



# Protecting Yourself While Responding to Chemical Incidents

Safety and Health Awareness for Responders to Chemical Incidents



Graniteville train derailment, EPA

July 2009

WORKER EDUCATION & TRAINING PROGRAM



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
National Institutes of Health

Trainer's Notes:



## Why This Training Tool Was Created

This training tool was created by the NIEHS National Clearinghouse for Worker Safety and Health Training under contract no. 273-05-C-0017 from the National Institute of Environmental Health Sciences Worker Education and Training Program (WETP). WETP has trained nearly two million emergency responders and hazardous waste workers since 1987 to do their jobs safely. WETP is part of the Department of Health and Human Services, which is a cooperating agency under the Worker Safety and Health Support Annex of the National Response Plan. As part of the coordinated effort, WETP created this training tool for those who may be involved in a chemical response and cleanup.

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## How to Use this Training Tool

- This training tool is an awareness-level health and safety resource for “skilled support personnel” who will participate in a response to a chemical release (including weapons and industrial chemicals) and are not required to get chemical training under 1910.120. It can also be used as a refresher course for those with a minimum level of training.
- This tool will help workers understand at an awareness level: the basics of chemical weapons deployment, how to protect against chemical and other hazards associated with a chemical release and response.
- Trainers may use this tool to aid in the development of a awareness level chemical release course or other awareness level materials (fact-sheets, table-top activities, etc.)

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### Trainer's Notes:

This tool is intended for responders who will participate in a response to a chemical release (including weapons and industrial chemicals). Many chemicals are inherently dangerous due to their possession of one or more of the following properties: reactivity, flammability, explosiveness, toxicity, or carcinogenicity. This tool is designed to help workers understand at an awareness level: the basics of chemical weapons deployment, how to protect against chemical and other hazards associated with a chemical release and response.

The article at the following URL describes the vulnerability of our chemical infrastructure to attack: [http://www.nti.org/e\\_research/e3\\_89.html](http://www.nti.org/e_research/e3_89.html) This could be used as a lead into the use of chemicals as a hazard and terrorist tool.



## Advanced/Additional Training Required for Those Involved in a Chemical Response

- This training tool does not replace the additional duty specific training or PPE specific training requirements.
- Regardless of work scope, there are many topics covered in this awareness training tool that have corresponding OSHA standards which must be met in order to safely and legally perform associated job duties.

**Contact the NIEHS National Clearinghouse for Worker Safety and Health Training for information for advanced training on response to releases of hazardous chemicals, 202-331-7733.**

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### Trainer's Notes:

#### Advanced Training is Required if:

- You are operating in a first response capacity (EMT Personnel, firefighter, police officer).
- You are operating in a first receiver capacity (emergency room staff or triage area staff).

#### Additional Training is Required if:

- You use a respirator.
- You use Personal Protective Equipment ( PPE) such as gloves, hearing protection or eye protection.
- Enter confined spaces such as collapsed structures, trenches or utility vaults.
- Use hazardous chemicals.
- Are in contact with human or animal tissue or fluids.

#### A partial list of corresponding OSHA standards follows:

- Hazardous Waste Operations and Emergency Response 29 CFR 1910.120
- Emergency Action Plans 29 CFR 1910.38; Occupational Noise Exposure 29 CFR 1910.95; Respiratory Protection 29 CFR 1910.134; Eye and Face Protection 29 CFR 1910.133; Head Protection 29 CFR 1910.135;
- Foot Protection 29 CFR 1910.136; Hand Protection 29 CFR 1910.139; Blood Borne Pathogens 29 CFR 1910.1030; and, Hazard Communication 29 CFR 1200.
- Additional information maybe found at: <http://www.osha.gov/SLTC/emergencypreparedness/standards.html>

#### Additional Hazardous Materials/WMD Response Training Standards

- NFPA 472/473

Help workers be aware that additional training for certain situations might be required.



## Employer and Worker Responsibilities

Employers and workers have responsibilities under the OSH Act.

- The Occupational Safety and Health Act requires employers provide a safe and healthful workplace free of recognized hazards and follow OSHA standards. Employers' responsibilities also include providing training, medical examinations and recordkeeping.
- Workers must follow the employer's safety and health rules and wear or use all required gear and equipment; follow safe work practices for their job, as directed by their employer; report hazardous conditions to a supervisor; and report hazardous conditions to OSHA if employers do not fix them.

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### Trainer's Notes:

For more information about OSHA, go to [www.osha.gov](http://www.osha.gov) or call 1-800-321-OSHA (6742).



## Module 1

### Intentional & Unintentional Chemical Releases



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## What is a Chemical Incident?

**A chemical incident is an intentional or unintentional uncontrolled release of a toxic substance into the environment which results in (potential) harm to public health and the environment.**

- Unintentional Release
  - Location Based
    - Fixed facility incident
    - Transportation Incident
  - Poor operations and Maintenance (O&M)
- Intentional Release
  - Sabotage, Terrorism
    - Secondary Devices
  - Preventative Measures/ Permitted Releases

**All releases have the potential to harm you, your co-workers and others that may have been or become exposed!**

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### Trainer's Notes:

Chemical Incident definition is from the Glossary of the Health Protection Agency, UK (<http://www.hpa.org.uk>).

The term "chemical incident" might refer to anthropogenic events such as the explosion of a factory which stores or uses, chemicals, contamination of the food or water supply with a chemical, an oil spill, a leak in a storage unit during transportation or an outbreak of disease that is (likely to be) associated with chemical exposure. Chemical incidents can also arise from natural sources such as volcanoes, earthquakes and forest fires.

Chemical incidents can cause injury through four basic injury mechanisms: fire, explosion, toxicity and the experience of traumatic events.

Chemical Response, "Manual for the Public Health Management of Chemical Incidents." World Health Organization. 2009. [http://whqlibdoc.who.int/publications/2009/9789241598149\\_eng.pdf](http://whqlibdoc.who.int/publications/2009/9789241598149_eng.pdf)

### Unintentional Release:

Lack of quality training, excessive chemical storage/use and lack of O&M could increase chance and magnitude of accidental releases

### Unintentional Release Example:

CAI/Arnel explosion Danvers, MA November 22, 2006

<http://www.chemsafety.gov/investigations/detail.aspx?SID=14>

Problems included: inadequate process hazards analysis, use of inappropriate or poorly-designed equipment and, inadequate indications of process condition. Warnings went unheeded, training and operator error. EPA and OSHA believe that it is rarely the action or inaction of a single operator that is the sole or even primary cause of an accident. The Safety Precedence Sequence illustrates that numerous barriers must fail before operator action can cause an accident:

### Safety Precedence Sequence:

Design for Minimum Hazard, Install Safety Devices, Use Safety Warnings, Control with Procedures / Administrative Controls, Personnel Action by Training, Awareness, Knowledge, Accepted Risk

<http://www.plant-maintenance.com/articles/ccps.shtml>

### Intentional Release

Chemical WMD involves: Chemical(s); Explosives (potential); Possible Secondary Devices; Crime Scene

HAZMAT involves: Chemical(s); Explosives (potential); Possibly a Crime Scene



## Unintentional Release: Fixed Facility Incidents

- High potential for damage based on the toxicity and the quantity of the chemicals located at the facility
- Could be caused by:
  - Lack of proper preparedness and/or training
  - Operations and Maintenance (O&M issues)
  - Onsite stored chemicals



Destroyed filter housing at BP refinery

**Example: March 23, 2005  
Texas City BP refinery.**

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### Trainer's Notes:

#### **EXAMPLE: BP America Refinery Explosion**

<http://www.csb.gov/investigations/detail.aspx?SID=20>

At approximately 1:20 p.m. on March 23, 2005, a series of explosions occurred at the BP Texas City refinery during the restarting of a hydrocarbon isomerization unit. Fifteen workers were killed and 180 others were injured. Many of the victims were in or around work trailers located near an atmospheric vent stack. The explosions occurred when a distillation tower flooded with hydrocarbons and was overpressurized, causing a geyser-like release from the vent stack.

Unintentional Chemical Release: Fixed Facility

#### **EXAMPLE: The BHOPAL Gas Incident – Bhopal , India**

**Chemical Response, "Manual for the Public Health Management of Chemical Incidents." World Health Organization. 2009.**

[http://whqlibdoc.who.int/publications/2009/9789241598149\\_eng.pdf](http://whqlibdoc.who.int/publications/2009/9789241598149_eng.pdf)

During The night of 2–3 December 1984 in Bhopal, India, an operator at the Carbide plant noticed a small leak as well as elevated pressure inside storage tank 610, which contained methyl isocyanate (MIC), a highly reactive chemical used as an intermediate in the production of the insecticide Sevin. The leak had been created by a strong exothermic reaction resulting from mixing of one tonne of water normally used for cleaning internal pipes with 40 tonnes of MIC contained in the tank.

Because coolant for the refrigeration unit had been drained previously for use in another part of the plant, tank 610 could not be cooled quickly. Therefore, pressure and heat continued to build inside the tank and the tank continued to leak. Both the vent gas scrubber and the gas flare system, two safety devices designed to neutralize potential toxic discharges from the tank before they escaped into the atmosphere, had been turned off several weeks before. At around 1:00, a loud rumbling echoed around the plant as the safety valve of the tank gave way. Nearly 40 tonnes of MIC gas were released into the morning air of Bhopal. It did not take long for the plume, carried by the changing winds, to spread over a large area.

At least 3800 people died immediately, killed in their sleep or during the flight that ensued. Local hospitals were soon overwhelmed with the thousands of injured people. The crisis was further deepened by a lack of knowledge of exactly which gas was involved and hence what the appropriate course of treatment should be. Estimates of the number of people killed in the first few days by the plume from the Union Carbide plant are as high as 10 000, with 15 000 to 20 000 premature deaths reportedly occurring in the subsequent two decades. The Indian government reported that more than half a million people were exposed to the gas. The greatest impact was on the densely populated poor neighbourhoods immediately surrounding the plant.

