a site that is remote from the actual release of the hazardous substance.

The course is designed to meet OSHA training requirements for First Receivers at the Awareness and Operations Level, as described in the OSHA standard on Hazardous Waste Operations and Emergency Response (HAZWOPER).

This course includes 10-hours of instruction, including classroom presentations and hands-on workshops. Three hours can be given as an Awareness Level for hospital employees. The eight hours of the program relating directly to decon actions are designed to meet requirements for hospital employees who are responsible for decontaminating patients.

To ensure you understand the information presented, you are encouraged to ask questions. Your active participation throughout this program is critical to your success. This content was updated July 27, 2023 and all web links were active at that time; if an error is found please inform the facilitator so it can be updated.

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Lessons Learned: Finding Solutions at Health Care Facilities

From September 11

Pre-planning

- Each responder organization must define safety requirements should a disaster occur
- Define information resources that will be needed and source
- Identify avenues to accessing any needed resources
- Link safety resources to response management
- Decision processes and implementation plans are defined and in place
- Understand and practice multi-agency approach to safety management

Really being ready

- Practice, Practice, Practice
- Simulations
- Emergency Operations Center—multi-agency
- Integrate safety into exercises
- Identify national resources and understand need to activate

From the aftermath of September 11…..

Planning offers opportunity to identify gaps

- No specialized PPE for medical responders
- Need to match protection with expected hazards

- Communication must be uninterrupted
- New information must be shared
- Must constantly update the hazard assessment
- Environmental monitoring equipment must be portable and sturdy; use, capabilities and limitation must be understood
- Procedures need to be described beforehand and implemented by everyone
- Organizational structure can be a barrier to safe and efficient responses to incidents

After Hurricane Katrina

- Improved Communication
- Satellite-based radio-telephones that do not depend on local transmission stations
- Improved egress
- Flat-bottom boats for evacuation of patients in areas with potential flooding
- Identify air-evacuation resources as part of planning

Look to what works—the experiences of Florida emergency responders….

- Improved Communication
- One State-wide EPC in Tallahassee; Twice-daily conference call briefings with all 67 county emergency coordinators
- Hospitals and nursing homes are represented in the EOC before and during the emergency
- Collaborate with responders regarding the risks and benefits of evacuation of frail patients.
- Planning for supplies
- Food, water and fuel for 4 days stockpiled or available prior to the emergency

Stress – The Neglected Hazard

A large building on fire, smoke full of toxic gases, potential terrorists, a densely populated neighborhood to evacuate, and patients rolling into the hospital in a seemingly endless stream. Sounds difficult enough … without putting stress into the equation. Now imagine that neighborhood full of frightened children and their beleaguered parents. Firefighters whose heart rates increase with the intensity of the fire. Police under pressure from the media and the community to pin down the arsonist. Hospital staff worn out from the extra-long hours without a break. Stress levels all across the board easily escalate.

Those first responders and receivers surrounding the World Trade Center suffered stress from a variety of sources, says the NIOSH Rand Report *Protecting Emergency Responders Vol. 1*. The responders at the scene and the receivers at nearby hospitals worked to save others until they dropped, disregarding their own health. The long hours, not to mention the long duration of the operation, coupled with the grueling hard work certainly contributed to stress. There were so many possible hazards workers had to be wary of that just keeping track of them all was difficult. The emergency personnel had to deal with the horrors of the attack up close. The rest of the country mourned from afar, but these men and women had to see the devastation up close. Many of the workers had never seen a dead body before – let alone one mangled from the building collapse.

According to the NIOSH Rand Reports, one hundred reports of psychological stress came in over the first nine weeks of work at the World Trade Center disaster site. NIOSH believes this risk to be one of the most understudied and underestimated risks that emergency personnel take. Overwhelming devastation and hard work can make workers unable to care for themselves properly. Officials at the WTC had emergency responders coming out of buildings with temperatures as high as 104 and 105 degrees who refused to take a break. While the workers are to be commended for their bravado, they should have taken time to avoid heat stress.

The risk that seems to put people most on edge is the risk that no one can see. A fire, sure, you can see it and put it out. But tell workers that anthrax is or might be present, and stress levels rise much faster. Fear tears through the ranks – was I exposed? The psychological stress of apprehension occludes the illness itself (which may or may not be present). OSHA's *Best Practices for Hospital-Based First Receivers* suggests having mental health personnel available for staff as a resource.

The NIOSH Rand Report *Protecting Emergency Responders Vol. 3* concludes that monitoring the mental health of emergency personnel is necessary not only during an emergency and directly afterwards, but prior to the incident occurring. If a worker walks into disaster dealing with a pending divorce or recently deceased loved one, that worker will have one more problem to add to the list when he or she comes out. The healthier a worker is, both physically and mentally, going into a potentially hazardous situation, the better s/he will deal with the situation.

NIOSH also suggests providing support for the families of emergency personnel. Knowing their loved ones are being cared for will relieve a burden from the shoulders of emergency workers. When the needs of workers are addressed, then they perform better.

During the Vietnam War, for some extremely high-stress situations (ex. dead and seriously injured children) soldiers coming out of an area would “pre-brief” the incoming soldiers. Without focusing on feelings, the soldiers would explain what to expect from the terrain and the sights and smells associated with the area. The theory was that incoming soldiers were verbally “inoculated” against the horror of the scene – they were better prepared to deal with the situation because they were forewarned. A similar technique of pre-briefing could be used in preparing first receivers to deal with the stresses of their job.

Resources:

NIOSH Rand Reports:

http://www.cdc.gov/niosh/npptl/guidancedocs/rand.html

OSHA Best Practices

http://www.osha.gov/dts/osta/bestpractices/firstreceivers_hospital.html

What events could result in transport of mass casualties to this medical center?

The following are needed for safe management:

- Hazard Vulnerability Analysis
- Emergency Management/Operations Plan (EMP/EOP)*
- Routine Practice Drills

*OSHA references an EMP while TJC references an EOP. These terms will be used interchangeably.

Hospital employees may be covered by OSHA regulations, if the workplace is in a state where state employees enforce the regulations – these are called state-plan states.

In states where the Federal government enforces OSHA, public hospital management is not legally required to comply. Some hospitals do follow OSHA – as a prudent health and safety practice.

Disaster Preparedness

Specialization

To better recognize and prepare for hazardous situations that might occur in your area, there are a few places to look. Become familiar with chemicals used in your area – specialize your Emergency Management/Operations Plans.

- Is there a storage facility for chlorine-based pool chemicals?
- Do trains regularly carry explosive gases through town?

Arm yourself with knowledge. Assets are not just how many oxygen masks you have, but what you know as well. Knowing what treatment and PPE are necessary in a chlorine gas leak crisis can save valuable time – the few minutes spent searching for the information could cost a life.

Get Connected

Knowing what hazards might occur is useless if you are not prepared to deal with them.

- Get to know your neighbors. The Joint Commission (TJC) requires that hospitals coordinate with other local hospitals and develop mutual aid plans in the event of a patient overflow.
- They require coordination between hospitals and the fire department, police, health department, and any community agencies that might deal with hazardous situations.
- Ensure that everyone is familiar with the Incident Command System and find out how quickly they would be able to respond if you requested help.

Internal Preparation

- Speed is crucial in emergency response situations.
- Hold drills and exercises regularly and keep first receivers up-to-date on training.
- Ensure there are enough people trained to respond to an emergency and enough working equipment and supplies to go around.

What sort of people do you have trained?

- Consider an all-volunteer first receiver squad.
- Volunteers for the extra duty will probably perform better than those forced into it – remember this isn't a risk-free operation for those involved.
- Consider utilizing any experience former firefighters, police or military may have had on a previous job by asking them to join the first receiver squad.

Impact

When preparing for disaster, keep in mind the regional impact. What sort of impact would it have on people? Is your region densely populated? Think about the property that might be involved – can it be repaired or replaced if damaged?

Economic impact is no small thing either – a large financial burden can fall on a community following a mass casualty incident.

Hazard Vulnerability Analysis (HVA)

OSHA recommends and TJC requires that all hospitals complete a HVA for hazard assessment and review it annually. This hospital-specific HVA helps guide your thinking about preparing for hazards in your community. It will help you come up with the risk percent that your region runs. If the number is high, then you should consider having large numbers of receivers trained. Even if the number is low, don't let that lull you into a false sense of security – the risk is still there. Always keep sufficient staff trained and equipment, or know where in your community or region those resources are maintained.

Emergency Management/Operations Plans (EMP/EOP)

The Emergency Management/Operations Plan is an outline for emergency response action. You can use the HVA to tailor the plan to your specific needs. You need to take into consideration specific hazards in your region, the part you will play in the incident, and the ways in which you will prepare for emergencies, respond to them, and how you will terminate the response. The EMP/EOP should include information on PPE usage in emergencies. OSHA recommends that all hospitals and other response organizations coordinate their EMP to better address everyone's needs and to speed the response along.

Resources:

OSHA Best Practices

http://www.osha.gov/dts/osta/bestpractices/firstreceivers_hospital.html

TJC Emergency Management Standards

http://www.jointcommission.org

Hospital Hazard Vulnerability Analysis Guide

Take the following questions into consideration:

Probability

What known risks are there?

Look up historical data for your area as well as vendor/manufacturer statistics.

Human Impact

What is the potential for patient/staff death or injury?

Property Impact

What is the cost to repair, replace, or set up temporary replacements for damaged facilities?

How much time will it take to recover?

Business Impact

How many/what sort of businesses would be interrupted?

Will employees be able to report to work?

Can customers reach facilities?

Was the company violating contractual agreements?

Will there be an imposition of fines and penalties or legal costs?

Will our supply of resources be interrupted?

Can products still reach their destinations?

What reputations will be damaged?

What will be the financial impact or burden?

Pre-planning

How up-to-date are our plans?

Do we have drills often enough?

Do we have enough people trained?

What kind of insurance do we have?

Do we have alternate sources of supplies available?

Do we have the necessary supplies and resources?

Do we have enough supplies and resources?

Is our staff available in a crisis?

Do we have necessary coordination between the buildings to organize in a hurry?

What's our backup system like?

How durable are our facilities?

How long will it take us to respond to an emergency?

How much are we capable of handling?

Look up historical data on past emergency responses – how did we do?

External Response

Do we have agreements in place with community agencies?

How is our relationship with local and state agencies?

Have we asked nearby hospitals to help us if we have patient overflow?

Have we talked with facilities that treat specific ailments?

How are our community resources?

How long will it take them to respond to an emergency?

How much are they capable of handling?

Look up historical data on past emergency responses – how did they do?

Kaiser Permanente has developed an HVA template which is available for use and is routinely utilized by hospitals across the United States. It is available at http://www.calhospitalprepare.org/hazard-vulnerability-analysis. Please note if adding or deleting events, the formula must be adjusted.

Hospital Hazard Vulnerability Analysis

Event	Probability	Severity			Severity Subtotal	Preparedness			Prepared-ness Subtotal	Total	% Risk
		Human Impact	Property Impact	Business Impact		Pre-planning	Internal Re-sponse	External Response			
	0=N/A 1=Low/None 10=Moderate 20=High	0=N/A 1=Low/None 10=Moderate 20=High	0=N/A 1=Low/None 10=Moderate 20=High	0=N/A 1=Low/None 10=Moderate 20=High	Add all Severity scores	0=N/A 1=High 10=Moderate 20=Low/None	0=N/A 1=High 10=Moderate 20=Low/None	0=N/A 1=High 10=Moderate 20=Low/None	Add all Prepared-ness scores	Add subtotals and probability	Divide Total by 140 and multiply by 100
Mass Casualty (trauma)											
Terrorism, Biologi-cal											
Mass Casualty (medical/infec-tious)											
Fuel Shortage											
Natural Gas Failure											
Sewer Failure											
Steam Failure											
Fire Alarm Failure											
Communications Failure											
Medical Vacuum Failure											
HVAC Failure											
Information Sys-tems Failure											
Fire, Internal											
Hazmat Exposure, Internal											
Average											

Use this form, based on examples found in the OSHA Best Practices for Hospital-Based First Receivers of Victims, to compute the risk of a Mass Casualty Incident at your hospital.

Duties and Limitations

Given a mass casualty incident involving hazardous materials, the participant will identify the duties and limitations of healthcare employees who provide decontamination at a health care facility, according to OSHA's Best Practices for Hospital-Based First Receivers.

When you have completed this chapter, you will be better able to:

- Define a mass casualty incident
- Identify the types of hazardous contaminants that may result in an exposure to healthcare workers
- Identify the elements of an Emergency Management Plan
- Explain the need for Standard Operating Guides at your health care facilities
- Identify training required for first receivers
- Identify your role within the Incident Command System for a scenario

Mass Casualty Incident

A mass casualty incident involves an emergency in which a large number of casualties are produced in a short period of time, usually as the result of an aircraft accident, hurricane, flood, earthquake, hazardous materials release, or terrorist attack. According to OSHA, a mass casualty is defined as "a combination of patient numbers and patient care requirements that challenges or exceeds a community's ability to provide adequate patient care using day-to-day operations." (See https://www.osha.gov/sites/default/files/firstreceivers_hospital.pdf)

You can assume that in the event of a mass casualty incident, local hospitals will be flooded with large numbers of people seeking treatment. OSHA estimates that as many as 80% of the total number of victims will come to the hospital in their own transportation.

If the mass casualty incident involves an exposure to a hazardous substance, the patients who arrive at the hospital on their own will not have gone through any decontamination. This will increase the risk of exposure to hospital employees.

Attack with Sarin in Tokyo

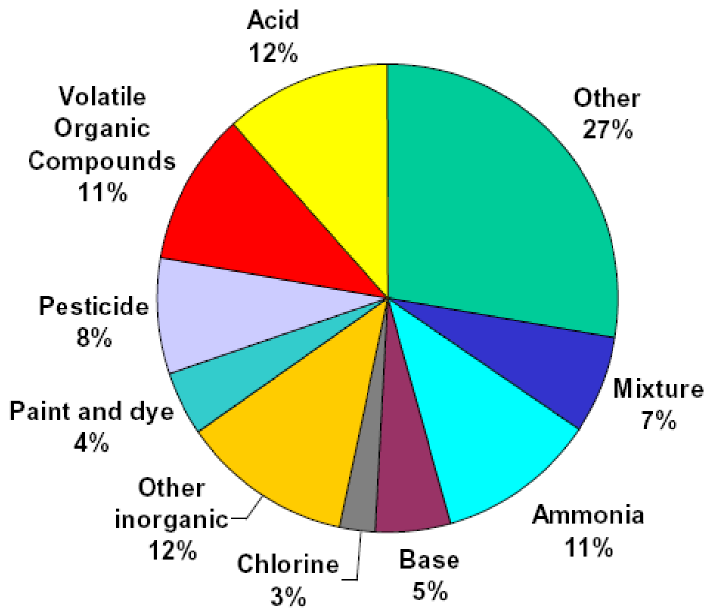
On March 20, 1995, a group of terrorists placed containers of the nerve gas Sarin in five cars of Tokyo's subway system. Within a short period of time, there were injured people at 15 subway stations. People experienced breathing difficulties and muscle weakness, and many lost consciousness. In all, ambulances transported 550 people to local hospitals. An additional 2,700 people made their way to hospitals or private clinics on foot or in private cars. A total of 12 people died from the Sarin exposure. As a result, 472 hospital staff members were exposed to contaminated patients. Most patients arriving at the hospital had rather mild symptoms and could leave after examination and treatment.

Hazardous Substance

A hazardous substance is any material that can cause harm to people, property, or the environment. Since OSHA is responsible for workplace health and safety, its definition of hazardous substance is based on the harm that could occur to employees.

In this course, the focus will be on those hazardous substances that healthcare workers could be exposed to as a result of a release that occurs away from the hospital. In these types of emergencies, the primary source of exposure would be from contaminated patients who come to the hospital for treatment. Although the risk from exposure to contaminated patients is low, compared to exposures at the scene of the release, healthcare workers may be exposed to hazardous substances on the patient, their clothing, or their personal effects.

In a summary of hazardous materials incidents in Wisconsin from 1993- 2003, the types of substances released included the following:



Source: Anderson, H. and Drew, J., Wisconsin Hazardous Substances Emergency Events Surveillance 1993 - 2003, Wisconsin Bureau of Environmental & Occupational Health, Madison, WI, October, 2004.

In the early stages of an emergency, the identity of the substance may be unknown. For this reason, healthcare workers need to know how to protect themselves.

Emergency Management Plan

The Joint Commission (TJC) requires hospitals to determine the hazards that employees may be exposed to; to provide for employee safety; and to coordinate emergency response activities with the community and other hospitals in the area. As part of TJC and OSHA requirements, hospitals must develop an Emergency Management/Operations Plan (EMP/EOP) that addresses these issues. The plan must include separate procedures for the Hospital Decontamination Zone, as well as the Post-Decontamination Zone. These OSHA required procedures are described below. (For sample EMP see Appendix D).

Hospital Decontamination Zone

The Decontamination Zone is any area where the type and quantity of hazardous materials is unknown and where contaminated patients, equipment or waste may be present.

For this zone, the EMP must include:

- Plans to assist the number of victims, ambulatory and non-ambulatory, that the community anticipates might seek treatment
- A description of training, equipment selection, equipment maintenance, and respiratory protection
- Procedures that encourage victims to comply with decontamination, such as shelters, tepid water, soap, privacy, and body coverings
- Procedures to limit employee exposure to contaminated medical waste and wastewater

Hospital Post-Decontamination Zone

The Post-Decontamination Zone is an area that where you would not expect personnel or equipment to be contaminated. This would include the Emergency Department (ED), as long as it is not contaminated. For this zone, the EMP should include steps to:

- Minimize contact between ED personnel and contaminated victims
- Activate the decontamination and security systems to limit the chance that a contaminated patient will enter the ED and contact unprotected staff
- Ensure that unannounced victims disrobe in the decontamination area, not the ED, and follow decontamination procedures before admission
- Protect ED staff from contaminated patients
- Reclassify the ED as a contaminated area, requiring proper protective equipment, should the need arise

Standard Operating Guides

According to the OSHA interpretation of the Hazardous Waste Operations and Emergency Response (HAZWOPER), a hospital must develop procedures for respiratory protection, personal protective equipment, decontamination, and incident command. These procedures, often referred to as Standard Operating Guides (SOGs) or Standard Operating Procedures (SOPs), should be included as part of the hospital's Emergency Management/Operations Plan.

The SOGs your hospital develops will depend on the types of hazardous substances that are present within your community, the role of your hospital as related to emergency response, and the type of equipment that is available. A sample SOG for one type of respiratory protection is provided below. In this course you will also review other SOGs that your hospital may develop and implement. (See also Appendix B for more examples)

<u>Loose-Fitting PAPR Pre-Operational SOG</u>

To be performed monthly and prior to each use:

Take off cartridges (if attached)

Inspect cartridge connections for wear

Reinstall cartridges into connection

Make sure cartridges are properly fitted

Verify that battery is fully charged

Remove blower tube (if attached)

Check blower tube for cracks, holes, etc.

Re-attach blower tube

Verify flow rate per manufacturer's instructions

Inspect head piece

_______Initials of Inspector

Levels of Training

Under the HAZWOPER standard, OSHA requires hospitals to provide training to employees who will be responding to emergencies. The type of training depends on the role of the employee, the zone they will work in (contaminated or not contaminated), and the likelihood they will come into contact with contaminated patients. There are several levels of training that may apply to employees in your healthcare facility.

Awareness Level

Awareness Level training is for those who work in the Cold Zone, an area generally free of contamination. This might include ED clinicians and clerks, triage staff, decontamination set-up workers, security, and those who track patients. Employees at the Awareness Level must be able to:

- Recognize the presence of a mass casualty incident
- Avoid physical contact with contaminated patients
- Immediately notify their supervisor and safety officer of possible contamination
- Allow properly trained staff to isolate and decontaminate the patient

OSHA does not list any minimum number of hours of training for employees at the Awareness Level. However, the training must provide employees with the ability to perform the tasks listed above.

Operations Level

According to OSHA, employees who will be working in the Warm Zone (Hospital Decontamination Zone) must receive Operations Level training. This is more extensive training than Awareness Level because employees at this level have the potential for being exposed to contamination on patients.

Training at the Operations Level must cover Awareness Level topics and must ensure that employees can:

- Understand the Emergency Management/Operations Plan and their role in it
- Understand the risks to their safety and health that may be present in the Warm Zone
- Select and use appropriate Personal Protective Equipment (PPE) and
- Implement patient decontamination procedures.