The Bhopal incident was the result of a combination of legal, technological, organizational and human errors. While the immediate cause of the incident was the unintended release of a large amount of water into a storage tank, the severe health effects of the chemical reaction that ensued were certainly aggravated by the failure of the various safety measures and the lack of community awareness and emergency preparedness. Economic pressure faced by industry, communities and governments can be a contributing factor that influences the likelihood and severity of a chemical incident.





## Unintentional Release: Transportation Incidents

- May concern roadway, rail, air and water transport
- Higher potential (than fixed facility) for incidents based on uncontrollable factors (e.g. weather) and the transportation of the chemical
- Location may increase hazards and risk factors, and could add to delay in response and clean up
- Can damage nearby structures such as buildings, overpasses, bridges and tunnels
- Affected area depends on the type of chemical, release factors, environmental conditions, etc....



DPC chlorine release

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### Trainer's Notes:

#### **EXAMPLE: Unintentional Methyl Bromide Gas Release -- Florida, 1988**

<http://www.cdc.gov/mmwr/preview/mmwrhtml/00001527.htm>

At approximately 11 a.m. on November 30, 1988, a tractor-trailer truck carrying 32 cylinders of a gaseous toxic pesticide (methyl bromide, 98%, and chloropicrin, 2%) overturned on an unpaved road in a rural area of Collier County, Florida. Methyl bromide gas, used primarily as an agricultural fumigant for nematodes, is a severe pulmonary irritant and neurotoxin. The major symptoms reported in this incident are consistent with previously reported symptoms (1). Renal tubule damage and pulmonary edema have been reported in fatalities associated with methyl bromide exposures (2). Nine emergency responders (none of whom were firefighters) and one local resident were treated at a community hospital for symptoms associated with exposure to the gas.

#### **Nonpetroleum Product Hazardous Material Incidents**

Fixed Facility      79%

Transportation      21%

*Hazardous Substance Emergency Event Surveillance (HSEES) System*

*1998 ATSDR Statistics for AL, CO, IA, MN, MS, MO, NY, NC, OR, RI, TX, WA, WI State Health Departments*

#### Items to note:

- Facility response plans require regulatory review
- Federal reporting requirements are under the National Response Plan (NRP)
- Chemical industry has the "responsible care plan"
- Voluntary security procedures to ensure security around the facilities
- Risk Management Plan for fixed facilities - CAA Section 112R
- Large facilities have SPCC requirements



## Intentional Release: Sabotage

- Deliberate action aimed at weakening an enemy, oppressor or employer through subversion, obstruction, disruption, and/or destruction (DHS definition)
- Incident can vary in size and scope of release.
- Release could have disastrous socio-economic consequences
- Sound engineering controls, countermeasures and O&M can reduce or prevent sabotage.



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### Trainer's Notes:

#### **EXAMPLE: Chemical Terrorism: Threat to Water Supplies**

<http://www.springerlink.com/content/e2755w0x362j2211/fulltext.pdf>

#### **Abstract**

Although for practical reasons, terrorist attacks on water systems are considered less likely than on other targets, threats to drinking water cannot be ignored. A large-scale chemical sabotage of drinking water, even insufficient to cause casualties, could still have disastrous socio-economical consequences. There is therefore a need to maintain a high-level of security around water treatment and distribution facilities, especially those supplying critical infrastructures, and to develop emergency preparedness programs at both the local and national levels.



## Intentional Release: Terrorism

- The unlawful use of force against persons or property to intimidate or coerce a government, civilian population, or any segment thereof, in the furtherance of political or social objectives (FBI definition)
- Use of the chemical agent *Sarin* in Tokyo signifies the introduction of weapons of mass destruction (WMDs) into the terrorist arsenal
- Since 9/11, the U.S. has increased efforts to train both emergency response, skilled support and civilian personnel to better handle incidents



1995 Tokyo, Japan  
Sarin Subway Attack

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### Trainer's Notes:

**Example: Terrorist Attack in Toyko** - Background and Emergency Response Information  
<http://www.emergency.com/japanatk.htm>

March 19, 1995 --Monday morning rush hour, in Tokyo, has disintegrated into chaos, according to Japanese news and government sources. Reports of toxic fumes in a subway station began at approximately 08:17 a.m. (Tokyo time) and have quickly escalated into a major mass casualty incident. According to the Tokyo Metropolitan Police, as many as five-hundred sixty-five (565) people have been hospitalized and five people are confirmed dead.

International terrorism has been a global issue for many years.

### How Do We Find Out It's a Terrorist Event?

A chemical terrorist event is likely to be discovered in one of two ways:

1. Local discovery of the environmental release or exposure incident
2. Diagnosis of the resultant patient cases



## Preventative Measures / Permitted Releases

- Sometimes chemicals are released intentionally to the environment to avoid a larger incident from occurring (pressure relieve, etc.).
- Often occur in very small amounts.
- Permitted, untreated chemical releases.

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Trainer's Notes:



## Secondary Devices

- Bombs that are placed at the scene of an ongoing emergency response
- Designed to explode after a primary explosion
- May contain additional chemical weapons

**Leave all suspicious items alone and report them immediately!**

### Warning Signs

Any abandoned container out of place for the surroundings.

Obvious devices containing blasting caps, timers, booster charges, etc.

Abandoned vehicles not clearly belonging in the immediate environment

Strong chemical odors with no apparent reason.

Unusual or foreign devices attached to pressurized containers, bulk storage containers or supply pipes.

Trip wires or other booby traps, suspicious mailing containers.



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### Trainer's Notes:

#### Background Information:

The intent of a secondary device is to inflict injury, damage, and fear among responders or other major emergency response event has attracted a large number of responders to the scene. Bombs can be made to resemble ordinary objects, lunch boxes, paper bags, etc... Secondary responders working at an explosive incident will have difficulty recognizing out of the ordinary objects. Typically these devices will be hidden in out of view locations, or camouflaged by placing the devices in ordinary objects such as vehicles, flashlights, briefcases, flowerpots, or garbage cans. Usually the devices are detonated by a time delay, although radio-controlled devices or cell phone activated devices could also be used.

The following basic guidelines for ESS organizations were derived by the EMR-ISAC from multiple sources and reviewed here for the benefit of emergency planning and training:

<http://www.usfa.dhs.gov/fireservice/subjects/emr-isac/infograms/ig2009/14-09.shtm>

- (1) Anticipate the presence of a secondary device at any suspicious incident.
- (2) Search for a secondary device before moving into the incident area.
- (3) Avoid touching or moving anything that may conceal an explosive device.
- (4) Effectively manage the scene with boundaries, exclusion zones, triage areas, etc.
- (5) Evacuate victims and non-essential personnel as quickly as possible.
- (6) Preserve the scene as much as possible for evidence collection and crime investigation.

For frequently asked questions about SEDs, see the OSHA web site at <http://www.osha.gov/SLTC/emergencypreparedness/guides/secondary.html>.



## Why Use Chemicals As Weapons?

- Yield a toxic effect upon exposure
- Cause fear and present a major danger of mass casualties and mass fatalities
- Widely available
- Difficult to detect
- Time lag and anonymity



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### Trainer's Notes:

#### What Does a Chemical Attack Look Like?

Chemical incidents are characterized by the rapid onset (minutes to hours) of medical symptoms and easily observed signatures:

- Colored residue
- Dead foliage
- Pungent odor
- Dead insects and animals

#### What Are We Up Against?

Use of high explosives, chemical weapons are not limited to the militaries of superpower nations. Often called the "poor man's" weapons of mass destruction, these improvised devices have become relatively easy to produce, hide, and utilize. They can be created in "clandestine" chemical weapons shops.



## Module 2

### Types of Chemicals and Their Health Effects



Chemical release training, Photo courtesy IAFF

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#### Trainer's Notes:

Comparison of the approximate lethalties of the agents based in terms of respiratory toxicity, If chlorine is used as a baseline (1.0):

- Phosgene (CG) is about six times more toxic.
- Hydrogen cyanide (AC) is about seven times more toxic.
- Parathion, an insecticide ingredient, is about twelve times more toxic.
- Mustard (H) is about thirteen times more toxic.
- Sarin (GB) is about two hundred times more toxic.
- VX is about six hundred times more toxic.

For skin toxicity, less than a pinhead of mustard agent is required to achieve a small blister. Less than a pinhead of VX can be lethal.

#### Types of Harm by Agent

- Chemical (primary)
- Asphyxiation (primary): Some chemical reactions may deplete oxygen or create gases which displace oxygen.
- Thermal (secondary): Many chemical reactions create heat. Also many may be flammable.
- Mechanical (secondary): Corrosive chemicals like strong acids can weaken structural elements.
- Psychological (secondary)

**A primary harm is caused as a direct result of the agent's release.**

**A secondary harm is caused as an *indirect* result of the agent's release.**



## What is a “Hazardous Chemical”?

- Any chemical that can do harm to your body

**NOTE: Most industrial chemicals can harm you at some level of exposure and dose**

### All chemicals are found in one of three forms:

- Solid (aerosol, dust, fiber, fume)
- Liquid (aerosol, mist)
- Gas (vapor)



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### Trainer’s Notes:

#### What are will the chemical affect?

The affected area by the chemical will depend on many factors; primarily the chemicals physical properties, environmental factors and deployment method will have the greatest impact. If an explosive device is used, as much as 50% of some materials may be destroyed in the blast. In most cases, the greatest amount of material will settle close to the deployment site but small amounts can travel large distances.