OSHA requires a minimum of 8 hours training for First Receivers at the Operations Level. This program is designed to meet Operations Level requirements for First Receivers.

Limitations of Operations Level Training

This program is designed to teach you how to perform decontamination at the hospital, away from the site where the release of the hazardous substance occurred. It does not provide you with the knowledge and skills you would need to respond to a release of a hazardous material.

Those who respond to a hazmat release, such as firefighters or members of an Emergency Response Team, require additional training in order to respond at the Operations Level. The chart below explains the difference between Operations Level duties for healthcare workers (First Receivers) and those who respond to a release (First Responders).

First Receivers	**First Responders**
Work at a site that is away from the actual release of a hazardous material.	Respond to a release of a hazardous material for the purpose of keeping it from spreading.
Provide decontamination of contaminated patients.	Provide decontamination at or near the site of release.
Wear limited levels of Personal Protective Equipment.	Wear more advanced levels of PPE.

As a First Receiver, you are not allowed to perform the duties of a First Responder, unless you receive additional training.

Skilled Support Staff

Another level of OSHA-required training is for skilled support staff. These would include employees who are not assigned to respond to emergencies, but who may be called upon to provide assistance to contaminated patients or perform other work in the Warm Zone. The content of their training must include:

- Nature of the hazards
- Expected duties
- Appropriate use of PPE
- Decontamination procedures

Although the hospital may provide this training as part of an orientation immediately prior to assigning these duties, OSHA recommends that all hospitals try to identify the skills that will be required and provide the required training well in advance of the emergency.

Technician Level

Technician Level training is designed for first responders, such as firefighters, who will enter the Hot Zone and attempt to confine or contain the hazardous material release. As First Receivers, you are not allowed to perform Technician Level activities.

Refresher Training

OSHA requires annual refresher training for all employees who are assigned first receiver or emergency response duties. There is no specified content or minimum number of hours required. However, the training must ensure employees are competent to continue to perform their assigned duties.

Incident Command System (ICS)

When a mass casualty incident occurs, confusion and chaos often result. These negative effects can result in more injuries and a worsening situation. In order to prevent chaos, OSHA requires that employers use an Incident Command System when responding to emergencies. An Incident Command System designates one person to be in charge of the incident. This person is called the Incident Commander (IC). In addition, the IC divides up other tasks that must be performed into the functions listed below. Any tasks not assigned become the responsibility of the IC.

Function	Description
Operations	Assists the IC in implementing the Action Plan
Planning	Keeps track of what is happening and develops alternative strategies for the IC
Logistics	Provides supplies and equipment required for the response
Finance	Tracks all expenses and ensures payment

Those individuals who will serve as Incident Commanders must receive training on their role during the incident. According to OSHA, Incident Commanders must know how to implement the Emergency Management Plan, including decontamination procedures. Your hospital should designate and provide training to those individuals who will perform Incident Command duties during an incident. As with other hospital personnel trained under this program, Incident Commanders must also receive annual refresher training.

According to OSHA, the IC must follow an Incident Action Plan when responding to an emergency. The IC should implement the plan in 4 different phases. You should be familiar with these phases in order to understand your role in the emergency response. These four phases include the following:

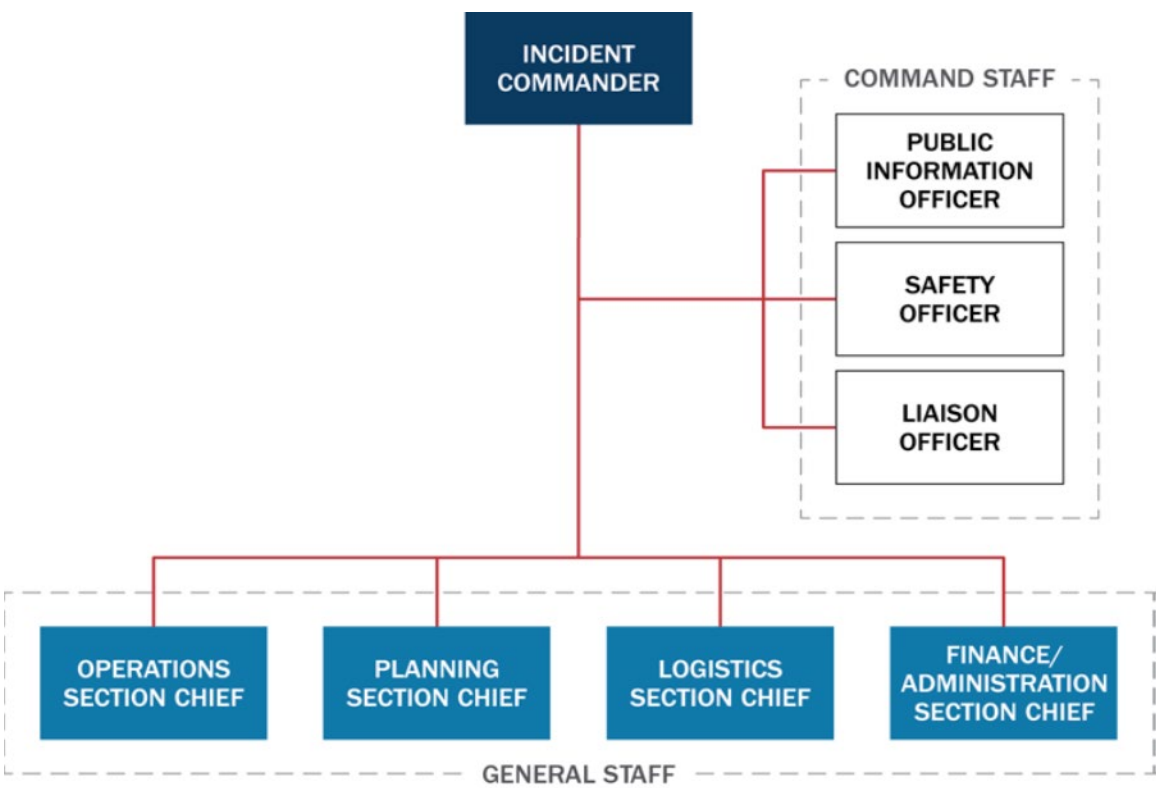
Phase 1 – Initial Actions	Notify proper authorities Identify the hazards Control the scene Protect responders
Phase 2 – Plan Development	Conduct risk/benefit analysis Determine goals Decide on tactics Evaluate resources Make assignments
Phase 3 – Sustained Actions	Conduct a briefing Initiate secondary decontamination Evaluate and adjust the plan
Phase 4 – Termination	Account for personnel Rehabilitate personnel Conduct a Post Incident Analysis Provide Critical Incident Stress Debriefing Document the incident Re-supply and recondition equipment

Incident Command System

Many hospitals have adopted an Incident Command System that is known as the Hospital Incident Command System or HICS. Under HICS, the Operations function will be responsible for patient decontamination. For this reason, First Receivers at the Operations Level will normally report to the Operations Chief or their designated supervisor. A chart of HICS is provided below.

This system provides a predictable chain of command, accountability for each function, a common language to eliminate confusion, improved documentation, and duty checklists for each position.

Incident Command System Structure



Source: https://www.fema.gov/sites/default/files/2020-07/fema_nims_doctrine-2017.pdf

Who will keep people out of this area?

Activity: Duties

Purpose: To provide participants with the opportunity to identify appropriate duties during a mass casualty incident.

Directions: Your instructor will divide the class into small groups. Based on the incident description provided, please indicate whether or not you will be trained to be able to perform the activities described below.

The Incident: A chemical-carrying freight train slammed into a parked locomotive causing the release of a poisonous cloud of chlorine gas from three tank cars. The accident occurred next to a textile plant and several other commercial buildings. Authorities ordered the evacuation of 5,400 residents living within a one-mile radius of the wrecked train. A total of 260 people showed up at three local hospitals, complaining of various symptoms, associated with chlorine exposure. A total of eight deaths occurred.

As a First Receiver are you trained to:	Yes	No
1. Respond to the incident and stop the chlorine release from the damaged rail cars?		
2. Assist with decontamination of victims at the scene of the incident?		
3. As victims report to the hospital, recognize that an emergency has occurred?		
4. Wear the appropriate PPE to protect yourself from exposure that may occur at the hospital?		
5. Assist with decontamination of victims who self-report to the hospital?		
6. Serve as the Incident Commander for this incident at the hospital?		

What will your duties be during an incident?

1.____
2.____
3.____
4.____
5.____
6.____

Summary

In this module you learned about the duties and limitations of First Receivers during mass casualty incidents. You discussed OSHA’s definition of a mass casualty incident, as well as the types of hazardous materials that are typically involved in emergencies. You reviewed the elements of an Emergency Management Plan and the need for Standard Operating Guides as part of the plan. You also learned about the different levels of training that are required for mass casualty incidents and hazardous materials releases and about your role within the Incident Command System.

Hazard Recognition

If you are not able to recognize a hazardous material, you may be injured or endanger others. For this reason, hazard recognition is a critical step in decontamination of victims at a health care facility. Hazard recognition enables you to determine what actions are safe to perform.

When you have completed this chapter you will be better able to:

- Recognize the presence of a hazardous substance and conduct a hazard assessment using a Hazard Assessment Worksheet.
- Assess chemical and physical hazards according to properties of toxic materials.
- Assess health effects according to the resources provided.
- Determine situations where medical surveillance is appropriate.

Activity: Hazard Assessment - Collecting Information

The next page shows a format for collecting information for a Hazard Assessment. After a review of each of the terms on the Hazard Assessment Worksheet, you will collect the information shown for a hazard that could be involved in a mass casualty incident in your area health care facility. (See also Appendix A for another copy of worksheet, and Appendix E for SDS to reference).

Hazard Assessment Worksheet

MATERIAL IDENTIFICATION

Product name____

Chemical Name____

MATERIAL DESCRIPTION

❑ Solid

❑ Liquid Appearance___________________________

❑ Gas Odor__________________________________

PHYSICAL / CHEMICAL PROPERTIES

Vapor Pressure: ❑ low (0-10 mmHg) ❑ moderate (10-100 mmHg) ❑ high (>mmHg)

Vapor Density: ❑ heavier than air ❑ lighter than air

Water Soluble: ❑ Yes ❑ No ❑ Partial❑

Specific Gravity: ❑ heavier than water ❑ lighter than water

pH:___________

Flash point: _____________

Oxidizer: ❑ Yes ❑ No

Incompatible Materials (Reactivity): ❑ Water ❑ Bleach ❑ Detergent ❑ Organics

Other:____

Decomposition products:____

Health Effects

Inhalation hazard ❑Yes ❑ No

Skin hazard ❑Yes ❑ No

Acute Effects: ____

Chronic Effects:____

Latent Effects: ____

Cancer Hazard ❑Yes ❑No

EXPOSURE LIMITS

OSHA PEL:_________________IDLH: __________________

Hazard Recognition

Hazard recognition is important to the health and safety of you and your coworkers. When a hazard is recognized, you can utilize proper personal protective equipment or other control to protect against the hazard.

If you know the name of the hazardous material, you can collect information from various resources and complete the Hazard Assessment Worksheet. Once you know and understand the hazards presented by the hazardous material, you will be able to decontaminate patients in a safe and systematic way, or assist in this activity.

The personal protective equipment you are being taught to use in this course has limitations. It is essential that you know these limitations and not take risks that endanger your ability to assist patients. When in doubt, always alert the appropriate person in the ICS.

Chemical and Physical Properties

Freezing Point

Definition Temperature at which a liquid or gas becomes a solid.

Example Water changes to ice.

Importance Helps determine what form the compound may take.

Melting Point

Definition The temperature at which a solid becomes a liquid or gas.

Examples Ice left at room temperature changes to a liquid (water). Dry ice (CO_2) left at room temperature changes to gas.

Importance Helps determine what form the compound may take.

Boiling Point

Definition The temperature at which a liquid changes into a vapor or gas.

Examples

Water 212ºF (100ºC)

Cadmium 1,409ºF

Acetone 133ºF

Chlorine –29ºF

Importance Determines whether a substance will be a liquid or gas at the temperature of the air.

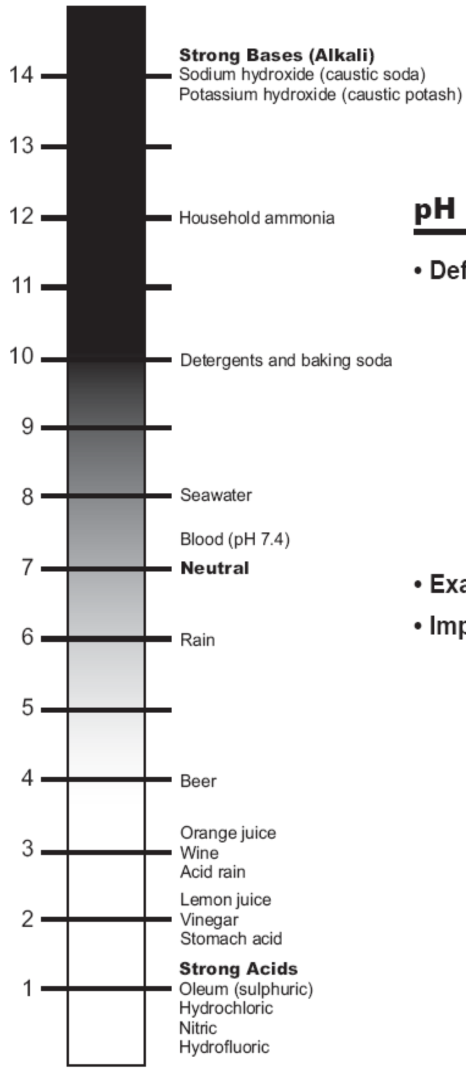
Appearance

Importance The color, cloudiness, odor, or other factors can help you recognize hazardous materials and predict hazards while decontaminating patients.

Odor

Importance Smell can help to identify some materials; however it is important to never intentionally use smell as you are receiving exposure!

Hazard Recognition



pH

- **Definition** Hydrogen ion concentration (pH) is used to determine if a substance is an acid or a base. A pH of 1 is very acidic; a pH of 14 is very alkaline. Because of the very large range in the values of pH, a special scale has been created. On it a change in pH of one unit (for example, from 3 to 4) represents a 10-fold change in acidity or alkalinity.
- **Example** See scale.
- **Importance** Compounds with high and low pH values will cause burns, irritate eyes, and irritate the nose and lungs. Substances with a pH less than or equal to 2 or greater than or equal to 12.5 are legally defined as hazardous waste. Materials with a pH less than 2.0 or greater than 11.5 will burn skin, eyes, and lungs.

Corrosive

Definition A compound which can quickly damage skin, eyes, other tissues, metal, and other solids. For example, strong acids (low pH) and bases (high pH) are corrosive.

Examples

Sulfuric acid (oleum)	Sodium hydroxide
Nitric acid	Lime
Hydrochloric acid	Lye
Hydrofluoric acid	Caustic soda

Importance Corrosives are reactive health and physical hazards and must be stored in glass or special plastics.

Flash Point (Fl. P.)

Definition The lowest temperature at which a liquid will give off enough vapor to start burning if there is a source of ignition, but there is usually not enough vapor (fuel) to sustain ignition.

Examples in degrees Fahrenheit (ºF)

Gasoline...............................–45
Acetone....................................0
Benzene.................................12
Methyl Ethyl Ketone (MEK).....20
Toluene...................................40
Xylene 84
Turpentine 95
Stoddard solvent.....................11
Butyl toluene 155
Creosol..................................187
Chloroacetaldehyde................ 190

Importance The flash point is used to classify the relative fire hazards of liquids. If the flash point of a liquid is low, it is considered flammable.

Flammable, Combustible, and Ignitable

Definition

The potential for a substance to catch fire. Highly **flammable** materials have a Fl. P. less than 100ºF (new DOT regulations Fl. P. < 73ºF). Flammables are further divided into Class 1A, 1B, and 1C, depending upon flash point and boiling point.

Materials are said to be **combustible** if their flash points range from 100º to 200ºF.

Ignitable materials have a Fl. P. < 140ºF.

Examples

Gasoline, methyl ethyl ketone (MEK), and xylene are examples of flammable liquids. Propane is an example of a flammable gas.

Importance

The flammable, combustible, or ignitable properties of a substance are important to know so a worker can determine the probability of a fire.

Autoignition Temperature

Definition

The lowest temperature at which a flammable gas/vapor-air mixture will ignite from its own heat source or contact with a heated surface without needing a spark or flame. Vapors and gases will spontaneously ignite at a lower temperature in pure oxygen than in air (21% oxygen).

Examples

Acetone........1,000ºF (537ºC)   Benzene..........1,044ºF (562ºC)

Toluene............997ºF (536ºC)   Methane..........ºF (537ºC)

Importance

Autoignition temperatures of chemicals may be lowered by other substances in a hazardous waste site. Methane may be produced by decaying organic material

Oxidizer

Definition

A chemical that reacts with another material and gives off large amounts of oxygen.

Examples

- Perchloric acid.........
- Household bleach
- Ozone
- Benzoyl peroxide.....
- Hydrogen peroxide
- Peroxides

Importance

Fires or explosions are more likely to occur if oxidizers are stored near flammables.

Solubility in Water

Definition Weight of a compound dissolved in a known volume of water (% or g/100 ml).

Examples Glucose............100% Hydrochloric acid............67% Methylene chloride............2%

Importance If a liquid spills into a water pool and is not soluble, it will either float to the top or sink to the bottom. If a compound is soluble in water, it will dissolve.

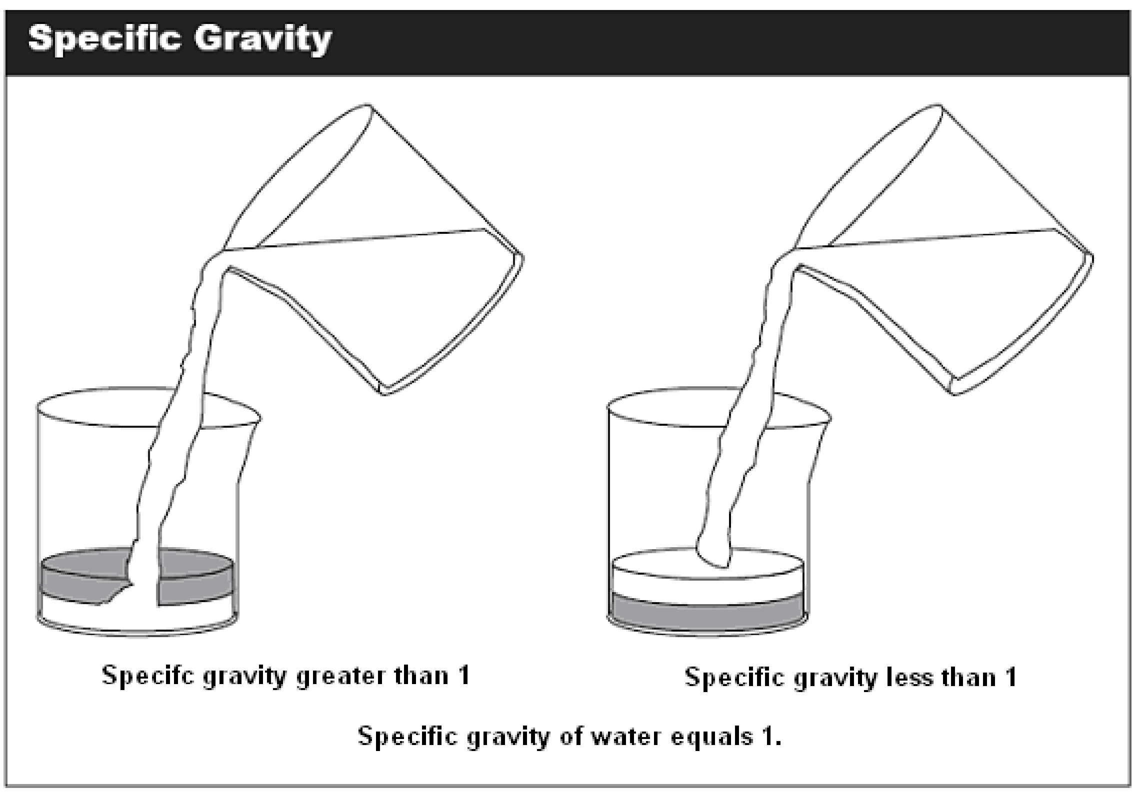
Specific Gravity (Sp. G.)

Definition Weight of a liquid compared with an equal volume of water (water = 1). If the chemical is not soluble in water and the specific gravity is less than one, the chemical will float. When the Sp. G. is greater than one, the chemical will sink.