#### Chemicals in Our Society

- The number of chemicals produced in industry now exceeds 87,000
- 500 new chemicals are introduced in industry every year
- Roughly 22% of work place diseases and injuries are caused by chemicals

**Source: International Labor Organization and the CAS**





## A Chemical's Effect on the Body Depends on Several Factors

- The physical form of the chemical
- How the chemical enters the body
- Chemical toxicity
- The amount of chemical that actually enters the body (dose)
- The individual's age, sex, race, and weight

**Chemicals can produce different health effects and sometimes can produce more than one effect at the same time.**

### **If solids get into the air...**

dust in the air can settle out on work surfaces, cups, plates, utensils, food, etc...

the settled dust can be swallowed with food or drinks or stirred back into the air

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### Trainer's Notes:

#### Chemicals Reactions to each other:

- Additive effects (alcohol and organic solvents)
- Synergistic effects (asbestos and cigarette smoke)
- Antagonistic effects (antibiotics and alcohol)
- Potentiating effects (alcohol and chlorinated hydrocarbons)

#### Chemical attack effectiveness is affected by meteorological conditions and other factors including:

- Temperature (air and ground)
- Humidity
- Precipitation
- Wind speed and direction
- Surrounding or nearby buildings and terrain
- Quantity and type of agent
- Type of dissemination (explosion, forced air, passive, higher altitude release, etc.)

#### Types of chemical exposures

##### *Acute*

- High exposure over a short time (instantaneous to a few days)
- After exposure stops, damage may reverse...or not.

##### *Chronic*

- Low exposure over a long time period (years)
- Can cause disease or other irreversible effects



## Liquids

- Can be absorbed through direct contact with the skin
- Can be inhaled through sprayed mists or evaporate to form vapors
- Mists can settle on the skin and be absorbed or settle and contaminate food or drink

## Gases and Vapors

- Constitute chemicals that are in the gas phase at room temperature
- Vapors evaporate from substances that are liquids or solids at room temperature
- Gases and vapors enter the body by inhalation and can reach the deep lung

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### Trainer's Notes:

#### Immediate vs. Delayed reaction

- Immediate shows up within minutes to a few hours.
- Some chemical weapons (mustard agents) may take a few hours to manifest symptoms.
- Delayed reactions will manifest up to 48 hours.
- **With most chronic exposures, you may have NO reaction until the disease has started to develop.**

#### Permanent vs. Reversible

- Some tissue and systems can reverse damage if the effect was not too bad, such as skeletal system and liver.
- Some tissues can not mend, such as the nervous system and kidneys.
- These can also depend on individual issues and type of exposures.

#### Local and systemic harm

- Some chemicals harm the body at the site of their exposure, such as an acid burn
- Other chemicals can effect entire body systems, such as lead and alcohol
- As if this is not enough, some can do both, such as alcohol



## How do chemicals enter your body?

- Ingestion
- Inhalation
- Absorption
- Injection

**Which one is  
the worst?**

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### Trainer's Notes:

Chemicals are only a hazard when you have been exposed to it. There are four major routes in which chemicals can enter your body.

1. The most common type of exposure is through inhalation. You inhale the chemical, which would then enter your lungs, where it would be absorbed into your blood stream. The majority of our exposure to chemicals is through inhalation. We breathe approximately 20 to 25 thousand breaths in one day, which averages a total volume of 10,000 – 14,000 liters of air in a day.
2. The second most common type of workplace chemical exposure is absorption through the skin. For certain chemicals, once it is absorbed through the skin, it goes into the blood stream.
3. The third most common type of chemical exposure is through ingestion, where the chemical enters the body through your mouth and is absorbed through the digestive tract. To minimize the ingestion route, good hygiene practices need to be observed - wash your face and hands prior to eating and drinking.
4. The last most common type of chemical exposure is through injection....where the chemical enters the body through a sharp object like a needle.



## Ingestion

- Chemicals can rub off dirty hands and contaminate food, drinks or tobacco products
- Chemicals in the air can settle on food or drink and be swallowed
- Swallowed chemicals are absorbed in the digestive tract
- Chemicals can be caught in mucus and swallowed

## Inhalation

- Airborne chemicals are breathed in through the mouth or nose
- Gases and vapors can reach the deep lungs
- Particle and droplet size affects where the chemical settles in the respiratory tract
- Where the chemical settles in the respiratory tract influences symptoms and diseases

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## Absorption

- If chemicals get onto the outside of your body they may be able to pass through to your blood stream
- Some areas are more at risk than others (i.e. eye, reproductive area, forehead)
- Open wounds can increase absorption
- Chemical properties affect absorption

## Injection

- Injection may occur when a worker is cut or their skin is punctured by a sharp, contaminated object such as metal, glass or a needle.
- Disaster response frequently requires handling of debris containing sharp objects.
- When handling sharp objects and debris that may be contaminated, wear a protective, durable work glove over your chemical protective glove.

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## Main Groups of Agents Used for Weapons Deployment

- Nerve agents (Cholinesterases inhibitors)
- Blister agents (Vesicants)
- Blood agents (Cyanogens)
- Choking agents (Respiratory system damaging)
- Incapacitating agents (Produce temporary effects)
- Toxic industrial chemicals (TICs)
- Incendiary chemicals
- Non Traditional Agents (NTA)

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### Trainer's Notes:

#### Signs of Nerve Agent Release

The most significant sign will be the rapid onset, within minutes, of similar symptoms in a large group of people. Except for dermal exposure, pinpointed pupils (miosis) are the best symptomatic indication of nerve agent use. Because nerve agents are so lethal, mass fatalities without other signs of trauma may also be present.

#### *Other signs include:*

- Explosions that seem only to destroy a package or bomb device
- Abandoned spray devices
- Numerous dead animals, fish, & birds
- Lack of insect life
- Mass casualties without obvious trauma
- Definite pattern of casualties and common symptoms
- Civilian panic in potential target areas (gov't buildings, public assemblies, subway system, etc.)

For more information, refer to other resources for specific agents hazards.

#### Nontraditional Agents:

Non-traditional agents (NTAs) are novel chemical threat agents or toxicants requiring adapted countermeasures. Encyclopædia Britannica Online: <http://www.britannica.com/EBchecked/topic/1404211/nontraditional-agent>



## Nerve Agents

### Signs and Symptoms of Nerve Agent Exposure:

#### “SLUDGEM”

**S = Salivation**

**L = Lacrimation (tearing)**

**U = Urination**

**D = Defecation**

**G = Gastrointestinal Distress (cramps)**

**E = Emesis (vomiting)**

**M = Muscle Twitching (bag of worms)**

Fire service bunker gear, properly worn will provide some limited protection for operations in the hot zone. **However, Level A protection is vital.**

**Nerve agents are some of the most toxic chemicals known.**

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### Trainer's Notes:

#### Nerve Agent Characteristics

- Clear, colorless, and tasteless liquids at ambient conditions
- All present a vapor hazard under temperate conditions
- All nerve agents penetrate the skin rapidly and well.
- Inhalation of vapors or aerosols are especially dangerous.
- Exposure to even minute quantities may be rapidly fatal.

#### Nerve Agent Detection

- Detection clues for nerve agents are limited because they resemble water or light oil without any characteristic odor.
- Clandestine activities that may involve nerve agent production may be evident by the presence of unusual chemicals, laboratory glassware, as well as underground "cook books," military manuals, or chemical textbooks.
- Organophosphate and Carbamate insecticides are also nerve agents that can be easily obtained

#### Nerve Agent Characteristics

*There are two major classes of nerve agents:*

- G-series agents
- V-series agents

The G agents are generally volatile and will evaporate, depending on concentration, in one to two days. The agents generally considered non-persistent and present both inhalation and skin contact threats.

VX has a low volatility and will evaporate about as quickly as motor oil. It is considered a persistent agent.

#### Nerve Agent Protection

Protection from these agents requires full respiratory and skin protection.



## Blister Agents

- Heavy oily liquids
- Pure state they are colorless and nearly odorless; Impure state they are dark colored
- Initial signs may include:
  - Complaints of eye and respiratory irritation
  - Reports of the characteristic odor of mustard, onion, or garlic
  - Similar symptoms experienced by a large number of people
- Signs may take hours to days to develop

**NOTE: A few drops of mustard on the skin can cause severe injury; 3 grams absorbed through the skin can be fatal.**

**Watch for explosions that dispense liquids, mists, or gas. Common types include explosions that seem only to destroy a package or bomb device, an unusual spray or abandoned spray devices.**

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### Trainer's Notes:

#### Types of Blistering Agents:

Mustards (H) (mustard agents); Lewisite (L); Phosgene oxime (CX); Phenylchloroarsine (PD); Ethylchloroarsine (ED)

#### Nitrogen Mustard

All of the nitrogen mustards are liquids that are dark in color and oily. These mustards are much more dangerous than sulfur mustard. The nitrogen mustard inflicts the most damage on the lower intestinal tract. The most toxic and most volatile of the three nitrogen mustards is HN-2, but HN-3 is used more because of its stability.

#### Phosgene Oxime (CX)

Phosgene oxime is found in both liquid and solid form. The only difference between this and the other mustards is that its "typical mustard agent effects" occur immediately after exposure.

#### Lewisite (L)

Lewisite is a dark oily liquid with a slight odor of geraniums and is a quick acting blistering agent that causes more pronounced blistering than most blistering agents. Once inside the body it causes systemic destruction. An exposure to a high concentration of Lewisite can kill in 10 minutes whereas a low exposure can cause symptoms to occur in 30 minutes. Lewisite is a mustard agent that is most often mixed with other chemical weapons agents to produce an extreme effect on an individual.

#### Phenylchloroarsine (PD)

PD has no odor or color and is most often in a liquid state. It is slightly less effective than sulfur mustard and all other characteristics of it are like that of sulfur mustard.

#### Ethylchloroarsine (ED)

ED causes an immediate irritating effect to any individual exposed to it, and is less persistent than sulfur mustard but is like sulfur mustard in every other way.





### Blood Agents

- Prevents the normal transfer of oxygen from the blood to the body tissues, resulting in chemical asphyxiation, rapid respiratory arrest and death.
- Cyanides or blood agents include common industrial chemicals, such as hydrogen cyanide and cyanogen chloride.\*
- **These commercially available and used in various manufacturing processes.**

### Choking Agents

- Choking agents cause harm by severely stressing the respiratory system tissue
- Severe distress produces profuse edema (resembles drowning) which can result in death by asphyxiation
- There are two choking agents:
  - Phosgene (CG) (smells like freshly cut grass)\*
  - Chlorine (Cl<sub>2</sub>)(smells like a swimming pool)\*
- **\*Both of these agents are commercially available and could be obtained and used as weapons.**

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**Trainer's Notes:**

\*There are two blood agents:

- Hydrogen cyanide (AC)
- Cyanogen chloride (CK)

Hydrogen cyanide (AC)

Common Names include: Formonitrile, Hydrocyanic acid, and Prussic acid.

Hydrogen cyanide (AC) is a systemic chemical asphyxiant. It interferes with the normal use of oxygen by nearly every organ of the body. Exposure to hydrogen cyanide (AC) can be rapidly fatal. It has whole-body (systemic) effects, particularly affecting those organ systems most sensitive to low oxygen levels: the central nervous system (brain), the cardiovascular system (heart and blood vessels), and the pulmonary system (lungs). It is used commercially and has a distinctive bitter almond odor (others describe a musty "old sneakers smell"), but a large proportion of people cannot detect it; the odor does not provide adequate warning of hazardous concentrations. It also has a bitter burning taste and is often used as a solution in water. (CDC)

[http://www.cdc.gov/NIOSH/ershdb/EmergencyResponseCard\\_29750038.html](http://www.cdc.gov/NIOSH/ershdb/EmergencyResponseCard_29750038.html)

Cyanogen chloride (CK)

Common Names include: Chlorcyan and Chlorine cyanide.

Cyanogen chloride (CK) is a highly volatile and toxic chemical asphyxiant that interferes with the body's ability to use oxygen. Exposure to cyanogen chloride (CK) can be rapidly fatal. It has whole-body (systemic) effects, particularly affecting those organ systems most sensitive to low oxygen levels: the central nervous system (brain), the cardiovascular system (heart and blood vessels), and the pulmonary system (lungs). Cyanogen chloride (CK) has strong irritant and choking effects. Its vapors are extremely irritating and corrosive. Cyanogen chloride (CK) is a chemical warfare agent (military designation CK). It is used commercially in chemical synthesis and fumigation. (CDC)

[http://www.cdc.gov/NIOSH/ershdb/EmergencyResponseCard\\_29750039.html](http://www.cdc.gov/NIOSH/ershdb/EmergencyResponseCard_29750039.html)



## Incapacitating Agents (Irritating Agents)

- Common incapacitating agents:
  - Chloropicrin
  - Chemical MACE
  - Tear gas
  - Capsicum/pepper spray
  - Dibenzoxazepine (CR)
- **Symptoms include burning and irritation of the eyes and throat**
- Effects are temporary although the irritant could trigger a secondary medical problem (such as an asthma attack or another respiratory problem).



**Not commonly used as a chemical weapon**

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### Trainer's Notes:

#### Chloropicrin

Chloropicrin is a clear, colorless, oily liquid with a strong, sharp, highly irritating odor. It is a strong lachrymator (watering of the eyes). Chloropicrin has been used as an insecticide and is most commonly used as a soil fumigant to control soil borne fungi, diseases and nematodes.

<http://pmep.cce.cornell.edu/profiles/extoxnet/carbaryl-dicrotophos/chloropicrin-ext.html>

#### Chemical MACE

Chemical MACE is a liquid that temporarily disables a person. It is prepared as an aerosol and sprayed in the face. It irritates the eyes and causes dizziness and immobilization.

<http://www.thefreedictionary.com/Chemical+Mace>

#### Tear Gas

Tear gas is any of a group of substances that irritate the mucous membranes of the eyes, causing a stinging sensation and tears. They may also irritate the upper [respiratory tract](#), causing coughing, choking, and general debility. Tear gas was first used in World War I in chemical warfare. Its effects are short-lasting and rarely disabling.

<http://www.britannica.com/EBchecked/topic/585270/tear-gas>

#### Capsicum/Pepper Spray

Aerosol sprays containing oleoresin capsicum, an extract of hot peppers, cause incapacitation through contact of the product with the skin, eyes, and respiratory system. The pain and irritation associated with pepper sprays arise from a family of compounds called capsaicinoids.

<http://www.nist.gov/cstl/analytical/organic/pepperspray.cfm>

#### Dibenzoxazepine (CR)

Most exposures are inhalational, ocular, or dermal and typically lead to complaints of eye, nose, and throat irritation; hacking cough; suffocation or choking sensation; and dyspnea (unpleasant or uncomfortable breathing). Although unlikely, high-dose exposures in an enclosed space may lead to the development of airway edema, noncardiogenic pulmonary edema, and possibly respiratory arrest.

<http://www.medterms.com/script/main/art.asp?articlekey=31475>



## Toxic Industrial Chemicals (TICs)

- Respiratory irritants
  - Acids, ammonia, acrylates, aldehydes, isocyanates
- Choking
  - Chlorine, hydrogen sulphate, phosgene
- Flammable gases
  - Acetone, alkenes, alkyl halides, amines
- Oxidizers
  - Oxygen, butadiene, peroxides
- Organophosphate pesticides

**TICs are any chemical with LCt50 less than 100,000 mgmin/m<sup>3</sup> and produced in quantities exceeding 30 tons annually at one facility-DOD**



**Interceptor trench train derailment**

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### Trainer's Notes:

Picture from IL EPA

#### Sources of Toxic Industrial Chemicals (TICs):

- Chemical manufacturing plants
- Food processing facilities
- Transportation assets
- Storage tanks/facilities
- Airports
- Barge terminals
- Pumping stations
- Mining operations

#### Special NOTE: Clandestine Laboratories

- Response personnel must also be aware of the dangers that clandestine labs can pose
- Both drug and weapons labs can be dangerous
- Multiple chemicals used
- "Street" chemists may have little or no chemical background
- Products created by clandestine methods is NOT an exact science; resulting in an unpredictable environment for the responder and skilled support
- NOTE: Additional training is required**



## Monitoring for Chemical Agents



**ADP 2000**



**CAM**

**PIDs**



**M8/M9 Tape**



**HAPSITE  
portable GG/MS**



**Combustible  
Gas Indicator**

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### Trainer Notes:

Even though CGIs and PIDs are traditional Hazmat tools, government agencies use these in addition to the dedicated "WMD" detectors.

#### ADP 2000

- Portable, hand-held device that can be used as a detector or as a continuously sampling monitor
- Simultaneously detects nerve and blister agents (GA, GB, GD, VX, HD, HN, L, Pepper spray, Mace)
- Powered by six internal alkaline or rechargeable batteries, external ac sources, or 9 to 18 V dc from a vehicle or external power supply
- Tested by SBCCOM Domestic Preparedness Program against live agents and found effective

#### Chemical Agent Monitor (CAM) and Improved CAM

- Detects, identifies, and provides relative vapor hazard read-outs for G and V nerve agents and H blister agents within one minute of agent exposure
- IMS technology

#### *Missions:*

- Area reconnaissance & Surveillance
- Decontamination operations
- Medical triage operations



## How can you protect yourself from hazardous chemicals?

- Reduce the threat and impact of terrorism and accidental release of chemicals by conducting vulnerability surveys for facilities and transportation routes/methods to identify areas where chemicals could be:
  - More securely stored
  - Reduce quantities stored on site
  - Transported through less populated or environmentally rich areas

When dealing with health and safety hazards try to control them by using the hierarchy of controls



### Trainer's Notes:

Controlling exposures to occupational hazards is the fundamental method of protecting workers. Traditionally, a hierarchy of controls has been used as a means of determining how to implement feasible and effective controls. One representation of this hierarchy can be summarized as follows:

- Elimination
- Substitution
- Engineering controls
- Administrative controls
- Personal protective equipment

The idea behind this hierarchy is that the control methods at the top of the list are potentially more effective and protective than those at the bottom. Following the hierarchy normally leads to the implementation of inherently safer systems, ones where the risk of illness or injury has been substantially reduced.

Elimination and substitution, while most effective at reducing hazards, also tend to be the most difficult to implement in an existing process. If the process is still at the design or development stage, elimination and substitution of hazards may be inexpensive and simple to implement. For an existing process, major changes in equipment and procedures may be required to eliminate or substitute for a hazard.

Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection. The initial cost of engineering controls can be higher than the cost of administrative controls or personal protective equipment, but over the longer term, operating costs are frequently lower, and in some instances, can provide a cost savings in other areas of the process.

Administrative controls and personal protective equipment are frequently used with existing processes where hazards are not particularly well controlled. Administrative controls and personal protective equipment programs may be relatively inexpensive to establish but, over the long term, can be very costly to sustain. These methods for protecting workers have also proven to be less effective than other measures, requiring significant effort by the affected workers.

29 CFR 1910.120(g) Engineering controls, work practices, and personal protective equipment for employee protection.

Engineering controls, work practices and PPE for substances regulated in Subpart Z. (i) Engineering controls, work practices, personal protective equipment, or a combination of these shall be implemented in accordance with this paragraph to protect employees from exposure to hazardous substances and safety and health hazards.