Examples Toluene 0.87 Methylene chloride 1.33

Benzene 0.88 Cadmium 8.65

Importance Important if floating compounds are flammable and/or toxic.

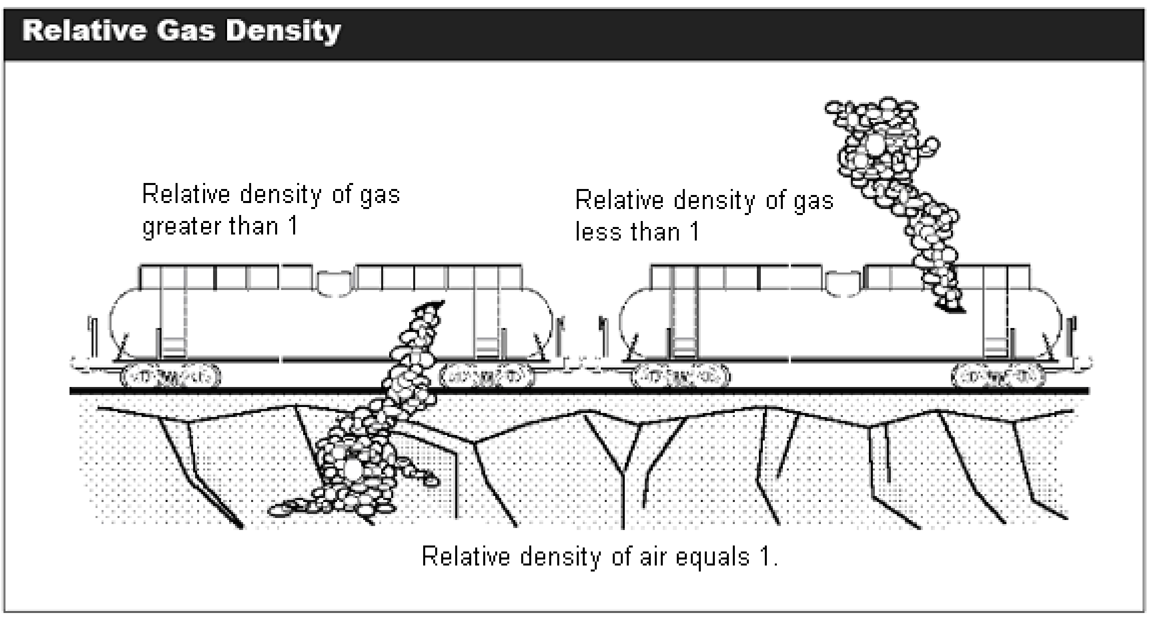


Relative Gas Density (R Gas D)

Definition Weight of a vapor or gas compared to an equal volume of air (air = 1). If greater than 1.0, the vapor or gas is heavier than air and will concentrate in low places. If less than the vapor or gas will rise.

Examples	Ammonia-0.59	Hydrogen sulfide- 1.19
	Benzene -2.70	Methylene chloride- 2.90
	Ethylene-0.97	Trichloroethylene-4.50
	Gasoline-4.40	

Importance Important because most vapors from toxic materials and many flammable materials are heavier than air and will accumulate in low-lying areas.



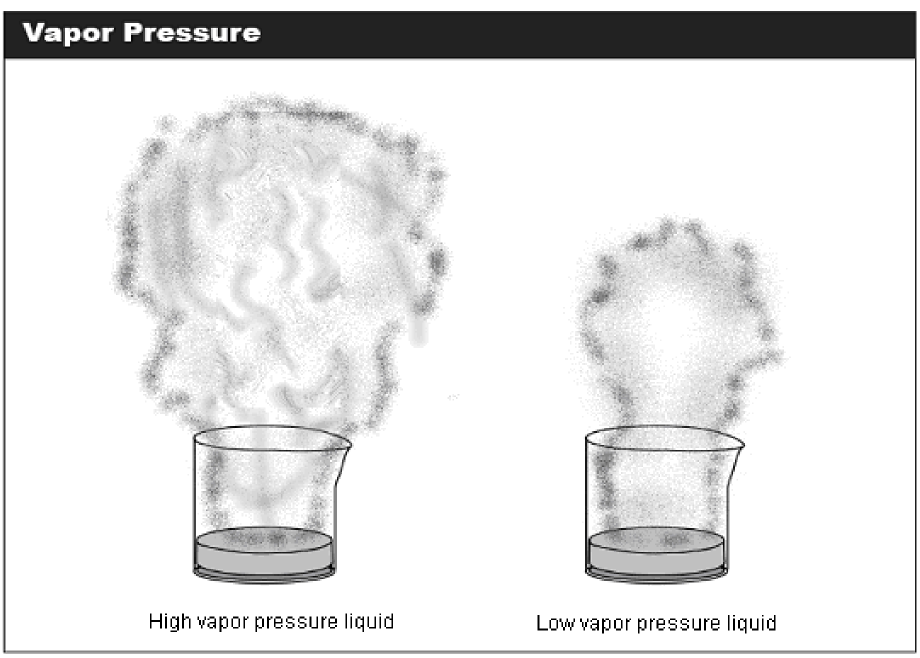
Gas Density

Vapor Pressure (VP)

Definition The tendency for a solid or liquid to evaporate into the air. (MSDS lists this property in millimeters of mercury [mmHg] at 68ºF.) The *lower* the boiling point, the *higher* the vapor pressure.

Examples	**BP (ºF)**	**VP (mmHg) at 68ºF**
Chlorine	-29	> atmosphere
Methylene Chloride	104	350
Acetone	133	180
Trichloroethylene	189	58
Xylene	269	9
Styrene	293	5
Cadmium	1,412	0

Importance Material with high vapor pressure will enter the air quickly and could overcome a first receiver who is not protected. Also, the higher the vapor pressure of a sealed chemical container, the more likely it is to explode as the temperature rises.



Viscosity

Definition Thickness of a liquid or its ability to flow. As the temperature increases, the liquid may become less thick.

Example Water has a low viscosity.

Molasses has a high viscosity.

Importance Because viscosity can change with the temperature, a high-viscosity substance may become runny when exposed to heat and spread more rapidly.

Volatility

Definition Volatility refers to how readily a material will evaporate into the air (vaporize). Volatility increases as the temperature increases.

Example Gasoline is a volatile liquid; lubricating oil is not.

Importance Volatile liquids can give off vapors which may be harmful to your health. Some volatile materials can produce a vapor heavier than air (high vapor density) that can creep along the ground and fill up manholes, trenches, or other low-lying areas. The vapor forces out oxygen and can result in death by suffocation. Some vapors' concentrations are explosive or flammable.

Incompatible Materials

Some chemicals may react adversely with some decontamination solutions and equipment. A water-reactive material trapped in a patient's clothing could react when wetted. Mixing bleach with an acid will release chlorine gas. Other, less serious incompatible materials may simply be ruined if they come into contact with the hazardous substance. You should segregate incompatible materials unless the decontamination process is specifically designed to handle them.

Decomposition Products

Decomposition products are created when a hazardous substance burns, explodes, or degrades. Hydrogen cyanide, sulfur dioxide, nitrogen dioxide, and hydrogen chloride are common decomposition products of hazardous substances. Knowing the decomposition products will allow you to identify the hazards during an emergency.

Health Effects

Understanding the health effects associated with exposures to hazardous materials can help the first receiver to:

- Avoid exposure
- Decide the appropriate response tactics
- Choose the proper personal protective equipment
- Chemicals enter our body in various ways.
- Inhalation
- Skin and eye absorption
- Ingestion
- Injection

Possible Health Effects

The health effects due to a hazardous substance can be acute, latent, or chronic.

<u>Acute Effects</u>

An acute health effect means that the body's response occurs at the time of exposure or within a few days. Acute effects may result from exposure to high concentrations of a substance. Examples of acute health effects include:

- Choking
- Coughing
- Nausea
- Dizziness
- Burning in eyes, throat, or on the skin

Latent Effects

A latent effect occurs when the onset of symptoms from an exposure is delayed. The delay may take from 1 to 72 hours. For example, breathing acid fumes may have a latent effect when tissue irritation occurs up to 48 hours later. First receivers need to know the latent effects of specific hazardous substances. They need this information to protect themselves and others in the area that may have been exposed.

Chronic Effects

A chronic health effect means that the body's response takes a long time to show up—for example, weeks, months, or even years. Chronic effects involve repeated or prolonged exposure to a chemical. Examples of chronic effects include:

- Cancer
- Liver disease
- Impotence
- Mental deterioration
- Lead poisoning

The effect can be at the point of contact (local) or in another part of the body (systemic)

Local Effect

A local effect from a chemical exposure occurs at the point of contact on our bodies, such as the skin, eyes, nose, throat and airways.

Systemic Effects

A systemic effect occurs when a chemical gets into the blood and causes harm at some point away from the point of contact. For example, solvents may cause damage to the nervous system after they are inhaled.

Factors That Influence the Body's Response to Exposure

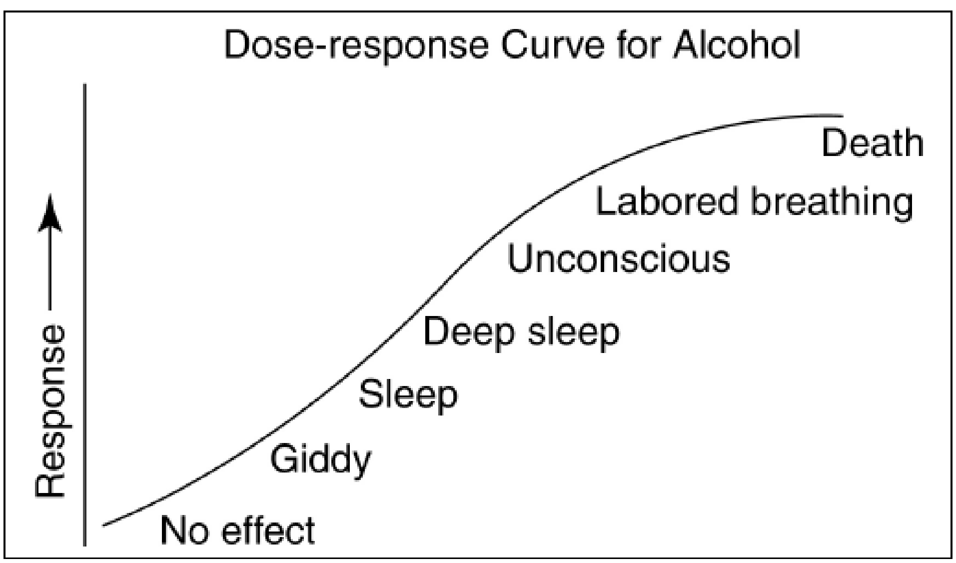
Different individuals have different reactions to chemical exposure. There are a number of factors which seem to influence response. These include current health status, age, race, sex, allergy history, and previous chemical exposure.

Different chemicals also can cause varying responses at different concentrations. This is known as a **dose-response relationship**.

The chemical is considered to be relatively **nontoxic** if a **large** amount of a chemical (dose) is needed to cause a bad or toxic response. The chemical is considered to be relatively **toxic** if a **small** amount causes a toxic response.

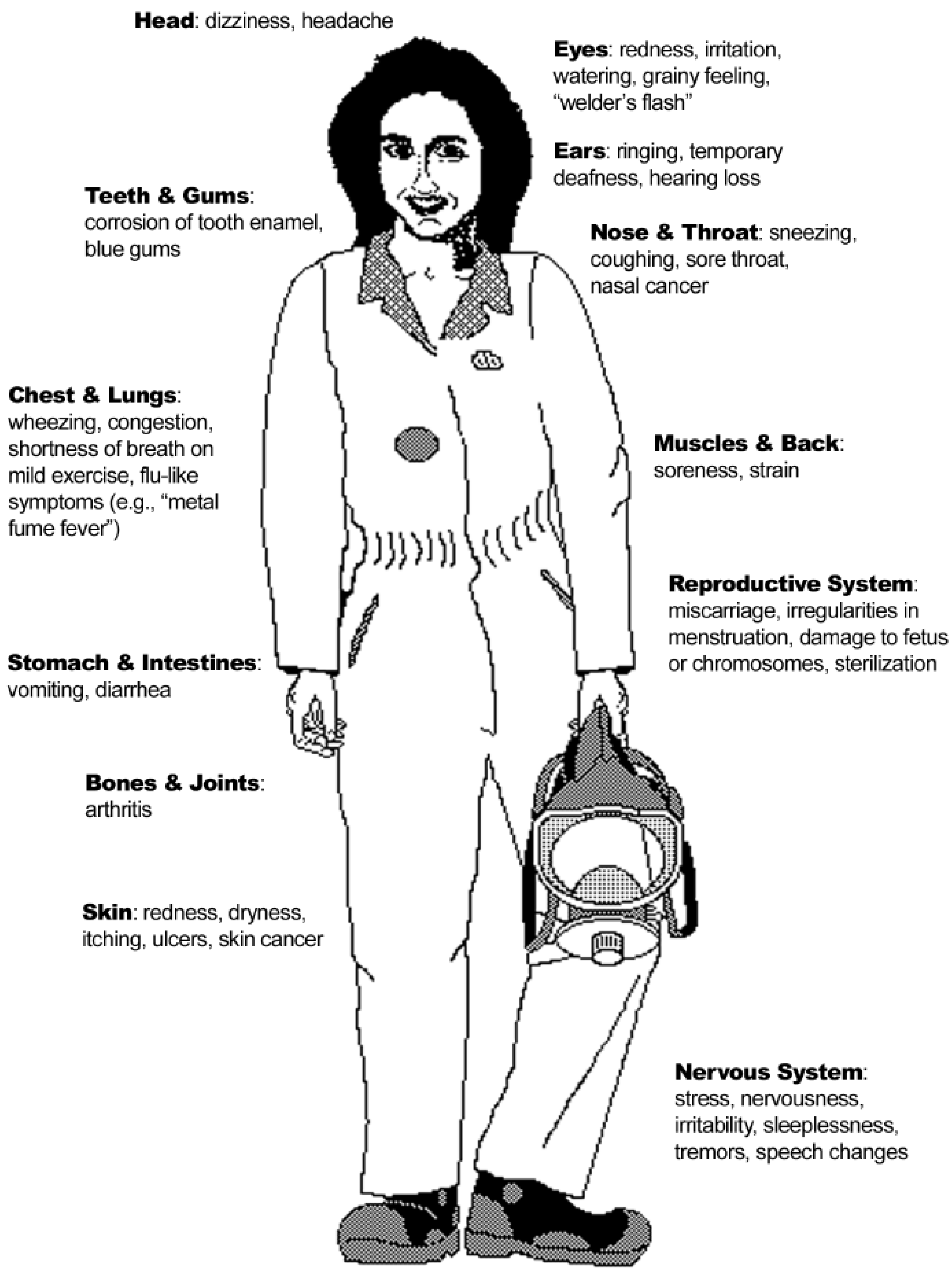
Animal and human studies of dose-response for various chemicals are used to determine the amount of exposure allowed to a chemical or if there is thought to be any allowable level. Safe and acceptable doses exist for nearly all chemicals.

When chemicals interact after they have entered the body, the effect can be worse than if only one of the chemicals was present in the body by itself. For example, asbestos exposure plus cigarette smoking increases the risk for lung cancer.



Health Effects:

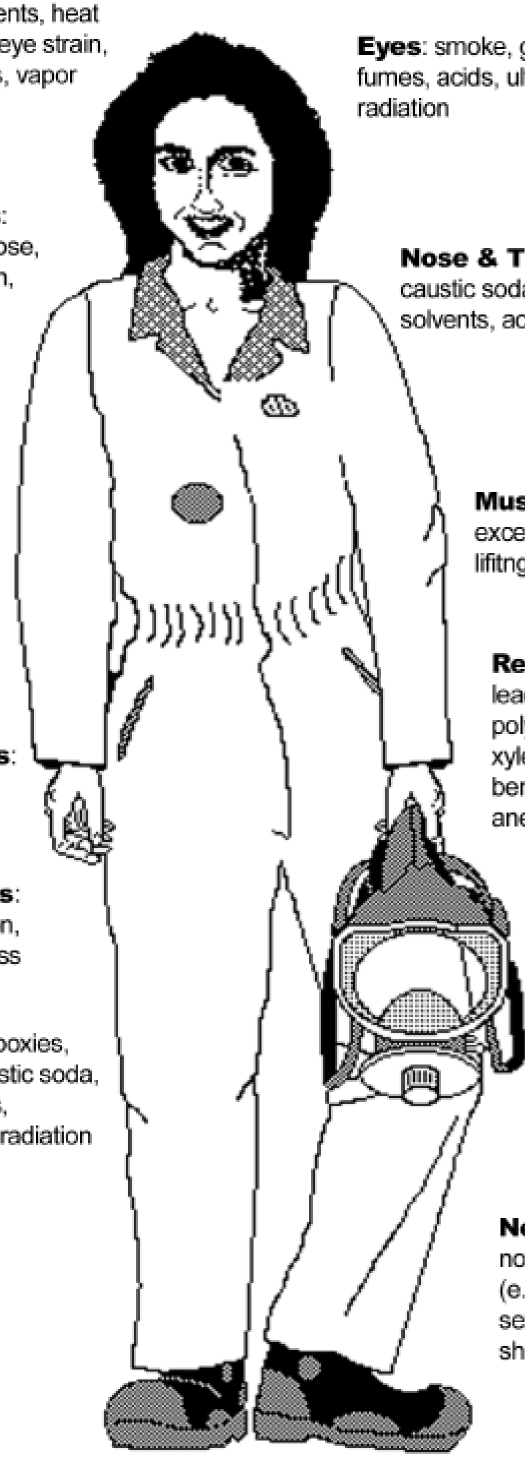
How Does Your Body React?



Adapted from the International Metal Worker's Union

Health Effects:

What Affects Your Body?



Adapted from the International Metal Worker's Union

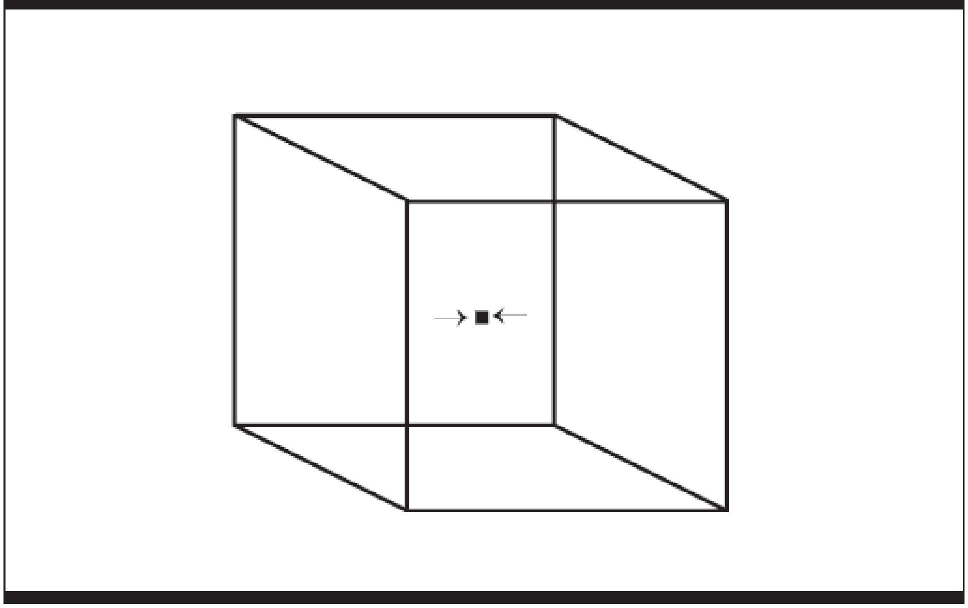
Measures of Concentration

Concentration is the amount of substance contained in a certain volume of air. Concentration of gases and vapors are usually measured in parts per million (ppm).

One part per million is equivalent to 1inch in 16.7 miles

One ppm is equivalent to one teaspoon in 1,300 gallons

Schematic of Part Per Million (PPM)



Concentrations of particulates, dusts, and mists are usually measured in milligrams per cubic meter of air (mg/m3).

There are about 400,000 milligrams in one pound.

There are about 35 cubic feet in one cubic meter. (A meter is about 40 inches.)

Fiber concentrations are measured in fibers per cubic centimeter (f/cc)

A cc is about the size of a sugar cube

Some concentrations are measured in percent.