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=standards&p\\_id=9765](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9765)



## Medical Countermeasures Chemical WMDs: Current Capabilities

### Pre-treatment

- *Pyridostigmine Bromide (NAPP)* (Inhibits “aging” of GD)  
**\*Not licensed\***

### Treatment

- *Atropine (Mk I)* (Blocks nerve agent)
- *Diazepam (CANAs)* (Anti-convulsant)
- *Pralidoxime Chloride (2-PAM Cl) (Mk I)* (Regenerates Cholinesterase)
- *Skin Exposure Reduction Paste Against Chemical Warfare Agents (SERPACWA)*



### Diagnosis

- *Field Cholinesterase Kit*

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### Trainer's Notes:

#### Pyridostigmine Bromide (NAPP)

Nerve Agent Pyridostigmine Pretreatment Tablet Set, NAPP. This is the pretreatment medication to be taken within 8 hours or less prior to exposure to nerve agents and use of the MARK 1. a. Description. The NAPP consists of 30=g pyridostigmine bromide tablets (21 total) which are packaged in a blister pack. Each blister pack (NAPP) contains enough tablets for 7 days (1 taken every 8 hours).

[http://www.gulfink.osd.mil/declassdocs/army/19960924/092496\\_aug96\\_decls5\\_0003.html](http://www.gulfink.osd.mil/declassdocs/army/19960924/092496_aug96_decls5_0003.html)

#### Atropine (Mk I)

Atropine stops the effect of the nerve agent by blocking the effects of over-stimulation. It effectively counters the actions of the nerve agent at nerve receptors. Atropine relieves the smooth muscle constriction in the lungs (wheezing, respiratory distress) and gastrointestinal (diarrhea, cramps) tract, and also dries up respiratory tract secretions.

<http://www.health.state.ny.us/nysdoh/ems/policy/03-05.htm>

#### Pralidoxime Chloride (2-PAM Cl) (Mk I)

The companion drug to Atropine is 2-PAM CL; this drug complements the action of Atropine. 2-Pam Chloride acts to restore normal functions at the nerve ending by removing the nerve agent and affecting toxin irreversibility. This antidote is effective at re-establishing normal skeletal muscle contraction (relieves twitching and paralysis of respiratory muscles).

<http://www.health.state.ny.us/nysdoh/ems/policy/03-05.htm>

The "Mark I Kit" contains antidotes to be used in instances of exposure to a nerve or organophosphate agent. The Mark I kit consists of two autoinjectors containing Atropine Sulfate and Pralidoxime Chloride.

#### Skin Exposure Reduction Paste Against Chemical Warfare Agents (SERPACWA)

SERPACWA is a barrier cream for use by service members to protect against the toxic effects of CW agents (such as blister [vesicant] and nerve agents). SERPACWA, when used in conjunction with MOPP gear, will prevent or significantly reduce the toxicity following cutaneous exposure to CW agents. Skin exposure reduction paste against chemical warfare agents serves as an antipenetrant barrier to CW agent. The SERPACWA was approved by the FDA in 2000 for use against chemical agents.

<https://rdl.train.army.mil/soldierPortal/afia/adlsc/view/public/24397-1/FM/4-02.285/appd.htm>



# How is Chemical Protective Clothing (CPC) Selected?

## Four point approach to selecting CPC

1. Evaluate hazard
2. Evaluate exposure to hazard
3. Evaluate chemical resistance
4. Evaluate physical resistance



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### Trainer's Notes:

#### What are the Health and Safety Issues of Wearing Personal Protective Equipment (PPE)?

- Heat stress
- Limited agility and dexterity
- Limited vision
- Limited hearing
- Issues of claustrophobia
- PPE is last on the Hierarchy of Controls!**

#### Resources:

NIOSH Personal Protective Equipment for Health Care Workers Who Work with Hazardous Drugs  
<http://www.cdc.gov/niosh/docs/wp-solutions/2009-106/>

National Academies Press

<http://www.nap.edu/readingroom.php?book=terrorism&page=ch3.html>

#### PPE Permeability

The American Society for Testing and Materials (ASTM) has developed methods for testing the permeability of protective clothing materials against a battery of liquids and gases.

<http://www.astm.org/>



## Personal Protective Equipment (PPE)

NIOSH recommends using the HAZWOPER standard definitions for Levels of protection to chemical weapon releases.

- Four and ½ levels of PPE
  - Level A
  - Level B and B+
  - Level C
  - Level D

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### Trainer's Notes:

See NIOSH CBRN PPE guidance document for further information about selecting PPE levels for chemical weapon release.  
<http://www.cdc.gov/niosh/docs/2008-132/pdfs/2008-132.pdf>

Depending upon your work site's PPE program and assigned job task, any of the following PPE may be required:

- Protective clothing ranging from standard coveralls to a chemical resistant suit with hood and booties.
- Respirator ranging from an N-95 to a PAPR for high exposure and strenuous work. In rare cases a supplied air respirator may be required.
- Protective footwear with steel toe and insole. A chemical resistant boot or outer boot may be required for some work.

### Guidance Document

PERSONAL PROTECTIVE EQUIPMENT (PPE) Levels and When They Should Be Use  
[http://www.dem.ri.gov/topics/erp/7b\\_1.pdf](http://www.dem.ri.gov/topics/erp/7b_1.pdf)





## Tips for Using PPE

- **NEVER use damaged PPE**
- Only use PPE that has been properly selected for the given hazard and that correctly fits
- Make sure you have had training before donning PPE in the hazard zone
- Always inspect PPE before use

**Only use PPE as a last resort to control hazards!**

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### Trainer's Notes:

#### Tips for Using PPE

- Disposable cut/abrasive resistant work glove. A chemical resistant glove may be required for some work.
- Fully enclosed goggles (better for ash) or safety glasses.
- Ear protection in noisy areas.
- Head protection if in construction or demolition zones.
- Be sure to follow your work site's PPE program.
- If you are working near downed power lines, use Nomex clothing compliant with NFPA 1500, rubber gloves, dielectric overshoes and insulated tools
- **The OSHA PPE standard (29 CFR 1910 Subpart I) must be followed when selecting and implementing PPE.**



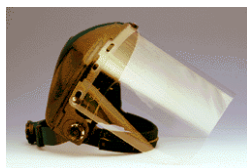
# PPE Examples



Safety glasses



Safety Goggles



Face Shield



Level C PPE with tyvek splash suit and APR respirators



Example of Leather gloves  
Courtesy Kirkwood



Example of Nitrile gloves  
Courtesy Kirkwood



N-95 respirator



1/2 face APR



Full face APR



PAPR

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Trainer's Notes:



## Level A

- Supplied air respirator
- Encapsulating suite
- Inner and outer gloves (outer gloves are part of the suite)
- Boots (could be part of the suit)
- May have head protection



Green suits

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### Trainer's Notes:

#### Level A definition as given by the EPA (general guideline):

Level A protection is required when the greatest potential for exposure to hazards exists, and when the greatest level of skin, respiratory, and eye protection is required. Examples of Level A clothing and equipment include positive-pressure, full face-piece self contained breathing apparatus (SCBA) or positive pressure supplied air respirator with escape SCBA, totally encapsulated chemical- and vapor-protective suit, inner and outer chemical-resistant gloves, and disposable protective suit, gloves, and boots.



## Level B and B+

- Supplied air respirator
- Splash suite (may cover SCBA for B+)
- Inner and outer gloves
- Boots
- May have head protection



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### Trainer's Notes:

#### Level B definition as given by the EPA (general guideline):

Level B protection is required under circumstances requiring the highest level of respiratory protection, with lesser level of skin protection. At most abandoned outdoor hazardous waste sites, ambient atmospheric vapors or gas levels have not approached sufficiently high concentrations to warrant level A protection -- Level B protection is often adequate. Examples of Level B protection include positive-pressure, full face-piece self contained breathing apparatus (SCBA) or positive pressure supplied air respirator with escape SCBA, inner and outer chemical-resistant gloves, face shield, hooded chemical resistant clothing, coveralls, and outer chemical-resistant boots.



## Level C

- APR (full or ½ face) or PAPR
- Splash suite
- Inner and outer gloves
- Eye Protection if ½ face APR is worn
- Boots
- May have head protection



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### Trainer's Notes:

#### Level C definition as given by the EPA (general guideline):

Level C protection is required when the concentration and type of airborne substances is known and the criteria for using air purifying respirators is met. Typical Level C equipment includes full-face air purifying respirators, inner and outer chemical-resistant gloves, hard hat, escape mask, and disposable chemical-resistant outer boots. The difference between Level C and Level B protection is the type of equipment used to protect the respiratory system, assuming the same type of chemical-resistant clothing is used. The main criterion for Level C is that atmospheric concentrations and other selection criteria permit wearing an air-purifying respirator.



## Level D

- Could include:
  - Apron
  - Gloves
  - Hard hat
  - Eye Protection
  - Boots
  - (Basic work PPE)



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### Trainer's Notes:

#### Level D definition as given by the EPA (general guideline):

Level D protection is the minimum protection required. Level D protection may be sufficient when no contaminants are present or work operations preclude splashes, immersion, or the potential for unexpected inhalation or contact with hazardous levels of chemicals. Appropriate Level D protective equipment may include gloves, coveralls, safety glasses, face shield, and chemical-resistant, steel-toe boots or shoes.