100% equals 1,000,000 parts per million

10% equals 100,000 parts per million

1% equals 10,000 parts per million

Exposure Limits

Enforceable exposure limits are set by OSHA. NIOSH and non-governmental agencies (such as the American Conference of Governmental Industrial Hygienists [ACGIH]) have also established exposure guidelines. These guidelines and recommendations are not legally enforceable. Several exposure limits are discussed below.

Permissible Exposure Limits (PELs)

Permissible exposure limits are legal exposure levels set by OSHA. Employers must keep exposures below the PELs.

Results of exposure monitoring can be requested under the OSHA standard "Access to Employee Exposure and Medical Records" (1910.1020). Records which workers can request include either environmental information or personal medical records. According to OSHA 1910.1020(e)(1), "Whenever an employee or designated representative requests access to a record, the employer shall ensure access is provided in a reasonable time, place and manner, but in no event later than fifteen working days after the request is made." The employer can comply by either making a copy of the requested record at no cost to the employee, allowing the employee to use the employer copy machine to copy the requested record, or by allowing the employee an opportunity to inspect the record.

Threshold Limit Values (TLVs)

Threshold limit values are recommendations for exposure limits which are prepared by the American Conference of Governmental Industrial Hygienists (ACGIH), a private, non-governmental agency. TLVs, which are not legally enforceable, are reviewed and updated annually.

Recommended Exposure Levels (RELs)

Recommended exposure levels (RELs) are set by NIOSH. RELs are not legally enforceable.

Most PELs and TLVs are determined as average exposures over an 8-hour work shift. Some PELs and TLVs have a "skin" description, which means that the material is readily absorbed through the skin.

Short-Term Exposure Limits (STELs)

These exposure limits are set by ACGIH and OSHA. The STEL is a maximum average concentration a person may be exposed to over a short period of time, usually 15 minutes. It is legally enforceable if set by OSHA. (See 29 CFR 1910.1000, Table 22, www.osha.gov).

Ceiling Limits (C)

Ceiling limits are exposure levels recommended by ACGIH which should not be exceeded at any time.

Skin, Sensitizer, and Carcinogen Notations

ACGIH uses "notations" to alert you to particular hazards. If a chemical can be absorbed through the skin, the word *skin* is shown in the TLV listing. Chlordane is one example.

Exposures that may result in sensitization are identified with the letters *SEN*. Maleic anhydride is an example of a sensitizer.

The cancer-causing potential of a material is indicated by the letter *A* followed by a number ranging from one to five. *A1* is a confirmed human carcinogen. *A2* is a suspected human carcinogen. *A3* is a confirmed animal carcinogen with unknown relevance to humans. *A4* is not classified as a human carcinogen. *A5* is not suspected as a human carcinogen.

For many compounds, no designation is provided because of inadequate data. The TLV booklet has a more detailed explanation of each category.

Immediately Dangerous To Life or Health (IDLH)

An IDLH level represents conditions that pose an immediate threat of severe impairment. You might think of IDLH as the concentration of the chemical that will kill or impair your ability to escape.

Time-Weighted Averages (TWAs)

Most PELs and TLVs are 8-hour, time-weighted average concentrations. The purpose of this type of measurement is to determine the average exposure over a typical 8-hour work shift. An example of how the TWA is calculated as follows

Time-Weighted Averages Calculated

An employee is exposed to acetone at 60 ppm for 6 hours and 12 ppm for 2 hours. What is the TWA?

$$\text{TWA} = \frac{(60 \text{ ppm} \times 6 \text{ hrs}) + (12 \text{ ppm} \times 2 \text{ hrs})}{(6 \text{ hrs} + 2 \text{ hrs})}$$

$$\text{TWA} = \frac{(360 + 24) \text{ ppm} \times \text{hrs}}{8 \text{ hrs}}$$

$$\text{TWA} = 48 \text{ ppm}$$

Time-Weighted Averages Calculated

Compare this result with the current OSHA PEL for acetone of 750 ppm.

- Has it been exceeded?
- Was it exceeded for any portion of the time sampled?
- Is there a STEL, C, S, SEN, SKIN, or carcinogen designation?

Important Points to Remember About Exposure Limits

The following considerations are important when thinking about exposure limits.

- Most PELs and TLVs are 8-hour average work exposures; however, most emergencies don't last this long.
- STELs are set for very few compounds.
- Measuring exposure during an emergency requires preplanning so emergency equipment is available and ready for use.
- Results of exposure monitoring can be requested under the OSHA standard on access to employee exposure and medical records (1910.1020).

Explosive Limits

Monitoring can provide information about substances in the air which may potentially cause an explosion. For flammable vapors and dusts, explosive limits have been determined.

Lower Explosive Limit (LEL) is the minimum concentration of a substance in air which is required for ignition. Concentrations below the LEL will not ignite. Below the LEL, the mixture is called "lean."

Upper Explosive Limit (UEL) is the maximum concentration of a substance in air which is required for ignition. Concentrations above the UEL won't ignite. Above the UEL, the mixture is called "rich."

Explosive Range is the concentration of a substance in air between the LEL and UEL. In this range, the substance will readily ignite.

Medical Surveillance

Medical surveillance is a program to protect employee health. It may include an occupational history, physical examination, and medical laboratory tests. Medical surveillance can be done:

- Prior to a new job assignment
- On a routine basis
- At termination of a job or job assignment
- If an employee exhibits signs or symptoms which may have resulted from exposure to hazardous substances during the course of an emergency incident

The purposes of medical surveillance include determining:

- Fitness for a specific job
- Possible effects of exposures in the work place
- Fitness to wear a respirator
- Fitness to wear protective clothing, especially in hot weather

Legal Requirements for Medical Surveillance

Under HAZWOPER, certain groups of workers exposed to hazardous materials are legally eligible for medical surveillance. The groups of first receivers who are eligible are:

- Members of official hazardous materials response teams
- First receivers who have signs or symptoms resulting from exposures at an incident
- Workers who wear respirators more than 30 days a year
- Workers whose exposure has exceeded exposure limits for more than days a year

Many employers include other workers in routine medical testing programs. A licensed physician must perform all medical testing and examinations or supervise those who do. The employer must provide the physician a copy of the HAZWOPER standard (29CFR 1910.120) and appendices and other specific information. This information includes:

- A description of the employee's job duties
- The employee's previous exposure levels or anticipated exposure level
- A description of personal protective equipment that has been or will be used
- Information from previous medical examinations of the employee which is not readily available to the examining physician

When a person who has been exposed to potentially hazardous substances sees a doctor, he or she should make sure the doctor understands what work tasks are performed daily and what things are done only occasionally. Understanding the patient's job will help the doctor be more effective.

The contents of the medical exam are not specified in HAZWOPER. The physician determines what the exam will include. Some typical items include:

- Baseline medical history and physical exam
- History of claustrophobia
- Lab studies (for example, blood and urine tests)
- EKG—resting vs. stress and stress with protective gear
- Pulmonary function testing
- Chest x-ray
- Hearing testing
- Other tests as necessary for a specific job

Employers are legally required to pay for mandatory medical surveillance exams. In addition, employees are not to lose pay for the time the exam takes. The exams should be scheduled at a time and place convenient for the employee.

After a medical surveillance examination has been completed, several things are required under HAZWOPER. These include:

- The employer will receive a copy of the physician's written opinion relative to the individual's employment. (Findings not impacting on employment will not be included.)
- The employee will receive a copy of the physician's opinion which was sent to the employer. The employee may also request a complete medical report from the physician.
- The employer must keep a record of this exam and other exposure records for the duration of that individual's employment plus 30 years thereafter. The record must include at least the following:
  - Name and social security number and employee physician's report.
  - Employee reports of health effects related to exposure.
  - A copy of information provided to employer except for OSHA 1910.120.

Things the employee should do:

- Report all work-related injuries or illnesses immediately to the company physician and/or a personal doctor
- Request and keep full copies of medical records
- Examine and keep copies of exposure records
- Actively participate in training on the potential health effect of all chemicals used or stored at work
- Ask questions of health and safety representatives
- See an occupational physician, if a second opinion is wanted

Medical Emergencies during a Mass Casualty Incident

If someone is injured or becomes ill during a mass casualty incident, action needs to be taken. Specific action will be determined by the Emergency Management Plan (EMP). The EMP should specify if First Aid will be administered or if outside help will be called immediately. First Aid should be administered only by people who are certified. Actions which may endanger the safety or health of other first receivers should not be taken.

Summary

In this module you participated in the hazard assessment portion of initial actions. As part of the hazard assessment, you assessed the chemical and physical properties of a hazardous material that might be involved in a mass casualty incident. You also assessed the health effects according to information resources provided.

Personal Protective Equipment

You will learn about respiratory protection as well as other personal protective equipment that will help you prevent exposure during a mass casualty incident.

When you have completed this chapter you will be better able to:

- Review regulations requiring PPE
- Identify different types of respirators
- Identify the levels of protection established by the EPA
- Identify the ways that hazardous materials degrade chemical protective clothing
- Identify the need for using two layers of gloves and the requirements for footwear

Regulations Requiring Personal Protective Equipment

Personal protective equipment (PPE) helps protect first receivers from a number of hazards including:

- Chemical contact with skin and eyes
- Temperature
- Respiratory hazards

PPE is effective only when properly selected, maintained, and worn during emergency activities.

The Emergency Management Plan (EMP), required by HAZWOPER, must include a description of PPE (chemical-protective clothing and emergency equipment). The Hazard Communication Standard (1910.1200) requires that employees receive information and training about protection from the hazards of chemicals in their work area and workplace. Some other OSHA standards also address PPE. (See www.osha.gov for full text.)

- 1910.95 Hearing Protection
- 1910.132 General Requirements—Full-Body Protection

- 1910.133 (a) Eye and Face Protection
- 1910.134 Respiration Protection
- 1910.135 Head Protection
- 1910.136 Foot Protection
- 1910.138 Hand Protection

It is important to distinguish between PPE use during a mass casualty event and routine duties. For routine duties, controls other than PPE are preferred (such as ventilation or special work practices). In emergency situations, these controls usually cannot be put into effect soon enough, and then PPE becomes the first line of defense to protect the employee's health and safety.

Respiratory Protection

The basic purpose of any respirator is to protect the respiratory system from inhalation of hazardous atmospheres. Respirators provide protection either by removing contaminants from the air before it is inhaled or by supplying an independent source of respirable air.

Types of Respirators

The most frequently used type of respirator during mass casualty incidents by first responders is the **self-contained breathing apparatus** (SCBA). This respirator protects the lungs by supplying air from a clean source, a tank carried on the first receiver's back. Air may also be supplied to the receiver from a remote location or a stationary tank. This type is called a **supplied air respirator** (SAR).

First receivers are likely to use an **air purifying respirator** (APR). These respirators protect against dust and toxic chemicals by filtering the air before it enters the lungs.

Self-Contained Breathing Apparatus (SCBA)/Supplied-Air Respirator (SAR)

SCBAs consist of a carrying assembly and bottle/tank/cylinder, a gauge, a safety valve, and a full facepiece. The bottle/tank/cylinder is equipped with an alarm to warn the wearer when air in the tank is getting low.

A supplied-air respirator (SAR) provides air to the worker from a tank or other source through air lines. When using an SAR, you must wear an escape bottle (usually with five minutes of air). This escape bottle allows you time to escape if the air supply is cut off.

It is unlikely that these would be used in hospital decon by first receivers. If needed based on the Hazard Assessment, specialized training will be provided.

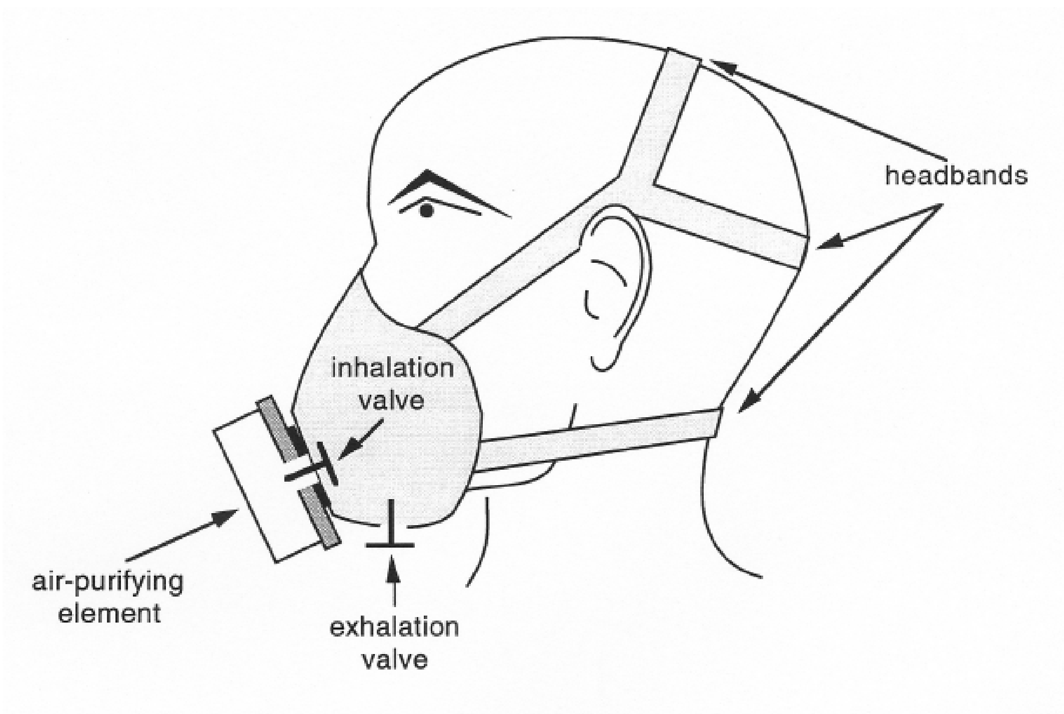
Air-Purifying Respirator (APR)

Air-purifying respirators (APRs) are used to protect against dusts and toxic chemicals. They work by filtering air before it enters the worker's body. In order to use an APR during an emergency, the identity and concentration of each toxic substance in the air must be known. Also, it must be known that the materials will not change or the concentration increase during the incident. Only with this information can the person overseeing the incident activities know that this type of respirator is sufficient.

APRs consist of a facepiece with an exhalation valve and one or two filtering units through which the air enters. Three types of facepieces are used with APRs. They are quarter-mask, half-mask, and full-face.

There are two types of filters used with APRs. One is a particulate filter, and the other is a chemical cartridge. Particulate filters are used to protect against dusts, mists, and fumes. Chemical cartridges are used to protect against certain vapors and gases. The two can be used together. Filters and cartridges must be selected for the specific exposures that are expected.

Operation of an Air-Purifying Respirator



Never wear an APR in an oxygen-deficient atmosphere. When the identity and concentration of a substance are not known, use an SCBA.

The basic purpose of any respirator is to protect the respiratory system from inhalation of hazardous atmospheres. Respirators provide protection either by removing contaminants from the air before it is inhaled or by supplying an independent source of respirable air.

How well the APR works depends on the size of the particles, concentration of the substance, and type of filter used. The filter(s) must be changed when loaded with the dust (particulate) or substance (chemical cartridge) or if it gets wet.

Powered Air-Purifying Respirator (PAPR)

A special type of APR is a powered air-purifying respirator (PAPR). It works by pulling air through filters and blowing it into the mask. PAPRs consist of a hood or helmet, filter, power source, and a facepiece.

The powered type contains a portable blower which pushes ambient air through a filter, cartridge or cannister and then supplies purified air to the wearer. The powered type is equipped with a tight-fitting facepiece or a loose-fitting helmet, hood, or suit. A loose-fitting PAPR does not require a fit test. However, inspection to ensure proper flow rate and operation is required for safe use.

See Appendix B for examples of SOPs for PAPRs.

Filters and Cartridges

Two types of filters are used with APRs.

- **Particulate filters** are used to protect against dusts, mists, and fumes.
- **Chemical cartridges** are used to protect against certain vapors and gases.

Filters and cartridges are selected according to specific exposures which are expected. Factors which affect how well the APR works include the size of the particles, concentration of the substance, and type of filter used. The filter(s) must be changed when loaded with the dust (particulate) or substance (chemical cartridge) or if it gets wet. Certain contaminants do not have an appropriate protective cartridge/canister due to their oxygen displacement characteristics or their status as known or suspected carcinogens.

Cartridge and filter colors designate what type of particulates or chemicals are filtered. OSHA regulation 29 CFR 1910.134 dictates the colors that may be used.

How do you tell if the cartridge needs to be changed? The Respirator Standard, 1910.134(d)(3), requires that respirators used to prevent gas or vapor exposures be equipped with an indicator showing that the cartridge has expired; this is called an End-of-Service-Life Indicator (ESLI). If no cartridge approved for a specific gas/vapor exposure has an ESLI, then the employer must use objective data to determine a change schedule. Should you smell contaminant before the cartridge has “officially expired,” notify the supervisor immediately and change the cartridge. For dust, a wearer may notice that it is more difficult to breathe as the filter becomes loaded.

Respirator Fit

A respirator will be effective only if there is a good seal between the facepiece and the wearer’s face. Therefore, all persons wearing respirators must first be fit-tested. Fit-testing includes qualitative and quantitative testing.

Because many different face shapes exist, the manufacturers have a number of sizes. The purpose of fit testing is to find the manufacturer/size combination which offers the best protection. Factors such as beards, weight loss or gain, dentures, dental work, or facial injury can change the shape of the face, thus potentially changing the fit and efficiency of the respirator. If for any reason any of these factors exist, retesting is required.

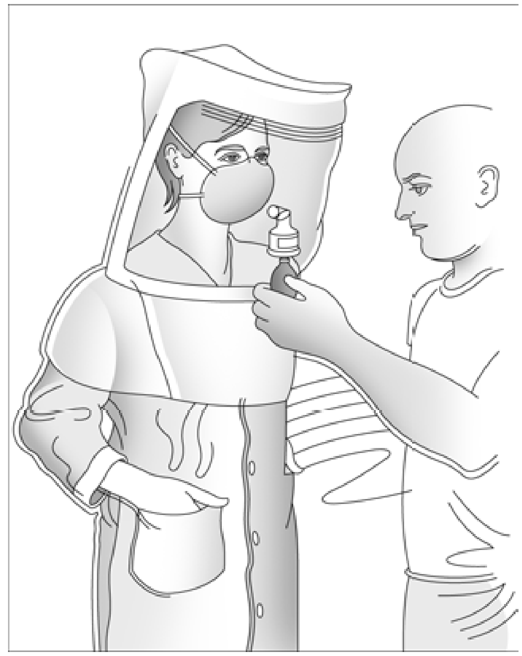
Annual Fit Tests

Two types of fit testing, qualitative and quantitative may be used to determine the size and model of respirator that an individual should wear, as well as how good the face-to-facepiece seal is. These tests should be repeated annually to document respirator effectiveness. Fit tests shall not be performed if facial hair is present in the seal area of the respirator. (OSHA 29 CFR 1910.134)

Qualitative Testing

Purpose: Checks effectiveness of preventing substances from entering the facepiece.

Method: While the individual is wearing a respirator, a test substance is released, as shown on the right. The test substance could be smelly (banana oil), sweet (saccharin), bitter (Bitrex) or an irritant (special smoke tube). The wearer should not be able to detect the substance while performing a series of prescribed tasks.



Requirements: This test or its equivalent is required by OSHA at least once a year.

There are several important cautions to qualitative fit testing:

- Some of the test substances may irritate the eyes or cause coughing
- A sensitivity test is first performed to determine the individual is capable of sensing the test solution
- Fit testing is often done in “ideal” environments. The fit may change after wearing the respirator several hours or during strenuous activity.
- Must be used only for Fit Factor (described later in this chapter) ≤ 100

Note: This method is not appropriate for SCBA facepieces. A quantitative method must be used.

Quantitative (Numerical) Testing

This test provides an objective assessment of the effectiveness of the respirator for the person who will wear it. This test measures the fit factor (FF), which is a comparison of the concentration of the substance outside of the mask to the concentration of the substance inside of the mask. This FF is useful in determining whether the respirator will effectively protect the wearer from specific chemicals. A disadvantage to this test is that special equipment and trained personnel are needed to administer it, although a computer and software can perform the calculations required.

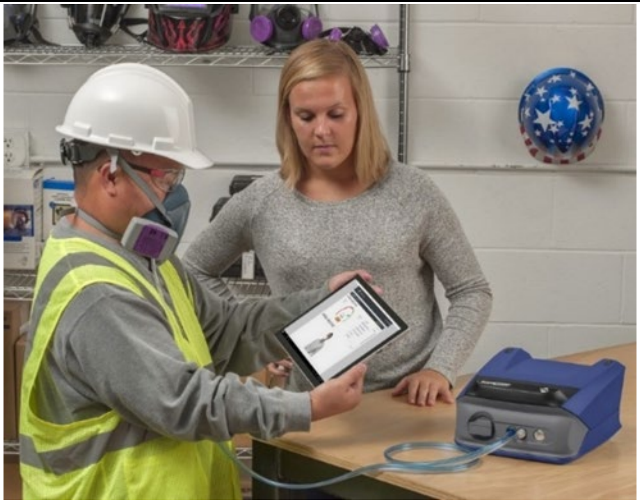


Photo courtesy of TSI Inc. to MWC.

Purpose: Measures effectiveness of the respirator in preventing a substance from entering the facepiece.

Methods: There are two methods for quantitative fit testing based on the fit testing device.

1. While an individual wears a respirator modified with a probe, the concentrations of particulates in the air inside and outside of the respirator are measured, as shown above. The test is repeated while the person performs specific tasks (speaking, running in place, etc.) that may affect fit.

2. While an individual wears a respirator connected to a fit testing device, a vacuum is drawn in the mask to assess seal for leaks. Then the user removes and re-dons the mask and the test is repeated twice.

Requirements: This test is mandated when a minimum fit factor of 50 for a full facepiece is required.

Routine Fit Checks

Two types of checks, positive- and negative-pressure checks, or the manufacturer's recommendation must be done each time a tight-fitting respirator is donned and before each use in the field to check the seal of the respirator. Manufacturer-recommended checks can be used if they are available. User checks do not replace yearly fit testing but provide a routine assessment as to whether the fit is still adequate.

Positive-Pressure Checks

Purpose	Checks the apparatus for leaks at valves or other points.
Method	Wearer covers the exhalation valve with hand and blows out. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage at the seal.
Requirements	Must be done before each use.

Negative-Pressure Checks

Purpose	Checks the facepiece-to-face seal.
Method	The APR wearer places hands over cartridges and inhales gently so the facepiece collapses slightly. The inhalation should be held for ten seconds. No outside air should be felt leaking into the facepiece.
Requirements	Must be done before each use.

Positive- and negative-pressure tests can be done quickly and easily in the field; however, they have the disadvantage of relying on the wearer's ability to detect the leaks.

Medical Fitness to Wear a Respirator

Before an employee is assigned to wear a respirator, a review must be performed by a licensed physician. This review helps to ensure that an employee is physically capable of performing the job with the added stress of a respirator. Some medical conditions which may prevent an individual from wearing a respirator include:

- Lung disease
- Claustrophobia
- Severe high blood pressure
- Heart disease

Medical exams should be done preplacement and at least every two years. There are specific record-keeping requirements for the results of medical exams.

Taking Care of Respirators

Like any other piece of equipment, respirators require routine inspection, cleaning, and maintenance in order to ensure proper protection. This inspection is especially important for equipment used infrequently (ex. for mass casualty incidents). Without routine care, the equipment may become damaged, outdated, or misplaced.

Some general guidelines on respirator care are given below. Specific requirements for the care of any particular respirator are listed in the manufacturer’s literature and the ERP.

For PAPRs, follow manufacturer recommendations regarding cleaning, storage and maintenance.

Facial Hair and Respiratory Protection

Section 29 CFR1910.134/1926.103b*, Definitions, states:

Tight fitting facepiece means a respiratory inlet covering that forms a complete seal with the face.

Additionally, Appendix A of 1910.134* (mandatory), states:

The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble, beard growth, beard, mustache, or sideburns which cross the respirator sealing surface.

OSHA's interpretation of this section is that there cannot be any facial hair when using any respirator which relies upon a good face-to-facepiece seal, such as any tight-fitting (as opposed to helmet or loose-fitting hood) air-purifying respirator. Even several days' beard growth or a heavy stubble can reduce the possibility of a face-to-facepiece seal.

*See http://www.osha.gov for full text

Minimum Requirements for a Respirator Program

OSHA requires that employers who make respirators available to their employees must have a written respirator program (29 CFR 1910.134). The program should be evaluated at least annually (or when requirements change) and modified to reflect changes in the workplace.

Minimum Requirements for a Respirator Program

- Procedures for selecting respirators for use in the workplace.
- Medical evaluations of employees required to use respirators.
- Fit testing procedures for tight-fitting respirators.
- Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations.
- Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators.
- Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators.
- Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations.
- Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations.
- Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance.
- Procedures for regularly evaluating the effectiveness of the program.

The respirator program should be included in or referenced in the Emergency Management Plan. Special considerations that may be included are:

- The need for corrective lenses in full-facepiece respirators
- Restriction on the use of contact lenses
- Communication needs.
- Use in dangerous atmosphere, including confined spaces
- Use in extreme temperatures

Persons using respirators under the above conditions or other unusual conditions should review special requirements with supervisors or health and safety representatives.

The respirator program will include a description of who is responsible for the various aspects of the program including selection, periodic and routine fit-testing, inspection, cleaning, repair, and maintenance.

Special Problems

- **Vision** - When a respirator user must wear corrective lenses, the item should be fitted to provide good vision and worn in such a manner as to not interfere with the seal between the respirator and the wearer. Temple bars or straps of a corrective spectacle which pass between the sealing surface of a full-facepiece respirator and the face may prevent a good seal and therefore such a spectacle should not be worn with a full-facepiece respirator. Special corrective lenses, which are made to be mounted inside a full facepiece are available and should be used by a person who needs corrective lenses. Face shields must be scratch free, to ensure proper vision.

- **Communications** - Speech transmission while wearing a respirator is often necessary to perform specific tasks. Although a respirator facepiece distorts the human voice to some extent, the respirator's exhalation valve usually provides a pathway for some speech transmission over short distances in relatively quiet areas. Talking while wearing a respirator may adversely affect the seal of the facepiece, especially a quarter-mask or half-mask facepiece.

- **Immediately Dangerous to Life or Health (IDLH) Atmospheres** - An IDLH atmosphere is one that is oxygen deficient or contains excessive concentrations of a contaminant including concentrations of a substance above the lower flammable limits. Under no circumstances should air-purifying respirators or powered air purifying respirators be used in an IDLH atmosphere.

- **Low-Temperature Environments** - A low-temperature environment may cause fogging of the lens in a respiratory-inlet covering and freezing or improper sealing of the exhalation valve. Coating the inside surface of the lens may prevent fogging at low atmospheric temperatures approaching 32o F, but severe fogging of the lens may occur at temperatures below 0o F. Full-facepieces are available with nose cups that direct the warm and moist air through the exhalation valve without contacting the lens, and these facepieces should provide satisfactory vision at temperatures as low as -25o F. At very low atmospheric temperatures, the exhalation valve of a respirator may freeze open or closed due to the presence of moisture. Dry respirable air should be used with an airline respirator and with the type of self-contained breathing apparatus that employs a cylinder of air when these devices are used in low-temperature atmospheres.

- **High-Temperature Environments** - A person working in a high-temperature environment is under stress due to the heat. Wearing a respirator in such an environment applies additional stress which can be minimized by using a respirator having a low weight and a low resistance to breathing. The air-line-type supply-air respirator is recommended for use in a high-temperature environment. Adequate rest breaks must be scheduled to prevent heat-related illness and fluid intake must be frequent during the work-rest regimen.

Chemical-Protective Clothing

Chemical-Protective Clothing (CPC) consists of special garments worn to prevent chemicals from coming in contact with the body. This clothing generally includes eye/face protection, boots, gloves, and suits/coveralls. CPC is used to protect employees from both chemical and physical hazards that they are likely to encounter while performing their tasks. The proper use of CPC can prevent or reduce exposure to a harmful substance. CPC is an important part of a first receiver's Personal Protective Equipment (PPE).

Chemical-protective clothing includes suits, booties, boots, gloves, and hoods which are made of special materials. These special materials are chemical-resistant, which means they act as a barrier to keep chemicals from coming in contact with the wearer's skin. Different materials provide protection from different types of chemicals. It is important to select CPC which is designed to protect against the specific chemical or type of chemical which may be encountered during a mass casualty event.

Types of Chemical-Protective Suits

Chemical-Protective suits are of two general types, totally encapsulating and partially encapsulating.

Totally Encapsulating Chemical Protective (TECP) Suit

Provides head-to-toe coverage to protect the wearer from chemicals. These are the large "moon suits" which have special seams and zippers to prevent chemicals from leaking into the suit. These suits have a face shield which is made as part of the hood. These suits are very bulky to wear, and the wearer can become very hot while working. These are the only suits that are considered vapor-resistant. TECP suits protect workers from hazards which are identified during site characterization. TECP suits must pass specific positive air pressure tests and be capable of preventing inward test gas leakage of more than 0.5%. Specific information about pressure tests can be found in OSHA 1910.120.

Hooded (Partially Encapsulating) Suit

Provides good protection from chemicals and may or may not have face shields. These suits are used when less skin protection is needed. The hood can either be part of the suit or detached. This type of CPC includes suits which look like totally encapsulating suits but have not passed the manufacturer's pressure test.

Disposable suits, which provide limited protection from chemicals, can be used in conjunction with these chemical-protective suits. Disposable suits can either be worn on top of other suits to protect them or on the inside of other suits to protect the wearer from chafing.

First Receivers are generally not responsible for CPC purchase or selection; however, it is important for receivers to understand the considerations which go into selecting CPC. The process by which the selection is made should be detailed in the employer's emergency management plan. Questions about CPC selection may be addressed to the person responsible for the selection. The type of chemical-protective suits selected will depend on the type and nature of potential exposure.

Levels of PPE

The EPA defines four levels of personal protective equipment. OSHA has adopted the same system. The level selected will depend on the degree of protection needed for the emergency.

- **Level A** provides the highest level of skin, respiratory, and eye protection.
- **Level B** provides the highest level of respiratory protection but a lower level of skin protection.
- **Level C** provides a lower level of skin, respiratory, and eye protection and should be used only when working with specific known substances at appropriate concentrations.
- **Level D** provides minimal protection from chemical hazards.

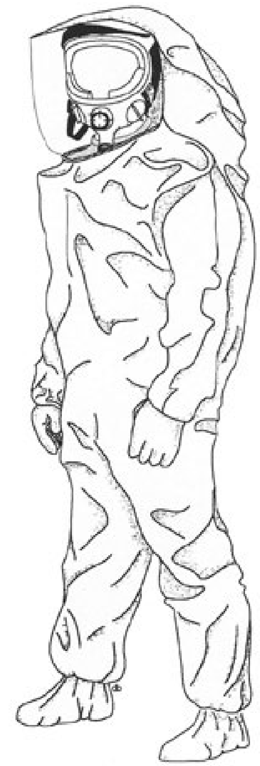
The employer should describe in the EMP the level of PPE which will be used for specific types of emergency situations.

Level A

Level A is the highest level of protection which can be worn.

What Is Level A Protection?

The following list constitutes Level A equipment; it may be used as appropriate:



- Positive-pressure, pressure-demand, full facepiece SCBA or positive-pressure, supplied-air to full facepiece with escape SCBA (NIOSH-approved)
- Totally encapsulating chemical-protective suit (TECP) (gas tight or vapor tight)
- Inner and outer chemical-resistant gloves
- Disposable protective suit, gloves, and boots (depending on suit construction, may be worn over totally encapsulating suit)
- Coveralls*
- Long underwear*
- Hard hat (under suit)*
- Chemical-resistant boots with steel toe and shank.
- Cooling system (ice vest, water/air circulation)*

*Optional as applicable
Note: Suit must be properly equipped with a pass-through airline connection, referred to as an airline egress if using an SAR.

When Is Level A Protection Needed?

Level A protection is required when:

- The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and respiratory system
- There is potential for splash, immersion, or exposure to vapors, particulates, or gases that are harmful to the skin or may be absorbed through the skin
- Confined space entry may be involved and the need for Level A cannot be ruled out (but explosion hazard has been ruled out)
- The skin absorption hazard may likely result in immediate death or serious illness/injury or impair the ability to escape

Level B

Level B is used when maximum respiratory protection is desired, but the skin/eye hazards do not require Level A.

What Is Level B Protection?

The following constitutes Level B equipment; it may be used as appropriate.

- Positive-pressure, full facepiece SCBA or positive-pressure, pressure-demand, supplied-air to full facepiece with escape SCBA (NIOSH approved)
- Hooded chemical-resistant clothing **OR** total encapsulating chemical suit (not gas tight or vapor tight)
- Inner and outer chemical-resistant gloves
- Outer chemical-resistant boots with steel toe and shank
- Boot covers: outer, chemical-resistant (disposable)*
- Hard hat*
- Face shield*
- Cooling system (ice vest, water/air circulation)*

  New Level B chemical-resistant clothing is designed to go over the SCBA. If appropriate for the potential exposures, this CPC should be used to protect the SCBA and prevent its contamination. In this case, the Level B ensemble will resemble a Level A ensemble, but the suit is not vapor-tight.

*Optional as applicable

When Is Level B Protection Needed?

Level B protection is required when:

- The highest level of respiratory protection is needed but a lower level of skin protection is acceptable
- The substances have been identified
- An SCBA is required
- Less skin protection is needed. (Vapor and gases are not believed to be present at high levels harmful to skin or capable of being absorbed through intact skin.)

Level C

Level C provides less skin and respiratory protection than Level A or B.

What Is Level C Protection?

The following list constitutes Level C equipment; it may be used as appropriate.

- A full-face or half-face air-purifying respirator (NIOSH-approved)
- Hooded chemical-resistant clothing
- Inner and outer chemical-resistant gloves
- Coveralls*
- Boots (outer), chemical-resistant steel toe and shank*
- Boot covers: outer, chemical-resistant (disposable)*
- Hard hat*
- Escape mask*
- Face shield*

*Optional as applicable

When Is Level C Protection Needed?

Level C provides protection when:

- The concentration(s) and type(s) of airborne substance(s) are known and the criteria for using an air-purifying respirator are met.
- Direct contact with the hazardous substance will not harm the skin or the substance will not be absorbed through any exposed skin.
- Air contaminants have been identified, concentrations measured, and an air-purifying respirator is available with an acceptable protection factor.
- An adequate level of oxygen (≥ 19.5%) is available and all other criteria for the safe use of air-purifying respirators are met.

Level D

This level offers no respiratory protection and low skin protection.

What Is Level D Protection?

The following list constitutes Level D equipment; it may be used as appropriate.

- Coveralls (work uniform)
- Chemical-resistant boots or shoes with steel toe and shank
- Hard hat*
- Gloves*
- Outer, chemical-resistant boots (disposable)*
- Safety glasses or chemical splash goggles*
- Escape mask*
- Face shield*

*Optional as applicable

When Is Level D Protection Needed?

Level D is required when:

- Minimal protection from chemical exposure is needed. It is worn to prevent nuisance contamination only.
- The atmosphere contains no known hazards.
- Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

Typical Uses of Level D Equipment

Level D protection is worn by personnel who may be exposed only to nuisance contamination while working with hazardous materials. Typically, workers involved with support activities such as equipment supply, maintenance, off-site vehicle operation, or supervision/management will wear Level D.

Level D may appear similar to “typical work clothes.” Differences include the chemical-resistant boots with steel shank.

A general rule for which level of protection to use is: **“The less you know, the higher you go.”**

Remembering Levels of Protection
A=All Covered, gas/mist tight B=Breathing Air, splash protection C=Cartridge Respirator or Air Purifying Respirator D=Don't Expect Protection, regular work clothes

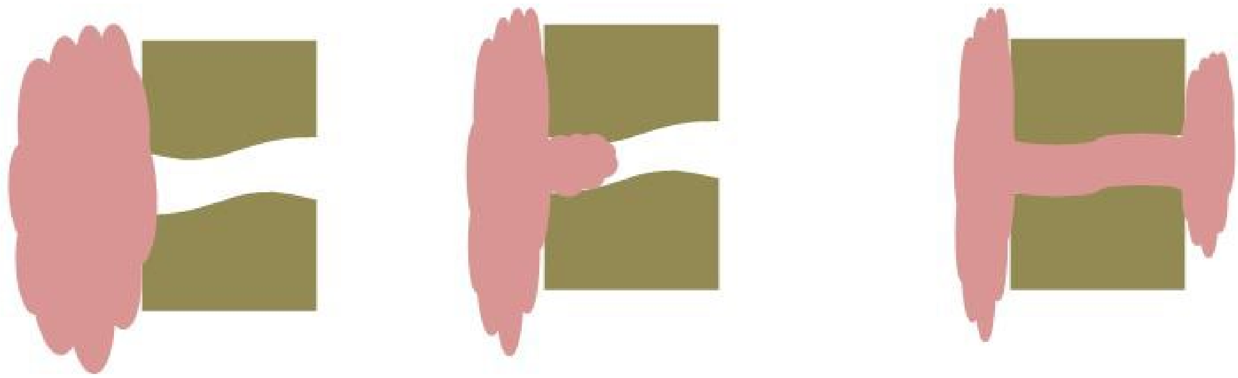
Precautions When Wearing CPC

- All joints such as suit-to-boots and suit-to-gloves in Levels B and C protection should be **secured with tape**. Fold the end of the tape back under to make a tab for easy removal.
- When removing suit, open and fold into itself as it is removed **to prevent contamination** of internal clothing.
- Materials used to make most suits do not "breathe." Rapid heat and moisture build-up will occur in the suit during use. **Look for signs of heat stress** (dizziness, headache, nausea, perspiration ceases), especially at temperatures over 70°F.
- Due to the size and weight of some suits, **motion is restricted**, especially when climbing, working in tight areas, or using hand tools.
- **Seams are the weak point** of suits, especially disposable ones. Use caution not to strain and split them. If this occurs, report the incident and follow the appropriate SOG (standard operating guide).
- Whenever possible, a **variety of suit sizes** should be on hand to fit the various sizes of personnel.
- Suits offer **no fire protection** and in some cases increase the possibility of injury, because they will melt. Use caution when suits are used in potential fire areas. If fire occurs, get out of the area.

Penetration, Degradation, and Permeation

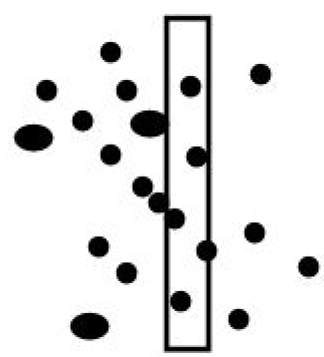
Chemicals can reduce the effectiveness of CPC garments through penetration, degradation, or permeation.

Penetration The flow of a chemical through zippers, stitched seams, or imperfections in the material.



Degradation A reduction in one or more physical properties of a protective material due to contact with a chemical.

Permeation The process by which a chemical moves through a protective material on a molecular level. The rate of permeation is dependent on six major factors:



- Contact time
- Material thickness
- Concentration
- Temperature
- Physical state of chemicals
- Size of the contaminant molecules and pore space

The following pages show some chemical-resistant materials used in CPC and their advantages and disadvantages.

Chemical-Resistant Materials

The following list describes some commonly used chemical-resistant materials and the advantages and disadvantages of their use. This list should not be used to select materials; manufacturer's guidelines and other references should be consulted.

Butyl Rubber

Use Mainly in encapsulating suit, but some gloves, boots, and splash gear.

Advantages Good for bases and many organics. Very resistant to gas/vapor permeation. Readily releases contamination. Good heat and ozone resistance.

Disadvantages Poor for aliphatic and aromatic hydrocarbons, gasoline, halogenated hydrocarbons, and abrasion resistance. More expensive than PVC or neoprene.

Chlorinated Polyethylene (CPE)

Use Only in fully encapsulating suits from ILC Dover.

Advantages Good for aliphatic hydrocarbons, acids and bases, alcohols, and phenols. Resists abrasion and ozone.

Disadvantages Poor for amine, esters, ketones, and halogenated hydrocarbons. Becomes very rigid when cold.

Natural Rubber

Use For boot covers because of durability and for disposable inner and outer gloves.

Advantages Good for bases, alcohols, and dilute acids. Inexpensive. Flexible.

Disadvantages Poor for organic chemicals. Ages (affected by ozone).

Neoprene

Use In all types of protective clothing.

Advantages Better than polyvinyl chloride (PVC) for organics. Durable. Abrasion- and cut-resistant.