**SCBA**



**PAPR**



**Air Line SAR w/escape**



**APR**

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**Trainer's Notes:**

Types of Respirators

*Supplied Air*

- Self Contained Breathing Apparatus (SCBA)
- Air Line

*Powered Air Purifying Respirators (PAPR)*

*Air Purifying Respirators (APR)*

- Full Face
- Half Face

Issues with Respirators

- Respiratory protection program
- Medical clearance
- Fit testing
- Proper selection
- Evaluate Chemical Hlf APR is there a cartridge
- Determine if there is a governing standard



## Respirators

### Wearing NIOSH-approved respirators:

- An N-95 or greater respirator may be acceptable for some activities
- Use an elastomeric, half-mask respirator with N,R, or P-100 series filters if asbestos or carcinogen may be present
- If airborne contaminants are causing eye irritation, full-face respirators with P-100 organic vapor/acid gas (OV/AG) combination cartridges should be used
- **Surgical masks should not be used because they do not provide adequate protection**
- Replace filters when breathing becomes difficult or you detect an odor through organic vapor cartridges



½ face respirator with P-100/OV/AG cartridges

**If in doubt about respirators, see your Supervisor!**

**See: OSHA respiratory protection standard, 29 CFR 1910.134**

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### Trainer's Notes:

#### Respirator Issues

- Protect yourself from breathing dust, it can contain toxic material.
- An N-95 or greater respirator is acceptable for most activities, including silica and portland cement dust
- If asbestos is present, use a half-mask elastomeric respirator with N,R, or P-100 series filters
- If airborne contaminants are causing eye irritation, full-face respirators with P-100 OV/AG combination cartridges should be used
- Make sure you are fit-tested for a respirator, it must fit properly to protect you
- Surgical masks should **not** be used because they do not provide adequate protection
- If in doubt about respirators, see your supervisor!**

#### Special rules for respirators

- Make sure you are medically cleared to wear your chosen respirator.
- Make sure you received the required training.
- Make sure you are fit tested for your respirator.
- Inspect your respirator each time you put it on and take it off.
- Perform a user seal check each time you put it on.
- Clean your elastomeric respirator at least once a day in accordance with manufacturers recommendations.
- Store elastomeric respirators in a clean bag.
- If your respirator becomes damaged or fails to function, stop work and retrieve a new one.

#### To properly select a respirator you must know:

- Know what the chemical is
- If there is already an applicable standard (i.e. asbestos standard)
- Know oxygen levels
- Know contaminant concentration
- Know if there is an approved cartridge (if APR)





## Noise Exposure

- Wear appropriate hearing protection in noisy work environments.
  - Examples: chainsaws, heavy equipment and blowers
- A worksite is considered noisy if you have to shout to be heard within three feet.
- The OSHA PEL for noise 90dB.



Ear plugs



Ear muffs

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### Trainer's Notes:

OSHA 29 CFR 1910.95

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=standards&p\\_id=9735](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9735)

OSHA Safety and Health Topics Noise and Hearing Conservation

<http://www.osha.gov/SLTC/noisehearingconservation/>



## Decontamination (Decon)

- Process of removing, destroying, or reducing the activity of materials such as ash, asbestos, or toxic chemicals that could endanger a person or the environment.
- Prevents spreading contamination to other locations (like your vehicle or home).
- **Site workers who use the site's Standard Operating Procedures/Guidelines (SOP/SOG) are less likely to be contaminated than site workers who do not use these practices.**



**Depending on your job task, you may come in contact with hazardous materials which will require you to be decontaminated**

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### Trainer's Notes:

A decontamination plan should include:

- Training
- Location and layout of decontamination stations and areas
- Decontamination methods
- Required decontamination equipment
- Standard Operating Procedures (SOPs) to minimize worker contact with contamination during decontamination
- SOPs for decontamination line personnel
- Procedures for collection, storage and disposal of clothing equipment and any other materials that have not been completely decontaminated
- Disposal of PPE and decon solutions as contaminated waste
- Adequate personal washing stations



## Types of Decontamination Procedures



Mass decon: Photo courtesy IUOE



Emergency decon: Photo courtesy IAFF



Self decon: Photo courtesy SEIU

Patient decon: Photo courtesy IUOE



Technical decon: Photo courtesy IAFF



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### Trainer's Notes:

#### Decon Resources

Department of Energy (DOE) Transportation Emergency Preparedness Program (TEPP) Planning Products Model Procedure for Radioactive Material or Multiple Hazardous Materials Decontamination

[http://www.em.doe.gov/PDFs/transPDFs/Decon\\_Procedure.pdf](http://www.em.doe.gov/PDFs/transPDFs/Decon_Procedure.pdf)

Emergency Management Center (EMC) at Oak Ridge National Laboratory Self- and Buddy-Decontamination Procedures

[http://emc.ornl.gov/CSEPPweb/PDF/poster\\_decon.pdf](http://emc.ornl.gov/CSEPPweb/PDF/poster_decon.pdf)



## Module 3

### Other Issues During Chemical Responses



Photo courtesy of IAFF

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Trainer's Notes:



## National Incident Management System (NIMS)

- Establishes uniform set of procedures to be used by emergency responders at all levels of government to conduct response operations.
- Designed to provide a framework for incident management – “One mission, one team...”
- Used for ALL types of incidents (mass casualty, planned events).
- First standardized approach to incident management and response.

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### Trainer's Notes:

#### National Incident Management System (NIMS)

The National Incident Management System (NIMS) provides a systematic, proactive approach to guide departments and agencies at all levels of government, nongovernmental organizations, and the private sector to work seamlessly to prevent, protect against, respond to, recover from, and mitigate the effects of incidents, regardless of cause, size, location, or complexity, in order to reduce the loss of life and property and harm to the environment. NIMS works hand in hand with the National Response Framework (NRF). NIMS provides the template for the management of incidents, while the NRF provides the structure and mechanisms for national-level policy for incident management.

NIMS is not an operational incident management or resource allocation plan. NIMS represents a core set of doctrines, concepts, principles, terminology, and organizational processes that enables effective, efficient, and collaborative incident management. NIMS was released in March 2004.

[http://www.fema.gov/pdf/emergency/nims/NIMS\\_core.pdf](http://www.fema.gov/pdf/emergency/nims/NIMS_core.pdf)



## Core Elements of NIMS

- Incident Command System (ICS)
- Preparedness (planning, training, exercises, qualifications and certifications of all personnel involved in incidents)
- Communications and Information Management
- Joint Information System
- NIMS Integration Center



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### Trainer's Notes:

#### Elements of NIMS

Within NIMS, preparedness focuses on the following elements: planning; procedures and protocols; training and exercises; personnel qualifications, licensure, and certification; and equipment certification. Effective adoption, implementation, and training of all NIMS components in advance of an incident or planned event will facilitate collaborative emergency management and incident response activities. Preparedness is a foundational step in emergency management and incident response; therefore, the concepts and principles that form the basis for preparedness are an integration of the concepts and principles of all NIMS components.

[http://www.fema.gov/pdf/emergency/nims/NIMS\\_core.pdf](http://www.fema.gov/pdf/emergency/nims/NIMS_core.pdf)



## Incident Command System (ICS)

- **Used to manage emergency situations (like chemical releases)**
- ICS uses:
  - Unity of command (one person in charge)
  - Span of control to manage personnel (3 - 7 people under one supervisor)
  - Life safety code
  - A modular system to manage resources (a system that can expand and contract with the emergency event)
  - Common terms to promote seamless communication



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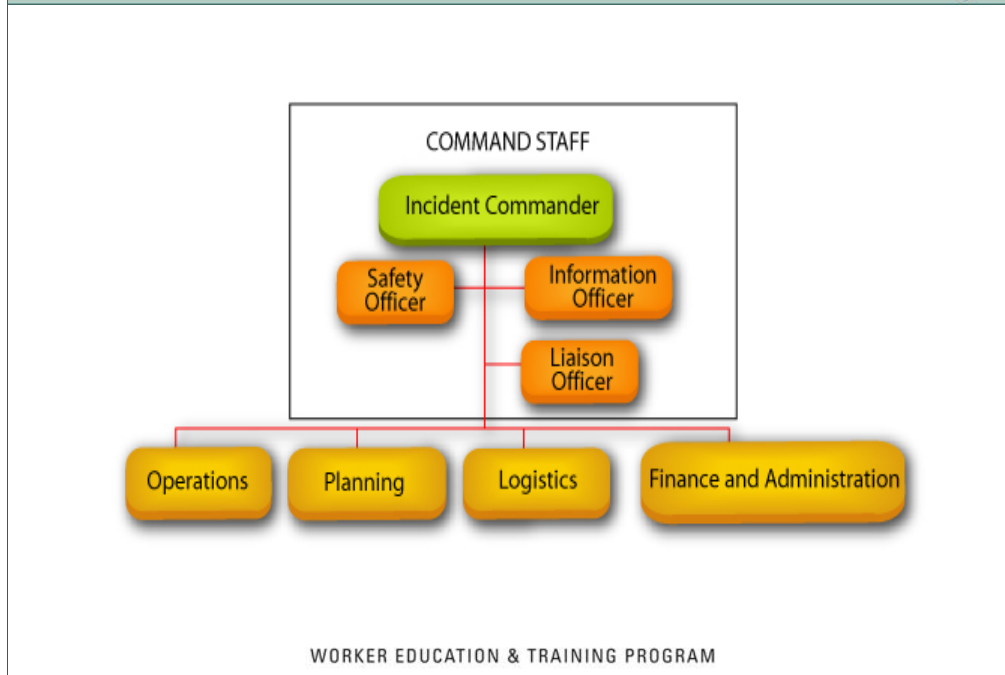
### Trainer's Notes:

#### Span of control

- 5 is the optimal number of people to have under one supervisor

#### Life safety code is:

- Protect self and public
- Control incident
- Protect property and environment



**Trainer's Notes:**

The National Incident Management System (NIMS) requires the use of the Incident Command System at domestic emergencies involving multi-jurisdictional participation.

Effective coordination (of both personnel and equipment) among local, state, and federal responders at the scene of a response is a key factor in ensuring successful responses to major incidents. An Incident Command System/Unified Command (ICS/UC) is the tool used to manage all emergency response incidents. Understanding the concepts of ICS/UC is as important for local responders, who generally arrive on-scene first and thus are most likely to implement the management system, as it is for state and federal organizations and any skilled support personnel that may be joining the response.

ICS is a standardized on-scene incident management concept designed specifically to allow responders to adopt an integrated organizational structure without being hindered by jurisdictional boundaries.