Disadvantages Not as good as PVC for acids and bases. Poor for chlorinated aromatic solvents, phenols, and ketones. More expensive than PVC.

Nitrile Rubber

Use	In gloves and boots and one encapsulating suit.
Advantage	Made specifically for petroleum products. Abrasion- and cut-resistant. Flexible. Good for bases, peroxides, PCBs, phenols, and alcohol.
Disadvantage	Poor for aromatic and halogenated hydrocarbons, amines, ketones, and esters. Loses flexibility in cold weather.

Polyurethane

Use	In boots and splash gear.
Advantage	Good for bases and organic acids, oils, and alcohols. Abrasion-resistant. Flexible (especially in cold weather).
Disadvantage	Poor for inorganic acids and other organic solvents.

Polyvinyl Alcohol (PVA)

Use	For gloves only.
Advantage	Excellent (the best) for oils, aromatic solvents, and chlorinated hydrocarbons. Ozone-resistant.
Disadvantage	Degraded by water. Not flexible. Expensive.

Polyvinyl Chloride (PVC)

Use	All types of protective clothing.
Advantage	Excellent for acids and bases. Very durable. Relatively inexpensive.
Disadvantage	Poor for chlorinated and aromatic solvents. Difficult to decontaminate.

Viton

Use	In fully encapsulating suits and gloves.
Advantage	Good for most organics including chlorinated hydrocarbons. Fair durability. Good for acids. Good for decontamination. Good for physical properties.
Disadvantage	Poor for oxygenated solvents—aldehydes, ketones, esters, and ethers. Expensive Protective Equipment

Teflon

Use	In fully encapsulating suits.
Advantage	Excellent chemical resistance against most chemicals.
Disadvantage	Limited permeation test data. Expensive.

Nomex

Use	For firefighters' turnout gear and a base fabric for some suits.
Advantage	Acid- and fire-resistant. Durable.
Disadvantage	Readily penetrated.

Tyvek

Use	Predominantly for coveralls.
Advantage	Dry particulate and dust protection. Disposable, lightweight, and inexpensive.
Disadvantage	Penetrable if not chemically treated. Poor durability.

Polyethylene (coated Tyvek)

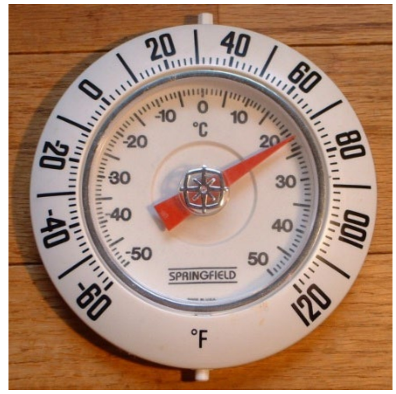
Use	Predominantly for coveralls, but also gloves and booties. It can be worn over CPC to prevent gross contamination of non-disposables.
Advantage	Good for acids and bases, alcohols, phenols, and aldehydes. Good for decontamination (disposable) and light-weight.
Disadvantage	Poor for halogenated hydrocarbons, aliphatic and aromatic hydrocarbons. Not very durable. Easily penetrated (stitched seams).

Precautions When Wearing CPC

Every level of chemical-protective clothing has limitations. The following precautions should be considered.

- Hearing and speaking are difficult in CPC with respiratory protection. It is important to establish other ways to communicate with each other. Hand signals or audio signals such as horns, sirens, and whistles can be used to communicate. Communication can also be improved by using two-way radios, such as a portable radio with microphone or radio with a microphone and speaker combination attached to the full-face respirator. Remember, any radio must be intrinsically safe to prevent an ignition hazard. Be aware of potential traffic areas.

- Due to the size and weight of some suits, motion is restricted, especially when climbing, working in tight areas, or using hand tools.



- Look for signs of heat stress (dizziness, headache, nausea, perspiration ceases), especially at temperatures over 70ºF.

- Always wear the correct size of footwear in order to prevent accidents. You should also make certain that the soles provide a proper grip for the surfaces that you will be encountering. Steel shanks, toes, and shin guards help to prevent puncture wounds and/or crushing injuries.

- Disposable booties may be slippery. Use caution when walking to prevent slips and falls.

- Care should be taken when donning and doffing inner and outer gloves. When donning gloves, make sure that no cracks or tears are present. When doffing gloves, take care not to spread contamination.

- All joints such as suit-to-boots and suit-to-gloves in Levels B and C protection should be secured with tape. Fold the end of the tape back under to make a tab for easy removal. Use special care when removing tape.

- Goggles and eye/face protection may become clouded due to moisture condensation during use. Follow manufacturer recommendation regarding use of products such as anti-fog film or spray on protective eye/face gear. Similarly, follow manufacturer instructions regarding clearing away any fog that may form on the inside of the face shield of a fully encapsulating suit.

- Be sure you are adequately hydrated prior to and after use of CPC.

- Avoid placing your hands or knees on the ground when in the Hot Zone to prevent contamination by chemicals and abrasion to the suit material. Avoid sitting on anything sharp in suits.

- When removing a suit, open and fold into itself as it is removed to prevent contamination of internal clothing.

- Suits have weak seams, especially if they are disposable. Be careful not to strain and split them. If splitting occurs, report it and follow the appropriate SOP (standard operating procedure).

- Use caution when suits are used in potential fire areas. If fire occurs, get out of the area.

- When dressing out with a team be careful to coordinate your dressout at the same speed and level as your team/buddy. The longer you are dressed out, the more stress is being put on your body.

- Completion of dressout should be delayed until ready to enter the work zone.

- Medical clearance is required for use of respirators.

Inspection, Maintenance, and Storage of CPC

It is important to inspect CPC to detect any evidence of chemical damage. CPC which is torn, degraded, or otherwise non-functional will not offer adequate protection to the wearer. The ERP should describe or reference SOGs for inspection, maintenance, and storage of CPC. CPC should always be inspected when it is:

- Received from the distributor
- Issued to employees
- Put into storage
- Taken out of storage
- Used for training
- Used for response
- Sent for maintenance

An inspection checklist should be developed for each item. Factors to consider are:

- Cuts, holes, tears, swelling, and abrasions in seams of the fabric
- Weakness in zipper or valve seals
- Signs of contamination such as discolorations or visible chemical
- Signs of malfunctioning exhaust valves

Proper maintenance can prevent CPC deficiencies and prolong the life of the equipment. A detailed SOG must be developed and followed rigorously.

Proper storage is important in order to prevent suit failures. The written SOG should describe storage before the CPC is issued to the wearer (in a warehouse, on-site, etc.), as well as storage after use. Check the manufacturer’s data, as most CPC used now has a shelf life.

Activity: Levels of Protection

Purpose: To provide participants with the opportunity to identify appropriate duties during a mass casualty incident.

Directions: Your instructor will divide the class into small groups. Based on the incident description provided, please indicate whether or not you will be trained to be able to perform the activities described below.

Slide	Level A	Level B	Level C	Level D
1 (a)				
1 (b)				
2				
3				
4				
5				
6				
7				
8				
9				
10 (a)				
10 (b)				

Gloves and Footwear

Hand Protection

Multiple layers of gloves are often necessary to protect receivers during a mass casualty incident. Two layers of gloves are used during patient decontamination:

- An outer glove provides chemical protection:
- An inner glove provides protection while doffing PPE and secondary chemical protection.

Materials for outer gloves:

- Butyl
- Silvershield
- Nitrile
- Neoprene
- Others

Materials for inner gloves:

- Medical grade nitrile

Foot Protection

The OSHA footwear rule 29CFR1910.136 rule states:

"...an employer shall ensure that each affected employee wear protective footwear when working areas where an employee's feet are exposed to electrical hazards or where there is a danger of foot injuries due to falling or rolling objects or a danger of objects piercing the sole of the shoe."

This is why it is recommended that ANSI-approved steel toe and shank footwear be worn during a mass casualty incident. The footwear also needs to provide chemical protection.

Maintenance and Inspection

The integrity of all PPE is essential if it is to protect you when needed. A systematic schedule must be developed and implemented to routinely inspect PPE. Maintenance/repairs must be completed in a timely manner. Always inspect all PPE before use. Report any failures or malfunctions during use to the appropriate official immediately. Any defects identified when doffing or cleaning of PPE post-incident should be reported.

Medical Monitoring

Medical monitoring is a requirement of the HAZWOPER standard and should be completed for all Decon Team staff.

At the Outset of the Incident

1. The medical monitoring equipment (blood pressure cuffs, stethoscopes, scales, thermometer, medical monitoring sheets) should be brought to the PPE dress out area.

2. 1-2 staff persons should be assigned responsibility to perform medical monitoring of all response personnel.

3. Time permitting (advance incident information and arrival notice has been given by EMS) each person intending to dress in PPE is to have the pre-entry medical monitoring assessment completed and recorded.

4. If there in inadequate time to perform pre-entry medical monitoring, it will be important for each staff member to exercise good judgment and dress out only if they know there is no preexisting condition that should preclude their use of PPE.

5. The clinical data obtained from medical monitoring done on each person must fall within the participation criteria listed. Persons whose vital signs exceed the requirements should either be sent to rest for 15-30 minutes and then re-examined or given a responsibility not requiring the use of PPE. **Staff are NOT to dress out until they meet the prerequisite criteria.**

During the Incident

1. After the completion of each work rotation requiring PPE use, the staff member is to have post-entry medical monitoring done. The elements of this exam are the same as the pre-entry exam. They are to be recorded on the same sheet. If significant changes in the clinical data are found or subjectively offered information indicate the need for more comprehensive evaluation or medical treatment, the staff member is to be seen in the Emergency Department or sent to Occupational Health.

2. Staff dressing out in PPE for a second work rotation are to have another pre-entry medical monitoring evaluation before donning PPE if the last exam performed was either abnormal or more than 2 hours old.

After the Incident

1. Once the incident is declared over, the records for all staff are to be reviewed by the charge Emergency Department physician or Occupational Health physician to determine if any further short or long-term clinical evaluation is necessary. If the decision is made that additional evaluation is needed, the staff member involved is to be immediately notified by the evaluating physician and arrangements made for the exam.

2. The costs associated with any follow-up evaluation or treatment associated with the incident will be the responsibility of the hospital.

3. Each staff member's medical monitoring record is to be put into their personnel file and retained per applicable state and federal laws.

Summary

In this chapter you learned about Levels of Protection and the types of respirators that may be used at a mass casualty incident. Proper inspection and maintenance of PPE is required if it is to be ready if needed.

Decontamination

In the event of a mass casualty incident, your role as a First Receiver will be to assist in decontaminating patients who arrive at the hospital. Since some of these patients may be contaminated, you will need to take special steps to protect yourself, the patients and other personnel, and the hospital from possible exposure. Based on previous incidents that have occurred, you can remove most of the contamination by removing clothing from the patients and by washing and rinsing the patients. In this module, you will learn how to ensure that you can decontaminate patients safely and effectively.

When you have completed this chapter you will be better able to:

- Identify work zones as applied to the decontamination area.
- Identify work practices to prevent the spread of contamination.
- Demonstrate deployment of a decontamination shelter and associated equipment.
- Identify need to monitor the environment.
- Identify elements of a decontamination briefing.
- Demonstrate methods of decontaminating ambulatory patients.
- Demonstrate methods of decontaminating non-ambulatory patients.

Work Zones

One of the basic elements of scene control is the creation of work zones. Prior to establishing the work zones, the receiver team should establish a secure area to avoid contact with contaminated patients who may enter the area.

It is critical to prevent the movement of contaminated materials and equipment from the decon area to a clean area, especially into the hospital. This can be accomplished by establishing work zones. The two work zones to be established are:

<u>Contaminated Zone</u>

The contaminated area is the “dirty” area. This includes areas where contaminated people approach the area with their possessions as well as contaminated areas of the decon tent. The contaminated zone also includes the waste side of the decontamination area.

Waste Side

The side of the decon tent which contains the grey water and bagged contaminated articles.

Decontaminated Zone

The decontaminated zone is the "clean" area where people have been separated from their contaminated clothing and have had possessions sealed in plastic bags. It includes the downstream area after a patient has showered, dried and used a Don-It pack as well as the path to the emergency department. The supply side of the tent is part of the decontaminated zone.

Supply Side

The "clean" side of the decon tent which contains fresh supplies and support equipment.

You will work in the decontamination area. This means you will not be at the site of an emergency, so you will not enter the site of an uncontrolled hazardous materials release.

However, the decontamination area itself is a work zone with work practices used to prevent the spread of contamination.

The following work practices and traffic control prevent the spread of contamination:

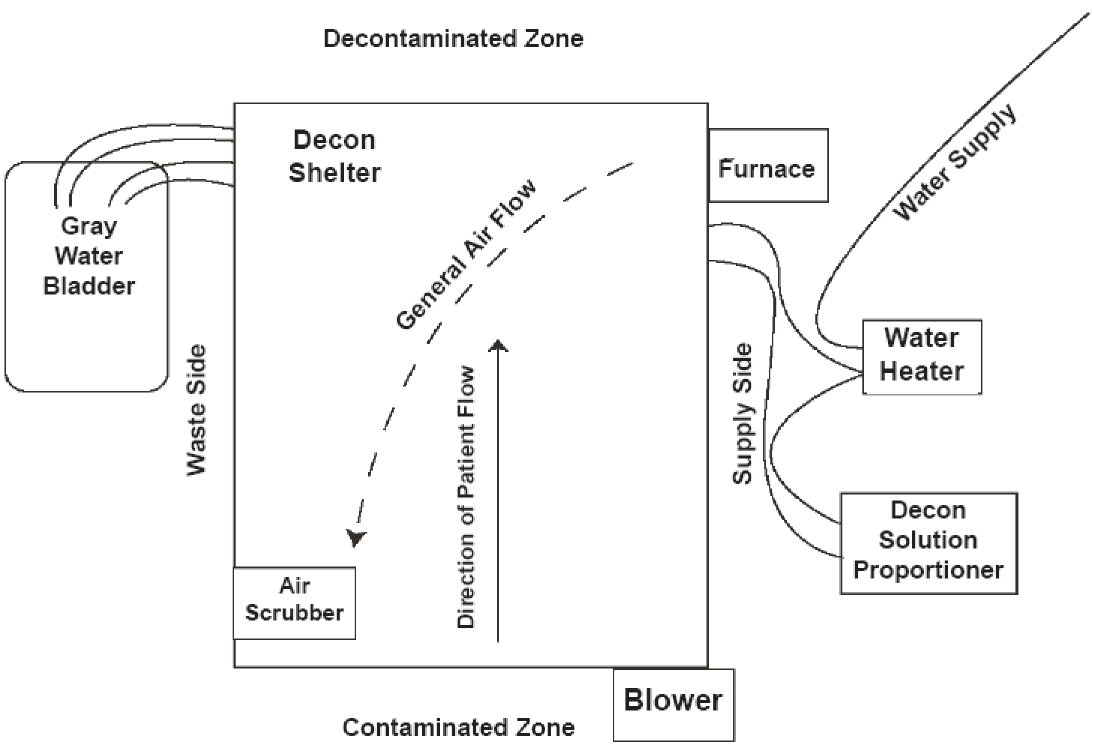
- Patients always move from "dirty" to "cleaner" areas.
- Decontamination workers do not move from "dirty" to "cleaner" areas.
- No one other than decontamination workers and contaminated patients should enter the decontamination area. If unauthorized people enter the decon area, they must proceed through as if contaminated.
- All material, equipment and waste must not leave the decon area. It will be cleaned up when the incident is terminated.
- One person is in charge of the decontamination area according to the ICS specified in your Emergency Management Plan.
- Always work with the concept of minimizing contact with contaminated areas.

Decontamination Shelter Deployment

The ability to setup and place the decontamination shelter into operation in a timely manner is necessary to prevent the hospital from being overwhelmed during mass casualty incident.

Note: There are different kinds of decon shelters and set-up requirements will vary.

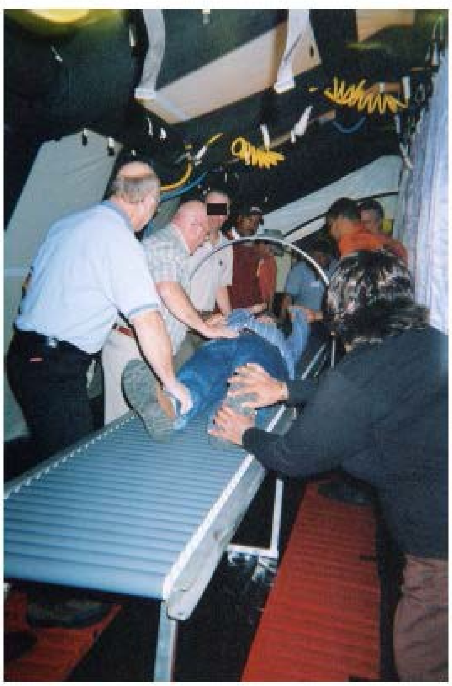
A team of four people to set up the tent is the minimum for the most efficient setup practice. One person will be responsible for setting up the tent and placing some of the internal devices. One person will be responsible for setting up the electrical supply and equipment, as well as setting up the propane supply. One person will be responsible for setting up the water supply, placing the shower assemblies, and providing for their water supply. Lastly, one person will set up the waste water collection system.



Stored Tent

* Practice drill only *

Tent setup for ambulatory patients.



Tent setup and use
for nonambulatory victims

* Practice drill only *

Alternatives to a Tent

When a self-contained tent is not available, a shelter can be constructed that complies with the following:

- tepid water is available
- waste water can be contained
- privacy is afforded during decontamination. Example: a tarp hung from a wall to form a "tent".

Non-ambulatory patients may be triaged to a facility that can accommodate their special needs.

Pre-planning and practice is essential. The types of incidents that might occur in your community should be anticipated, numbers of potential victims estimated and plans made for use of multiple facilities, as needed.

Portable shower

Collection pools and water supply

Stationary shower in health care facility

Plumbed line in Emergency room area

Activity: Decon Deployment Skills

Purpose: To practice the deployment and striking of a decontamination shelter.

Directions: Your instructor will divide you into groups of four. Acting as a team, each group will set up the tent, electricity and propane supply, water supply and wastewater containment, and then strike the decontamination shelter. When you have completed these tasks, fill out the checklist. (See Appendix C for SOGs.)

Performance Skills Checklist

Activity	Yes	No
1. Did you select a functional area to deploy the shelter?		
2. Did three members of your group roll out the tent?		
3. Did your group immediately establish an electrical supply for inflation?		
4. Did your group establish a propane supply?		
5. Did your group establish a water supply?		
6. Did your group set up the waste-water containment system?		
7. Did your group strike the decon shelter?		

Donning PPE

When donning PPE it is important to follow an SOG. Your instructor will direct you through the SOG in “Level C Loose Fitting PAPR (First Receiver) SOG”. (See Appendix B.)

Following an SOG helps to ensure no steps are missed and that everyone dresses simultaneously so that heat stress is minimized.

Donning CPC

Monitoring

Monitoring is useful for determining the location and amount of contaminant in the decontamination area. A monitoring system can alert first receivers to hazards that might otherwise go undetected. Monitors exist for several hazards you might encounter while decontaminating patients during a mass casualty incident.

Need to Conduct Monitoring

The decontamination area is monitored for hazardous materials for several reasons. Monitoring can sometimes:

- Detect the presence of a hazardous atmosphere.
- Identify the hazardous materials present.
- Measure the concentrations of the atmospheric hazards.
- Verify the effectiveness of decontamination.

Uses of Monitoring Information

Monitoring may be used in the decontamination to:

- Identify the hazards that may be present during the emergency.
- Determine specific tactics that may be used to minimize the spread of contamination from the decontamination area.
- Determine the isolation area around the decontamination area.
- Identify the levels of exposure to first receivers.
- Provide clearance monitoring when terminating the decontamination area.

Hazardous Atmospheres

Oxygen

- The normal concentration of oxygen in air is 20.9%. OSHA has set a limit of 19.5% as the lowest acceptable level of oxygen without the use of a supplied air respirator. An oxygen monitor will alarm at less than 19.5% or more than 23.5% oxygen. A decrease in oxygen from 20.9% to should be investigated to determine the cause of the decrease.

Combustible Gases

- Combustible vapors might be a hazard within the decon tent. The four-gas monitor measures the amount of the vapor or gas from zero to the lower explosive limit of the calibration gas. The monitor is generally set to alarm at 10% of the lower explosive limit. If the monitor alarms, leave the area unless otherwise directed by the incident commander or designee.

Toxic Gases

- Specific toxic gases may be identified and measured by people who have specialized training.
- If a toxic gas or vapor exceed its IDLH, you will be directed to leave the area until the concentrations is lowered.
- Examples of toxic gases that can be monitored are sarin and VX nerve agents, blister agents, (such as mustard gas), and toxic industrial gases such as chlorine, phosgene and ethylene oxide.

Radiation

Radiation monitors may be used to detect radiation and radioactive material used in “dirty bombs.” You should leave the area if directed by a person trained in the use of radiation monitors or who has results from radiation monitoring.

Patient Decontamination

Primary decontamination is performed at the site of a hazardous material release. Secondary decontamination is performed on victims before they are allowed in the emergency department. You are being trained only as a first receiver to perform secondary decontamination.

Ambulatory Patients

Personal Decon Kits are single use, disposable kits to ensure patient privacy. They help ensure effective patient decontamination by encouraging patient participation. It has been determined that 80% of contaminants may be eliminated if the patient simply removes their clothing. Showering with soap and water is often sufficient to remove the remainder.

Obviously, personal decon kits are for use by ambulatory patients who can help themselves. The majority of patients who will present themselves to an emergency department are ambulatory.

Non-Ambulatory Patients

Non-ambulatory patients will need special handling. While protecting the airway, remove all clothing, jewelry, etc., preferably by cutting. Do not pull contaminated clothing over the patient's head. Bag and label the belongings. Move the patient, headfirst and on a stretcher, downstream to a cleaner area and wash according to the decontamination plan. Keeping the airway (head) upwind as much as possible helps to keep airborne contaminants from being inhaled. Remember to give the patient a clean stretcher before he or she enters the decontaminated zone.

Very limited treatment, such as administration of a Mark I Kit may occur in the decontamination area. However, the patient must be thoroughly decontaminated before receiving treatment in the ED. Even if the patient suffers cardiac arrest, continue your decontamination activities before passing the patient to uncontaminated areas of the hospital.

All personnel, clothing, equipment and sample containers leaving the contaminated area (hot zone) must be decontaminated to remove any hazardous materials that may have adhered to them. Decontamination can be accomplished by:

- Removal of Patient Clothing

  The majority of contamination is removed from the patient by simply removing the clothing. Patients able to undress should be directed to do so by using a Personal Decon Kit. This is the case whether they arrive in personal clothing or in temporary clothing provided by EMS.

  Patients unable to undress should be cut out of their clothes in the following manner with the patient supine (laying on their back):

  1. Cut shirt on midline from bottom to top. Next cut sleeve from cuff to neck. Repeat on other sleeve. Remove any underclothing, jewelry, etc.

  2. Cut midline of pant leg from cuff to waist. Repeat on other pant leg. Cut away underclothing. Cut shoelaces and socks if they cannot be removed easily. The patient should be naked.

  3. Clothing should be double bagged and tagged with patient identification. Remember, the clothing may be evidence.

- Warm Water Rinse

  Warm water may be sufficient for decontamination of some water soluble hazardous materials. Warm water may open pores and slightly increase patient exposure to the material.

- Cold Water Rinse

  Cold water will close skin pores and may prevent entry of the hazardous material into the patient. However, it may also trap small amounts of chemical within the pore. If a highly toxic chemical is involved, a gross cold water rinse followed by a warm shower may be most beneficial.

- Soap or Detergent

  Non-water soluble hazardous materials such as oily or greasy substances may need the use of a soap or detergent. In some cases blotting the material off the skin may be helpful before a soap or detergent wash, followed by a rinse. Soaping and rinsing should be done from top to bottom to keep as much contaminant as possible from the head. Instruct patients to pay special attention to washing skin folds, ears, nose, joints, groin, hair and nails.

- Specialized Decon Solution

  Specialized decon solutions may be available for certain, specific hazardous materials. These must be evaluated on a case by case basis. You will be advised of the need for specialized decon solutions and instructions for its use in the decon briefing.

Deconning first responders or first receivers who worked in high levels of PPE

Deconning a first receiver

Decon Briefing

Prior to the decon briefing, the Incident Commander in conjunction with the Hazmat Branch Director and the Safety Officer must determine the goal and the objectives that will be used. The Hazmat Branch Director must discuss the goal and objectives during the decon briefing so the first receivers know what to do and what is expected of them.

During the decon briefing, the Hazmat Branch Director must discuss several other items. First, the Hazmat Branch Director will explain how the decon team will communicate with personnel outside the decon area. Portable radios are the most effective form of communication. However, emergency signals for evacuation of the decon area must also be in place.

In addition to communications the Hazmat Branch Director should inform the decon team about the hazards present and the methods they will use to control the hazards. The entry team should also be aware of any special information about the site, such as the slope of the floor, the presence of drains and other details that may be critical. The Hazmat Branch Director should address places of refuge and emergency evacuation routes as well as signs and symptoms to be expected if exposure occurs.

Activity: Ambulatory Patient Decon

Purpose: To practice directing an ambulatory patient through decontamination in a mass casualty incident.

Directions: Practice directing an ambulatory patient through the decontamination process.

Performance Skills Checklist

Skill	Yes	No
Did you direct them to undress?		
Did you provide them with personal decon kits?		
Was their clothing bagged and labeled?		
Did they do a cold water rinse?		
Did they do a warm water rinse?		
Did the patient soap themselves thoroughly?		

Activity: Non-Ambulatory Patient Decon

Purpose: To practice decontaminating a non-ambulatory patient in a mass casualty incident.

Directions: Practice decontaminating a non-ambulatory patient (or dummy),

Performance Skills Checklist

Skills	Yes	No
Did you cut shirt off on midline from bottom to top?		
Did you cut sleeves from cuff to neck?		
Did you cut away underclothing and remove socks and shoes?		
Did you bag and label the victim’s clothing?		
Did you do a cold rinse?		
Did you do a warm water rinse?		
Did the patient receive a thorough soaping?		
Did you keep the patient moving headfirst/downstream?		
Did the patient receive a clean stretcher before going to triage?		

Self-Decontamination and PPE Doffing

It is important to use a SOG while self-decontaminating and doffing your PPE. Your instructor will direct you through the SOG in Appendix B, titled “Level C Loose Fitting PAPR Decon (Dry) SOG”. Following a SOG helps to ensure no steps are missed and that everyone minimizes the spread of contamination.

Activity: Decon Briefing

Purpose: To practice conducting a decon briefing prior to conducting mass casualty patient decontamination.

Directions: Your instructor will set up the scenario involving a mass casualty decontamination incident at your facility. Each person will perform an activity as a member of the decon team. Prior to the scenario, you will review procedures for decon tent deployment and proper use of a PAPR. Using participants, the instructor will demonstrate the donning, doffing and decontamination procedures contained in the SOG. Prior to conducting this exercise, your instructor will discuss the elements of a decon briefing.

Performance Skills Checklist

Donning	Yes	No
Did you inspect your PAPR and CPC?		
Did you begin donning and then participate in a decon briefing?		
Were your sleeves taped over the widest part of your hand?		
Did you don your PAPR according to manufacturer specifications?		
Self-Decon		
Did you rinse off significant decontamination with decon solution before doffing?		
Doffing		
Did you doff your PPE at the exit of the decon shelter?		
Did you remove your PAPR before your CPC?		
Did you remove your CPC in a manner that did not allow contamination to spread inside your suit?		
Did you immediately move away from the decon shelter?		

Activity: Donning and Doffing Skills

Purpose: To practice donning and doffing of personal protective equipment during a casualty incident decontamination scenario.

Directions: At the conclusion of the hazardous materials scenario fill out the checklist below.

Performance Skills Checklist

Donning	Yes	No
Did you inspect your PAPR and CPC?		
Did you don your boots/booties and participate in a decon briefing?		
Did a partner tape your sleeves over the widest part of your hand?		
Did you don your PAPR according to the manufacturer’s specifications?		
Self-Decon		
Did you rinse your PPE with decon solution before doffing?		
Doffing		
Did you doff your PPE at the exit of the decon shelter?		
Did you remove your PAPR first?		
Did you remove your CPC in a manner that did not allow contamination to spread inside your suit?		
Did you immediately move away from the decon shelter?		

Summary

In this module you participated in a decontamination briefing that brought all the participants together and got them “on the same page.” You established a decontamination area, donned personal protective equipment, implemented decontamination techniques, and doffed your PPE, according to a predetermined Standard Operating Guide.

Termination

Termination is a critical step in the response, assuring that procedures are reviewed and preparations are made should another incident occur.

When you have completed this chapter, you will be better able to:

- Identify the elements of the Termination Phase.
- List site transfer options.
- Demonstrate an aspect of the Termination. Phase Aspects included in a complete Termination procedure include Personnel, Equipment and Property, and Site Transfer. Each is reviewed below.

Personnel

- Personnel Accountability Report (PAR)

  To ensure safety, the Hazmat Branch Director must account for all personnel during termination.

- Rehabilitation (Rehab)

  An area should be set up for rehab of personnel. Drinking water or medical evaluation may be necessary after some tasks.

- Post Incident Analysis (PIA)

  The IC should conduct a debriefing of all on-scene personnel within 24 hours of incident termination.

- Critical Incident Stress Debriefing (CISD)

  If appropriate, first receiver team personnel should be made aware of the CISD policy.

- Documentation

  An incident report should be completed after each mass casualty incident. The report should include actions taken, personnel involved, equipment used and monitoring data.

Equipment and Property

- Resupply of Equipment

  Any equipment that is used during the incident should be recovered and accounted for. All expended equipment must be resupplied to prepare for future incidents.

- Inventory of Equipment

  At the conclusion of the incident the team must conduct an inventory of all equipment. Documentation of damaged or lost equipment is required. Having a checklist will ensure that all equipment is response ready.

Restowed

Site Transfer

Once the incident is complete, the Safety Officer should ensure the site is returned to the proper authority. This could be the facility manager or some other hospital management official.

In order to safely transfer the site to normal operation the area must be determined to be safe. This could occur through clearance air monitoring, cultures or other tests as described in the SOG.

The emergency may be terminated and the contaminated area isolated as a hazardous materials site. It may be cleaned up by trained hazardous waste site remediation workers or other adequately trained personnel.

Activity: Termination Skills

Purpose: To practice the resupply and inventory component of a hazardous material scenario.

Directions: At the conclusion of the decontamination scenario, your instructor will provide directions regarding resupplying equipment and conducting an inventory. When the activity is completed, fill out the checklist below.

Performance Skills checklist

Activity	Yes	No
Did you return non-disposable PPE to its storage area?		
Did you inspect the PAPR?		
Were you directed to disassemble the decontamination area?		
Was the decontamination area disassembled?		

Summary

The Termination Phase provides a consistent approach to “tying up the loose ends.” It supports the first receivers by ensuring that their needs are met first. You discussed the importance of transferring the site back to the area supervisor. Finally, you practiced the resupply and inventory of equipment that is needed as the first step toward a high degree of readiness for the next incident.

Closing and Program Evaluation

Thank you for participating in this program.

This is an opportunity to ask any questions you may have, or to discuss how the knowledge and skills learned can be used at work. Were all of your initial questions answered?

Please take the next 10 minutes to complete the program evaluation forms. These are important for improving the program. The Midwest Consortium does take your comments seriously and has made changes in content and the skill exercises based on feedback. Your comments are anonymous.

We hope to see you at another Midwest Consortium program in the future.

Appendix A

Hazard Assessment Worksheet

MATERIAL IDENTIFICATION

Product name____

Chemical Name____

MATERIAL DESCRIPTION

❑ Solid

❑ Liquid Appearance__________________________

❑ Gas Odor________________________________

PHYSICAL / CHEMICAL PROPERTIES

Vapor Pressure: ❑ low (0-10 mmHg) ❑ moderate (10-100 mmHg) ❑ high (>mmHg)

Vapor Density: ❑ heavier than air ❑ lighter than air

Water Soluble: ❑ Yes ❑ No ❑ Partial❑

Specific Gravity: ❑ heavier than water ❑ lighter than water

pH:___________

Flash point: _____________

Oxidizer: ❑ Yes ❑ No

Incompatible Materials (Reactivity): ❑ Water ❑ Bleach ❑ Detergent ❑ Organics

Other:____

Decomposition products:____

Health Effects

Inhalation hazard ❑Yes ❑ No

Skin hazard ❑Yes ❑ No

Acute Effects: ____

Chronic Effects:____

Latent Effects: ____

Cancer Hazard ❑Yes ❑No

EXPOSURE LIMITS

OSHA PEL ____ IDLH ______

Appendix B

Loose-Fitting PAPR Pre-Operational SOG

This should be performed monthly and prior to each use.

- Inspect cartridge connections for wear and tear.
- Install cartridges into connection and make sure they are properly fitted. See Manufacturer's Instructions.
- Verify that the battery is fully charged.
- Verify flow rate per manufacturer's instructions (6 cfm).
- Inspect the blower tube for cracks, holes, etc.
- Attach the blower tube to the air outlet.
- Inspect the headpiece.

Level C Loose Fitting PAPR (First Receiver) SOG

- Verify that all PPE (PAPR, suit, boots, tape and outer and inner gloves) is ready and in the dress out area.
- Perform an operational check of the PAPR (SOG in Appendix).
- Remove watches, jewelry, leather shoes and other personal items.
- Inspect suit.
- Don suit to waist.
- Don chemical resistant boots.
- Prepare 2 strips of chemical tape 18" each with tab on one end.
- Conduct decon briefing.
- Don inner glove (blue nitrile medical N-dex).
- Don outer glove.
- Insert your arms into the sleeves of the suit and pulling it over shoulders.
- Pull the elastic wrist of the suit over the thumb and palm of hand with the outer glove. Spread hand out flat, stretching the elastic wrist and tape the outer glove to the suit with the 18 inch strip.
- Close front zipper and seal storm flap (if training use 10" tape strip).
- Don the loose fitting PAPR. Place the motor-blower against the lower back with the breathing tube extended upward. Fasten the belt with the motor-blower around the waist. Turn on the battery and verify the airflow to the hood. Pull the hooded respirator over the head and adjust the headband and the elastic neck seal so it fits under the chin.
- Assign suit number.
- Ensure wearer is breathing without distress and indicates readiness with a thumbs-up sign.

Level C Loose Fitting PAPR Decon (Dry) SOG

Station I

- If the suit has been exposed to a chemical or biological agent, the wearer should decon the suit before removing it.
- Place a large and small bag in the decon area.
- Step into the large bag.
- Remove the hooded PAPR and motor blower with belt and place it in the small bag.
- Open the stormflap and unzip the suit.
- Pull the hood off, touching only the outside of the hood.
- Grab the back of the suit with both hands and pull the suit off the shoulders.
- Pull one arm out of the suit while turning the sleeve inside out. The outer glove should turn inside-out and come off with the suit.
- Place the free hand inside the shoulder of the suit and remove the other sleeve and outer glove touching only the inside of the suit.
- Touching only the inside of the suit, complete the suit removal by rolling the suit inside out to the boot, keeping the suit inside the bag.
- Step out of the boot with the right foot and then the left foot.

Station 2

- Remove the inner gloves without touching the outside of the glove to the skin and place in waste container.
- Immediately move to a shower and wash and rinse thoroughly.

Appendix C

Decontamination Tent SOG

<u>Establish placement of the tent</u>

Place the tent in its carrying bag in the area where you would like to have contaminated people enter the decontamination process. A level area is preferred. When you open the bag, the first fabric that you see should be the entry point to the tent, which should be oriented toward the "contaminated" side. Position the tent so that as it inflates it unrolls toward the "decontaminated" side. Once positioned, any assistants that have other tasks to perform may do so.

<u>Inflate the tent.</u>

There are two air inlet ports to the right of the entry. One inlet port accepts a low pressure air hose that is fed from an electric blower. The other inlet port will accept an adapter hose for inflation with a Self Contained Breathing Apparatus (SCBA) cylinder.

Hospitals will most often use the low pressure blower and air hose and it will be necessary to have a source of 110 volt AC power. This should have been one of the first items in place from the electrical setup worker. The blower is used to both pressurize the tent and to evacuate air from the tent when taking it down. Make certain that the low pressure air hose is attached to the side of the blower that will inflate the tent. Look for the arrow indicating direction of flow.

- Place the Decon pools in the tent.
- Place the Elevation Grids in the tent.
- Place Doff-It Packs near the entrance of the tent.
- PlaceDon-It Packs near the exit of the tent.

Electricity and Propane SOG

Overview

To supply all appliances in the tent, it will be necessary to secure a source of 3500 to 4000 watts of electrical power. The items that need to be powered are 4 fluorescent lights, 4 waste pumps, a blower that provides fresh air into the tent, a furnace, an air filter/exhaust fan, and the blower for inflating the tent. Also, propane is needed to provide hot water and to provide warm air if weather conditions dictate.

Procedure

- Secure a source of electricity.
- Set up the inflator/deflator blower with power.
- Provide an electric cord to supply four gray water transfer pumps to the gray water containment bladder area on the waste side of the tent.
- Provide an electric cord to the supply side of the tent to power four fluorescent lights.
- Set up the ventilation blower and furnace assembly to blow air in near the exit of the tent.
- Set up the air scrubber exhaust fan assembly inside the entrance of the tent.
- Attach a propane cylinder to the water heater.
- Hang four fluorescent lights in tent and hook to power supply.

Waste Water Collection System SOG

Supplies Needed

- Gray water containment bladder
- 4 gray water transfer pumps
- 4 gray water hoses
- 2 1/4-inch gated wyes
- 4 electric extension cords to transfer pumps
- Doff-It and Don-It packs

Procedure:

- Assist with the placement of the tent.
- Place the gray water containment bladder on the "waste" side next to the Zumro tent.
- Attach two 3/4-inch gated wye connectors to the two 4-inch inlets of the gray water containment bladder.
- Place all 4 gray water hoses through a port into the interior of the Zumro tent.
- Place the end of each hose near one of the decontamination pools inside the Zumro tent.
- Attach a gray water transfer pump to each of the decon pools at the fitting that is provided on the side of the pool. There should be 4 pools and 4 transfer pumps. Make certain that the decon pool is turned so that the electric transfer pump is outside of the secondary containment.
- Attach decon gray water pickup assemblies to the inside connection in the decontamination pools.
- Attach each of the gray water hoses to one of the gray water transfer pumps.
- Attach an electric power supply to each of the gray water transfer pumps.

Strike and Package SOG

Do not begin this procedure until directed to do so.

- Connect inflation hose to shelter intake valve.
- Connect “deflate” side of blower to the hose.
- Open intake valve until approximately two threads of the “open/close” ring show or “PUSH TO OPEN” depending on valve style.
- Run inflator until all the air is removed from the airframe, approximately 5-7 minutes. (Do not run the blower for more than 20 minutes continuously to avoid overheating.)
- Place canopy and deflated airframe within the floor area of the tent.
- Fold the tent in half and in half again along the long dimension of the tent. Roll toward intake valve.
- Place carry case over top of rolled tent.
- Roll tent and carry case upside down.
- Close carry case.

Appendix D

Emergency Management Plan

Purpose

The purpose of this document is to provide a standardized and systematic approach to emergency operations.

Scope

The policies and guidelines found in this SOG apply to all personnel employed by ____________________________who respond to mass casualty incidents.

Phase I: Initial Actions

First Receiver personnel will manage every emergency scene using an Incident Command System. The ICS will be implemented by the first arriving personnel on the scene and will continue through termination. The Incident Commander will implement an accountability system using name badges and the Incident Command Worksheet. The IC will track individual members by job assignment and work zones. Upon arrival, first in personnel wil accomplish the following.

Notification - The first arriving person will transmit a brief initial report indicating who is in command, where command will be located, a brief description of the situation, and primary assignments for in-scene personnel and arriving personnel. The Incident Commander will also establish an identifiable command post. Finally, the Incident Commander will ensure that notification is provided to appropriate internal and external authorities, depending on the emergency.

Identification - For each incident, the Incident Commander should complete the Identification Worksheet. For the purpose of identifying hazards and assessing the situation at the site, the Incident Commander should assign a Reconnaissance Team. The IC and Recon Team should consider such sources as witnesses, workers, supervisors, occupants, Material Safety Data Sheets, maps/drawings, and Emergency Management Team observations. Influencing factors include site details, patient assessment, and resource information.

Isolation (Scene Control) - The IC must establish clearly defined hot, warm and cold zones using barriers, caution tape, or security control. Cars, trucks, carts and other moving equipment must be kept clear of the scent. All personnel will report to a staging area until assigned a task by the Incident Commander.