An ICS allows integrated communication and planning by establishing a manageable span of control. An ICS divides an emergency response into five manageable functions: Command, Operations, Planning, Logistics, and Finance and Administration.

You can find more information on ICS at <http://www.osha.gov/SLTC/etools/ics/about.html>.

The following training (and more) is available from FEMA's Emergency Management Institute: ICS-100, Introduction to ICS; ICS-200, Basic ICS and IS-700: NIMS An Introduction.

Information on who must take what training can be found at <http://www.fema.gov/emergency/nims/faq/training.shtm>.





## Health and Safety Plans (HASP)

OSHA has set regulations that require Health and Safety Plans (HASP) to protect workers involved in national response operations. (OSHA, 29 CFR 1910.120, HAZWOPER)



**Review your  
HASP before  
you start work!**

Photo from EPA; it is of an IL waste water treatment plant explosion in 2004.

The HASP serves as a guide for employers and workers to follow during their daily operations to prevent the spread of contamination, injury, and death.

WORKER EDUCATION & TRAINING PROGRAM

### Trainer's Notes:

OSHA, 29 CFR 1910.120, HAZWOPER

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=standards&p\\_id=9765](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9765)

Model Health & Safety Plan (HASP) for Clean-up of Facilities Contaminated with Anthrax Spores

<http://www.osha.gov/dep/anthrax/hasp/index.html>

This HASP template was prepared by OSHA and funded by EPA. It provides model language that is acceptable to OSHA in meeting the requirements of OSHA's Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard, 29 CFR 1910.120 or 29 CFR 1926.65, paragraph (b)(4). There are 13 HASP chapters included here, one for each of the required elements listed in paragraph (b)(4) of HAZWOPER.

The chapters include:

1. Organizational Structure
2. Site Characterization and Job Hazard Analysis
3. Site Control
4. Training
5. Medical Surveillance
6. PPE
7. Exposure Monitoring
8. Heat Stress
9. Spill Containment
10. Decontamination
11. Emergency Response
12. Standard Operating Procedures (SOPs)
13. Confined Spaces



## HASP (continued)

Any HASPs must cover **ALL** of the following:

- Introduction
- Key Personnel
- Hazard Assessment
- Training
- PPE
- Temperature Extremes
- Site Control
- Decontamination
- Emergency Response/Contingency Plan
- Emergency Action Plan
- Confined Space Entry
- Spill Containment
- Exposure Monitoring and Air Sampling

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Trainer's Notes:



## Proper Instruction for Emergency Responders

Personnel shall be given:

- An initial briefing at the site prior to their participation
- Instruction in the wearing of appropriate personal protective equipment
- Information on what chemical hazards are involved
- Explanation of what duties are to be performed
- All other appropriate safety and health precautions

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### Trainer's Notes:

#### Examples of emergency responders and their activities:

- Electrician needed to cut power in order to insure the safety of responders
- Fork lift driver needed to reposition a rail car during initial response
- Mental health experts
- People sampling for exposures from a variety of agencies.

#### Best Practices

- Never work alone around exhaust gases.
- Conduct air quality tests prior to/during work near exhaust gases where internal combustion engines are running.
- Direct exhaust gases away from the work area.
- Avoid exposure to exhaust gases wherever possible.
- Install carbon monoxide detectors in work areas where internal combustion engines are being utilized.
- Maintain internal combustion engines in good working condition to minimize toxic exhaust gases.
- **Ensure good ventilation to all work areas**

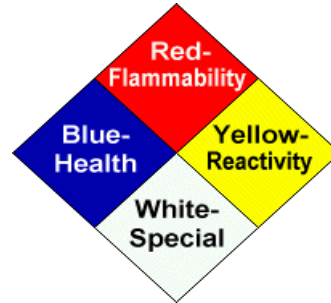
#### General Safety Tips

- Be careful and use safety measures outlined in your worksite's HASP at all times.
- Walking/working surfaces may be wet, slippery and unstable. Spread sand and wear slip resistant footwear if possible, to reduce slips and falls.
- Walking over and handling debris that is unstable can cause cuts, scrapes, bruises, sprains, etc.
- Make sure you have had a current tetanus vaccination.
- Revaccinate for a dirty wound if current vaccination is over 5 years old
- If you will be performing direct patient care or otherwise expect to have contact with bodily fluids, get the Hepatitis B vaccine series
- Use steel toe insole, non-slip footwear.
- Use durable outer gloves when handling debris.
- Wear ear protection for noisy environments.
- Wear eye protection (e.g. goggles) for environments with air debris.



## Hazardous Materials and Hazard Communication

- If an explosive device was used to deliver the agent, or if a severe crash or explosion was involved, it may have dislodged or damaged tanks, drums, pipes, and equipment which may contain hazardous materials not present in the initial portion of the incident.
- Do not handle unidentified or damaged containers-report these to your supervisor.
- Understand Material Safety Data Sheets (MSDS). Follow as appropriate.
- NFPA 704M warning labels may also be useful in the field.
- Specific Hazard Communication training is required for any potential chemicals that you may come in contact with.



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### Trainer's Notes:

#### Examples of potential explosive devices:

- Compressed gas cylinders and propane cylinders
- Gasoline cans (and other fuel containers)
- Bulk chemicals & chemical containers
- Lead acid batteries
- Transformers
- Paints and thinners
- Bulk pesticides
- Bulk fertilizers
- Munitions
- Laboratory equipment
- Electrical Transformers
- Air conditioners
- Large metal appliances, lawn mowers, tractors, chainsaws, ATVs, etc.
- Automobiles



## Emergencies in the Field

- Ask what first aid support is available during your briefing and be sure you understand where it is located.
- If infrastructure is damaged, understand how that may effect responders requiring medical attention.
- For minor injuries or health concerns go to:
  - First Aid
  - Local hospitals or clinics
  - EMT or nurse station
- For serious emergencies call 911
  - Know your exact location
- Notify your supervisor about all injuries and emergencies.



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### Trainer's Notes:

**Before work assignments**, understand how emergency services will be contacted (i.e., on-site service, cell phone, cb radio, etc.). Especially in densely populated areas emergency services may be severely overloaded. Also, medical facilities, access ways and equipment may be damaged in not functioning.

**OSHA Subpart D 1926.23** contains specific requirements for the provision of first aid, medical attention, and emergency facilities.

### Additional OSHA requirements:

- Names of employees to contact for further information
- Training of sufficient employees to assist in evacuation **before** program is implemented
- The plan must be reviewed whenever a change has taken place and upon initial assignment
- If the employer has 10 or fewer employees, the program can be communicated verbally



## Structural Integrity

- **Never assume that damaged structures or ground are stable.** Have it certified safe by a registered professional engineer or architect.
- Assume all stairs, floors and roofs are unsafe until inspected.
- Explosions can rearrange and damage many types of structures.
- Watch out for unstable ground or flooring that could give way to a lower level.



**Leave immediately if you hear shifting or unusual noises. A COLLAPSE MAY BE OCCURRING!**

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### Trainer's Notes:

For more information, visit the NIOSH Structural Collapse topic page "Preventing Injuries and Deaths of Fire Fighters due to Structural Collapse" ([www.cdc.gov/niosh/99-146.htm](http://www.cdc.gov/niosh/99-146.htm)).

OSHA requires walls or floor to be shored or braced before demolition if workers are within structure. Cut off, cap or control all service utility lines outside the building before demolition work is started. Notify appropriate utility company in advance.

If it is necessary to maintain any utilities during demolition, such lines shall be temporarily relocated and protected.

Determine if any hazardous substances have been on the property. Remove any found hazardous substance before demolition. Do not cut or remove any structural or load-supporting members on any floor until all stories above such a floor have been demolished and removed.



## Debris Piles and Unstable Surfaces

- **Only walk and work on surfaces you know are stable.** When possible, use other ways to get to work surfaces, such as bucket trucks.
- Erect scaffolding and park lift equipment on stable surfaces and anchor it to stable structures.
- Wear protective equipment provided, including hard hats, safety glasses, leather gloves and safety shoes with slip resistant soles.
- Use fall protection with lifelines tied off to suitable anchorage points, including bucket trucks, whenever possible.



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### Trainer's Notes:

#### Debris Removal Hazards Concerns:

- Overhead power lines
- No traffic control (direction)
- Congested, bottle-neck areas
- Worker on top of potentially unstable load
- Modified trailer used to haul oversized load debris
- Low visibility from dust, smoke and/or ash



## Heavy Equipment Use

- **OSHA requires machinery to be inspected by a qualified worker before each use.**
- Be alert to the activities around you.
- Do not use equipment unless trained to do so.
- Do not walk under or through areas where heavy equipment is lifting objects or behind equipment.
- Do not climb onto or ride loads being lifted or moved. Do not ride on equipment or in bucket.
- Pay attention to extremely sloped terrain.
- Do not exceed the load capacity of lifting equipment.



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### Trainer's Notes:

Types of heavy equipment that may be used during chemical release response and cleanup include: Front end loaders, Excavators/backhoes, Forklifts, Bobcats, ATVs, Tractors, Cranes, Trailers, and Dump trucks

Structures are often built into the hillside or located adjacent to a steep embankment. Be careful of the lay of the land and use spotters when operating equipment on or near this type of terrain. **DO NOT EXCEED EQUIPMENT'S ABILITY TO HANDLE THE SLOPE OF THE TERRAIN.**

### Congestion of heavy equipment and debris

#### APPLICABLE OSHA STANDARD

1926.550(a)(5) The employer shall designate a competent person who shall inspect all machinery and equipment prior to each use, and during use, to make sure it is in safe operating condition. Any deficiencies shall be repaired, or defective parts replaced, before continued use.