Protection - The Incident Commander must consider actions that will protect first receivers and the public. Fellow workers, family members, friends, unassigned police, fire, and medical personnel must be removed from hazardous areas. The Incident Commander must assign personnel to control hazards depending on the emergency. This may include air monitoring, ventilation, energy control/power lockout, and other hazard mitigation activities that do not involve entry into the hot zone. The Incident Commander will ensure that personnel who are at risk will wear appropriate personal protective equipment. People with key information or skills should be assigned to work with the response team or stage in designated areas. Easily accessible patients who are outside the hot zone must be treated, tracked and transported.

Phase II: Plan Development

Once the Incident Commander has gained control of the scene, the next phase requires the establishment of goals and objectives and the development of an incident control plan.

Size-Up - Prior to committing resources to a course of action, the Incident Commander must evaluate the influencing factors. The first step in this process requires a risk/benefit analysis. The Incident Commander must weigh the risks that will be taken against the benefits that will be gained from taking those risks. During size-up, the Incident Commander also determines the operational mode based on the available resources. An offensive mode will require personnel to enter the hot zone. A defensive mode includes operations that do not require entry into the hot zone. A transitional mode allows the Incident Commander to change the mode based on predictable events that occur during the incident. A transitional mode may begin as offensive and become defensive or vice versa.

Strategic Goals - The strategic goals include those elements the Incident Commander and the Management Team will attempt to accomplish during the incident. The goals for any emergency include notification, identification, protection, isolation, spill control, leak control, fire control, rescue/recovery and termination. The Incident Commander will select achievable goals based on the information collected during Phase I and the size-up. The goals selected should be indicated in the Incident Action Plan.

Tactical Objectives - The tactical objectives are used to accomplish the goals identified in the Incident Control Plan. The Incident Commander must determine which tactical objectives will result in achieving the strategic goals(s) and in which order they must be implemented. The tactical objectives are written into the Control Plan.

Resource Evaluation - The Incident commander must continually evaluate personnel and equipment resource levels during the incident. The Incident Commander must decide which internal and external resources will be necessary to implement the Control Plan. Level I resources include those that are on scene. Level II resources include personnel and equipment that is within the jurisdiction and is prepared for emergency response. Level III resources include those requested through mutual aid and other pre-arranged agreements from off-site. Level IV resources include those available through state and federal government agencies.

- During the Plan Development Phase, the Incident Commander will assign tactical operations to individuals or teams. The Incident Commander may expand the ICS by assigning command staff and general staff functions.

Phase III: Sustained Actions

This section should address the transition of a response from the initial emergency stage to the sustained action stage where resources are fully committed to achieving the strategic goals.

Briefing - Prior to committing to tactical operations, the Incident Commander should brief response team members on the following: hazards and site details identified; goals and objectives listed in the Control Plan; levels of personal protective equipment; and emergency signals.

Initiate Assigned Tasks - Once the Incident Commander has provided a briefing, response personnel will begin performing their assigned tasks. The specific tasks will depend on the type of incident.

Evaluate Control Plan - The Incident Commander will continuously evaluate the Control Plan for the incident. If the tactics accomplish the strategic goal(s), the Incident Commander will re-evaluate all aspects of the Control Plan, including goals, tactics, resources, and assignments.

Phase IV: Termination

Incident termination includes on-site termination operations and follow-up procedures that occur after personnel are reassigned and equipment has been returned to its previous location.

Termination (Personnel) - Personnel accountability must be on-going throughout the incident and must be officially concluded and documented prior to leaving the incident site. Personnel must be properly rehabilitated throughout the incident and prior to collecting all equipment. The Incident Commander will conduct a post-incident analysis with all personnel involved in the incident within 24 hours of the event. Emergency Management Team members will be trained in recognizing the need for Critical Incident Stress Debriefing. CISD will be provided to those in need by the following:

____.

The Incident Commander will complete an incident report that documents actions taken, personnel involved, equipment used, and patient status. Documentation will also include a copy of the Incident Command Worksheets, all state and federal reports required for the incident, and any reports mandated by the employer.

Recovery (Equipment) - Once the incident is completed, the Incident Commander will ensure that control of the site is returned to the authority having jurisdiction. This will include the name of the person to whom control is transferred and the time of transfer. Any response equipment that is used during the incident will be recovered and accounted for. All expended equipment will be resupplied or reconditioned before placing the unit(s) back in service. At the conclusion of the incident, all equipment will be inventoried, and the Incident Commander will document whether it was recovered, damaged, or expended. Finally, the Incident Commander will record his/her name and the time the incident was terminated.

Appendix E

Material Safety Data Sheet: LETHAL NERVE AGENT (GB)

SECTION I - GENERAL INFORMATION

DATE: 14 September 1988 REVISED: 28 February 1996

MANUFACTURER'S ADDRESS:

U.S. ARMY CHEMICAL BIOLOGICAL DEFENSE COMMAND

EDGEWOOD RESEARCH DEVELOPMENT,

AND ENGINEERING CENTER (ERDEC)

ATTN: SCBRD-ODR-S

ABERDEEN PROVING GROUND, MD 20101-5423

Emergency Telephone #'s: 0700-1630 EST: 410-671-4411/4414

After: 16:30 EST: 410-278-5201, Ask for Staff Duty Officer

CAS REGISTRY NUMBERS: 107-44-8, 50642-23-4

CHEMICAL NAME: Isopropyl methylphosphonofluoridate

ALTERNATE CHEMICAL NAMES:

O-Isopropyl Methylphosphonofluoridate

Phosphonofluoridic acid, methyl-, isopropyl ester

Phosphonofluoridic acid, methyl-, 1-methylethyl ester

TRADE NAME AND SYNONYMS:

Isopropyl ester of methylphosphonofluoridic acid

Methylisopropoxfluoridic acid

Isopropyl Methylfluorophosphonate

O-Isopropyl Methylisopropoxfluorophosphine oxide

Methylfluorophosphonic acid, isopropyl ester

Isopropoxymethylphosphonyl fluoride

Isopropyl methylfluorophophate

Isopropoxymethylphosphoryl fluoride

GB

Sarin

Zarin

CHEMICAL FAMILY: Fluorinated organophosphorous compound

FORMULA/CHEMICAL STRUCTURE:

C4H10FO2P

NFPA 704 HAZARD SIGNAL:

Health - 4

Flammability -

Reactivity -

Special – 0

SECTION II - HAZARDOUS INGREDIENTS

NAME	FORMULA	% BY WEIGHT	AIRBORNE EXPOSURE LIMIT (AEL)
GB	C4H10FO2P	1000	.0001mg/m3

SECTION III - PHYSICAL DATA

BOILING POINT: 158 C (316 F)

VAPOR PRESSURE (mm Hg): 2.9@25 C

VAPOR DENSITY (AIR=1): 4.86

SOLUBILITY: Miscible with water. Soluble in all organic solvents.

SPECIFIC GRAVITY (H2O=1.0887 @ 25 C

FREEZING/MELTING POINT: -56 C

LIQUID DENSITY (g/cc):

1.0887 @25 C

.102 @ 20 C

PERCENTAGE VOLATILE BY VOLUME:

22,000 m/m3@ 25 C

6,090 m/m3@ 20 C

APPEARANCE AND ODOR: Colorless liquid. Odorless in pure form.

SECTION IV - FIRE AND EXPLOSION DATA

FLASH POINT (METHOD USED): Did not flask to 280 F

FLAMMABLE LIMIT: Not applicable

LOWER EXPLOSIVE LIMIT: Not available

UPPER EXPLOSIVE LIMIT: Not available

EXTINGUISHING MEDIA: Water mist, fog, foam, CO2.

Avoid using extinguishing methods that will cause splashing or spreading of the GB.

SPECIAL FIRE FIGHTING PROCEDURES: GB will react with steam or water to produce toxic and corrosive vapors. All persons not engaged in extinguishing the fire should be evacuated. Fires involving GB should be contained to prevent contamination to uncontrolled areas. When responding to a fire alarm in buildings or areas containing agents, firefighting personnel should wear full firefighting protective clothing (without TAP clothing) during chemical agent firefighting and fire rescue operations. Respiratory protection is required. Positive pressure, full face piece, NIOSH-approved self-contained breathing apparatus (SCBA) will be worn where there is danger of oxygen deficiency and when directed by the fire chief or chemical accident/incident (CAI) operations officer. In cases where firefighters are responding to a chemical accident/incident for rescue/reconnaissance purposes, they will wear appropriate levels of protective clothing (See Section VIII).

Do not breathe fumes. skin contact with nerve agents must be avoided at all times. Although the fire may destroy most of the agent, care must still be taken to ensure the agent or contaminated liquid or vapor can be fatal.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Hydrogen may be present.

SECTION V - HEALTH HAZARD DATA

AIRBORNE EXPOSURE LIMITS (AEL): The permissible airborne exposure concentration for GB for an 8-hour workday or a 40-hour work week is an 8-hour time weighted average (TWA) of 0.0001mg/m3. This value is based on the TWA of GB which can be found in “AR 40-8, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX.” To date, the Occupational Safety and Health Administration (OSHA) has not promulgated a permissible exposure concentration for GB.

GB is not listed by the International Agency for Research on Cancer (IARC), American Conference of Governmental Industrial Hygienists (ACGIH), Occupational Safety and Health Administration (OSHA), or National Toxicology Program (NTP) as a carcinogen.

EFFECTS OF OVEREXPOSURE: GB is a lethal cholinesterase inhibitor. Doses that are potentially life threatening may be only slightly larger than those producing least effects. Effective dosages for vapor are estimated for exposure durations of 2-10 minutes. Symptoms of overexposure may occur within minutes or hours, depending upon dose. They include miosis (constriction of pupils) and visual effects, headaches and pressure sensation, runny nose and nasal congestion, salivation, tightness in the chest, nausea, vomiting, giddiness, anxiety, difficulty in thinking and sleeping, nightmares, muscle twitches, tremors, weakness, abdominal cramps, diarrhea, involuntary urination and defecation. With severe exposure symptoms progress to convulsions and respiratory failure.

EMERGENCY AND FIRST AID PROCEDURES:

INHALATION: Hold breath until respiratory protective mask is donned. If severe signs of agent exposure appear (chest tightens, pupil constriction, incoordination, etc.), immediately administer, in rapid succession, all three Nerve Agent Antidote Kit(s), Mark I injectors (or atropine if directed by physician).

Injections using the Mark I kit injectors may be repeated at 5 to 20 minute intervals if signs and symptoms are progressing until three series of injections have been administered. No more injections will be given unless directed by medical personnel. In addition, a record will be maintained of all injections given. If breathing has stopped, give artificial respiration. Mouth-to-mouth resuscitation should be used when approved mask-bag or oxygen delivery systems are not available. Do not use mouth-to-mouth resuscitation when facial contamination exists. If breathing is difficult, administer oxygen. Seek medical attention IMMEDIATELY.

EYE CONTACT: Immediately flush eyes with water for at least 15 minutes, then don respiratory protective mask. Although miosis (pinpointing of the pupils) may be an early sign of agent exposure, an injection will not be administered when miosis is the only sign present. Instead, the individual will be taken IMMEDIATELY to a medical treatment facility for observation.

SKIN CONTACT: Don respiratory protective mask and remove contaminated clothing. Immediately wash contaminated skin with copious amounts of soap and water, 10 % sodium carbonate solution, or 5% liquid household bleach. Rinse well with water to remove decontaminant. Administer Nerve Agent Antidote Kit(s), MARK I injectors only if local sweating and muscular twitching syptoms are observed. Seek medical attention IMMEDIATELY.

INGESTION: Do not induce vomiting. First symptoms are likely to be gastrointestinal. IMMEDIATELY administer Nerve Agent Antidote Kit(s), MARK I injector(s). Seek medical attention IMMEDIATELY.

SECTION VI - REACTIVITY DATA

STABILITY: Stable when pure.

INCOMPATIBILITY: Attacks tin, magnesium, cadmium plated steel, and some aluminum. Slightly attacks copper, brass, and lead; practically no attack on 1020 steels, Inconel and K-monel.

HAZARDOUS DECOMPOSITION: Hydrolyzes to form HF under acid conditions and isopropyl alcohol and polymers under basic conditions.

HAZARDOUS POLYMERIZATION: Does not occur.

SECTION VII - SPILL, LEAK, AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: If leaks or spills occur, only personnel in full protective clothing will remain in area (See Section VII). In case of personnel contamination see Section V for emergency and first aid instructions.

RECOMMENDED FIELD PROCEDURES: Spills must be contained by covering with vermiculite, diatomaceous earth, clay, fine sand, sponges, and paper or cloth towels. Decontaminate with copious amounts of aqueous sodium hydroxide solution (a minimum 10 wt. %). Scoop up all material and clothing and place in a DOT approved container. Cover the contents with decontaminating solutions as above. After sealing, the exterior of the container will be decontaminated and then labeled according to EPA and DOT regulations. All leaking containers will be over packed with vermiculite placed between the interior and exterior containers. Decontaminate and label according to EPA and DOT regulations. Dispose of the material according to Federal, State and local regulations. Conduct general area monitoring with an approved monitor to confirm that the atmospheric concentrations do not exceed the airborne exposure limits (See Sections II and VIII). If 10 wt. % aqueous sodium hydroxide solution is not available then the following decontaminants may be used instead and are listed in the order of preference: Decontaminating Agent, DS (DS2), Sodium Carbonate, and Supertropical Bleach Slurry (STB).

RECOMMENDED LABORATORY PROCEDURES: A minimum of 56 grams of decon solution is required for each gram of GB. Decontaminant and agent solution is allowed to agitate for a minimum of one hour. Agitation is not necessary following the first hour. At the end of the hour, the resulting solution should be adjusted to a pH greater than 11.5. If the pH is below 11.5, NaOH should be added until a pH above 11.5 can be maintained for 60 minutes. An alternate solution for the decontamination of GB is 10 wt. % sodium carbonate in place of the 10% sodium hydroxide solution above. Continue with 56 grams of decon for each gram of agent. Agitate for one hour but allow three hours for the reaction. The final pH should be adjusted to above zero. It is also permitted to substitute 5.25% sodium hypochlorite or 25 wt. % Monoethylamine (MEA) for the 10% sodium hydroxide solution above. MEA must be completely dissolved in water before addition of the agent. Continue with 56 grams of decon for each gram of GB and provide agitation for one hour. Continue with same ratios and time stipulations. Scoop up all material and clothing and place in a DOT approved container. Cover the contents with decontaminating solution as above. After sealing, the exterior of the container will be decontaminated and then labeled according to EPA and DOT regulations. Dispose of according to waste disposal methods provided below. Dispose of decontaminate according to Federal, State and local regulations. Conduct general area monitoring with an approved monitor to confirm that the atmospheric concentrations do not exceed the airborne exposure limits (See Sections II and VII).

WASTE DISPOSAL METHOD: Open pit burning or burying of GB or items containing or contaminated with GB in any quantity is prohibited. The detoxified GB (using procedures above) can be thermally destroyed by incineration in EPA approved incinerators according to appropriate provisions of Federal, state and local Resource Conservation and Recovery Act (RCRA) Regulations.

NOTE: Some states define decontaminated surety material as an RCRA Hazardous waste.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:

CONCENTRATION RESPIRATORY PROTECTIVE EQUIPMENT.

<0.0001mg/m3A full face piece, chemical canister, air purifying protective mask will be on hand for escape. (The M9-, M17-, or M40- series masks are acceptable for this purpose. Other masks certified as equivalent may be used)

>0.0001or = 0.2 mg/m3A NIOSH/MSHA approved pressure demand full face piece SCBA or supplied air respirators with escape air cylinder may be used. Alternatively, a full face piece, chemical canister air-purifying protective mask is acceptable for this purpose (See DA PAM 385-61for determination of appropriate level)

>0.2 or unknown mg/m3NIOSH/MSHA approved pressure demand full face piece SCBA suitable for use in high agent concentrations with protective ensemble (See DA PAM 61for examples)

VENTILATION:

Local Exhaust: Mandatory. Must be filtered or scrubbed to limit exit concentration to < 0.0001mg/m3. Air emissions will meet local, state and Federal regulations.

Special: Chemical laboratory hoods will have an average inward face velocity of 100 linear feet per minute (lfpm) +/- 10% with the velocity at any point not deviating from the average face velocity by more than 20%. Existing laboratory hoods will have an inward face velocity of 150 lfpm +/- 20%. Laboratory hoods will be located such that cross drafts do not exceed 20% of the inward face velocity. A visual performance test using smoke producing devices will be performed in the assessment of the hoods ability to contain agent GB.

Other: Recirculation of exhaust air from agent areas is prohibited. No connection is allowed between agent areas and other areas through the ventilation system. Emergency backup power is necessary. Hoods should be tested at least semiannually or after modification or maintenance operations. Operations should be performed 20 centimeters inside hood face.

PROTECTIVE GLOVES:

Butyl Rubber Glove M3and M4 Norton, Chemical Protective Glove Set

EYE PROTECTION: As a minimum chemical goggles will be worn, For splash hazards use goggles and face shield.

OTHER PROTECTIVE EQUIPMENT: For general lab work, gloves and lab coat will be worn with mask readily accessible. In addition, daily clean smocks, foot covers, and head covers will be required when handling contaminated lab animals.

MONITORING: Available monitoring equipment for agent GB is the M8/M9 Detector paper, detector ticket, blue band tube, M256/M256A1kits, bubbler, Depot Area Air Monitoring System (DAAMS), Automatic Continuous Air Monitoring System, Automatic Continuous Air Monitoring System (ACAMS), real time monitoring (RTM), Demilitarization Chemical Agent Concentrator (DCAC), M8/M43, M8A1/M43A2, Hydrogen Flame Photometric Emission Detector (HYFED), CAM-M1, Miniature Chemical Agent Monitor (MINICAM) and the Real Time Analytical Platform (RTAP).

Real-time, low-level monitors (with alarm) are required for GB operations. In their absence, an Immediately Dangerous to Life and Health (IDLH) atmosphere must be presumed. Laboratory operations conducted in appropriately maintained and alarmed engineering controls require only periodic low-level monitoring.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: When handling agents, the buddy system will be incorporated. No smoking, eating and drinking in areas containing agents are permitted. Containers should be periodically inspected for leaks either visually or by a detector kit. Stringent control over all personnel practices must be exercised. Decontamination equipment will be conveniently located. Exits must be designed to permit rapid evacuation. Chemical showers, eyewash stations, and personal cleanliness facilities must be provided. Wash hands before meals and each worker will shower thoroughly with special attention given to hair, face, neck, and hands, using plenty of soap and water before leaving at the end of the work day.

OTHER PRECAUTIONS: GB must be double contained in liquid and vapor tight containers when in storage or outside a ventilation hood.

For additional information see “AR 385-61, The Army Toxic Chemical Agent Safety Program” “DA PAM 61, Toxic Chemical Agent Safety Standards,” and “AR 40-8, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX.”

SECTION X - TRANSPORTATION DATA

PROPER SHIPPING NAME: Poisonous liquids n.o.s.

DOT HAZARD CLASSIFICATION: 6.1, Packing Group I, Hazard Zone A

DOT LABEL: Poison

EMERGENCY ACCIDENT PRECAUTIONS AND PROCEDURES: See Sections IV, VII and VII.

PRECAUTIONS TO BE TAKEN IN TRANSPORTATION: Motor vehicles will be placarded regardless of quantity. Drivers will be given full information regarding shipment and conditions in case of an emergency. AR 50-6 deals specifically with the shipment of chemical agents. Shipments of agent will be escorted in accordance with AR 740-32.

Appendix F

Medical Monitoring Record Form

NAME: ______________________________

DATE: ______________________________

PROTECTIVE EQUIPMENT:

SUBSTANCE INVOLVED (IF KNOWN):________________________________

CRITERIA	PRE	POST*
Weight		
Temperature and Method (98° F min, 99.2° F max)		
Pulse (100 bpm)		
BP and Method (140 bpm systolic/ 100 diastolic)**		
Respiration		

Medical History:

- Any medications last 72 hours:

- Alcohol past 24 hours:

- New medications/diagnosis last 2 weeks:

- Symptoms, fever, NV, diarrhea, cough in past 72 hours:

- Pregnancy:

- Prior heat stress or exhaustion:

- Additional notes:

***Mental Status** (Alert, oriented to time/place, clear speech, normal gait, etc.):

***Time in suit: ____**

Pre-Monitoring Conducted by: ________________________________

***Post-Monitoring Conducted by: ______________________________**

****At onset of an incident, fear and anxiety may cause employees' blood pressure to be elevated.