1926.550(a)(6) A thorough, annual inspection of the hoisting machinery shall be made by a competent person, or by a government or private agency recognized by the U.S. Department of Labor. The employer shall maintain a record of the dates and results of inspections for each hoisting machine and piece of equipment.

### Competent Person:

1926.32(f) defines competent person as one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. The OSHA construction standards do not require employees performing crane inspections to have a Level II rating, which is a term used in an ANSI standard not referenced in the OSHA standards.





## Aerial Lifts

Vehicle-mounted devices used to get a worker to an elevated position (called cherry pickers or boom trucks)

- Read and understand the safety and operating instructions before using. Elevate the lift only when it is on a firm and level surface and never drive when the lift is elevated above the safe limit.
- Never use near electric lines unless they are deenergized or adequate clearance is maintained.
- Check for overhead objects and stay far from debris piles, drop-offs, and floor openings.
- Refuel tanks only when the unit is off and charge batteries in a well ventilated area away from open flames.
- Whenever working out of a aerial lift, a full body harness must be worn and properly attached to the basket.

**Only trained  
and authorized  
people may  
operate the lift.**

WORKER EDUCATION & TRAINING PROGRAM

Trainer's Notes:



## Falls from Heights Six Feet and Higher

- Employees shall be protected from falls greater than six feet to a lower level. (29 CFR Part 1926.500)
  - Guardrail systems
  - Safety net systems
  - Fall arrest systems (less effective than guardrail and safety net systems)
  - Cover or guard any openings or floor holes as soon as they are created
  - Make sure floor hole covers support two times the weight of employees, equipment, and materials
  - Be careful when stepping into areas that are unstable/uneven or where the surface cannot be visualized (i.e., if covered by water)



**Workers should prevent items from falling onto people below.**

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### Trainer's Notes:

29 CFR Part 1926.500

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_id=10756&p\\_table=STANDARDS](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10756&p_table=STANDARDS)

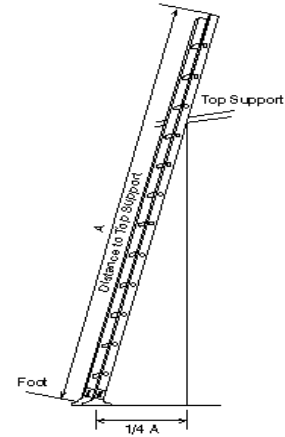
This subpart sets forth requirements and criteria for fall protection in construction workplaces covered under 29 CFR part 1926. Exception: The provisions of this subpart do not apply when employees are making an inspection, investigation, or assessment of workplace conditions prior to the actual start of construction work or after all construction work has been completed.



## Ladder Safety

**Ladders can create a falling hazard. Make sure your ladder is secure.**

- Position portable ladders so the side rails extend at least 3 feet above the landing.
- Secure side rails at the top to a rigid support and use a grab device when 3 foot extension is not possible.
- Do not apply more weight on the ladder than it is designed to support and make sure that the weight on the ladder will not cause it to slip off its support.
- Before each use, inspect ladders for cracked, broken, or defective parts.
- Use only ladders that comply with OSHA standards.



WORKER EDUCATION & TRAINING PROGRAM

Trainer's Notes:



## Driving and Traffic Issues

- Worksites must be posted with legible traffic signs at points of hazard. Flag persons (Flaggers) are used when signs, signals, and barricades do not provide adequate protection for workers.



Traffic workers may experience:

- Heavy traffic
- Inexperienced or poor drivers
- Poor visibility due to chemical plume/cloud

**Those working near traffic should wear high visibility clothing or PPE.**

WORKER EDUCATION & TRAINING PROGRAM

### Trainer's Notes:

#### OSHA Regulations

29 CFR 1910.145, *Occupational Safety and Health Standards*, "Specifications for accident prevention signs and tags;"  
Worker transportation to and around the jobsite present safety hazards that can be reduced through proper planning. Workers who drive in the course of their duties shall possess valid licenses appropriate for the vehicles they are driving (including a commercial driver's license, if required). Drivers shall comply with all applicable traffic safety regulations. Employers shall ensure compliance with state laws governing the use of seat belts. Vehicles should be equipped with a sufficient number of seats for each passenger.

Extra care should be exercised when driving on roads that may have been damaged by the fires. Roads may be undermined, or impassable. Traffic may be heavy, especially around checkpoints. Traffic signs may be knocked down or not visible, and traffic signal lights may be inoperative. Street signs and landmarks may not be available. Allow extra time when traveling and drive defensively.

Sufficient parking areas should be arranged for workers in a location convenient to where they report for work. Parking areas shall be adequately lit and graded. Traffic issues include:

- Movement of unusual vehicles
- Oversized loads such as mobile homes
- Heavy operating equipment.
- Be prepared for delays.
- Watch for other drivers.
- Flaggers may be hidden or obstructed by larger vehicles.

**Hazards include:** Congestion; Multiple entrances/exits to roadway; Power lines; Uncontrolled grapples with debris; Worker with multiple tasks – flagging & truck loading; No signage entering the zone; 2 way traffic; Limited Visibility for traffic

#### Flagmen (persons)

- Used when signs, signals, and barricades do not provide adequate protection to the worker
- Signaling directions must conform to *Manual on Uniform Traffic Control Devices for Streets and Highways* 1988 Edition, Revision 3 (1991), or the Millennium Edition (December 2000).
- Flagman must wear red or orange reflectorized warning garments

#### Barricades

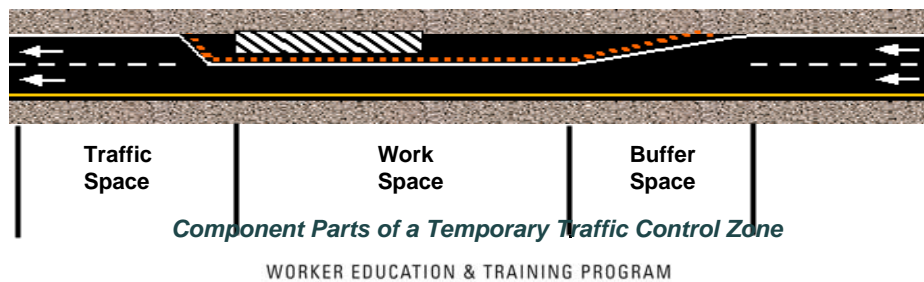
OSHA 29 CFR 1926.202

For employee protection must conform to applicable portions of *Manual on Uniform Traffic Control Devices for Streets and Highways* 1988 Edition, Revision 3 (1991), or the Millennium Edition (December 2000).



## Road Work Zone Safety

- There must be a traffic control plan for the movement of vehicles.
- Traffic Control Devices should be used inside the work zone.
- Flaggers and others providing temporary traffic control should wear high visibility, reflective clothing.
- Flagger stations should be illuminated.
- **Flaggers should be trained/certified and use the signaling methods required by the authority in charge.**



### Trainer's Notes:

This type of signage alerts incoming traffic to work zone areas.

•High visibility garments: While such garments may make a worker more conspicuous to approaching drivers, they do not offer any actual protection from traffic. Such garments must be used in conjunction with other traffic safety means.

### Traffic signs

Construction areas shall be posted with legible traffic signs at points of hazard. All traffic control signs or devices used for protection of construction workmen shall conform to *Manual on Uniform Traffic Control Devices for Streets and Highways* 1988 Edition, Revision 3 (1991), or the Millennium Edition (December 2000)

### Subpart G – Signs, Signals, and Barricades, 29 CFR 1926.200 Accident Prevention Signs and Tags

Before work begins in the vicinity of vehicular or pedestrian traffic that may endanger employees, warning signs and/or flags or other traffic control devices shall be placed conspicuously to alert and channel approaching traffic. Where further protection is needed, barriers shall be utilized. At night, warning lights shall be prominently displayed, and excavated areas shall be enclosed with protective barricades.

The employer shall insure that an employee finding any crossed or fallen wires which create or may create a hazardous situation at the work area remains on guard or adopts other adequate means to warn other employees of the danger and has notified the proper authority at the earliest practical moment.

Signs and symbols required by Subpart G shall be visible at all times when work is being performed, and shall be removed or covered promptly when the hazards no longer exist.

If work exposes energized or moving parts that are normally protected, danger signs shall be displayed and barricades erected, as necessary, to warn other personnel in the area.

### 29 CFR 1926.201 Signaling, Flagmen

When operations are such that signs, signals, and barricades do not provide the necessary protection on or adjacent to a highway or street, flagmen or other appropriate traffic controls shall be provided.

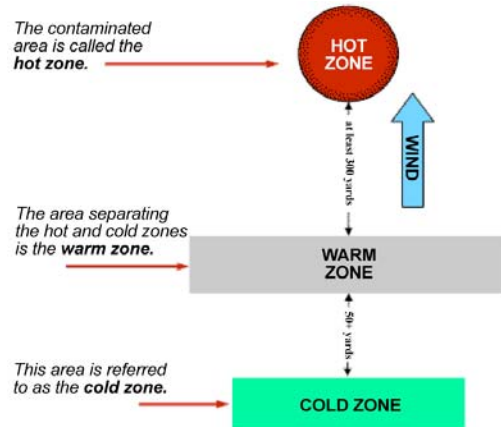
Signaling directions by flagmen shall conform to *Manual on Uniform Traffic Control Devices for Streets and Highways* 1988 Edition, Revision 3 (1991), or the Millennium Edition (December 2000).

Hand signaling by flagmen shall be by use of red flags at least 18 inches square or sign paddles, and in periods of darkness, red lights.

Flagmen shall be provided with and shall wear a red or orange warning garment while flagging. Warning garments worn at night shall be of reflectorized material.



## Site Control



- Site control consists of the following components:
  - Control zones (see image to left)
  - HASP
  - Communication
  - Emergency plan
  - Site map
  - Use of “buddy system”

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### Trainer's Notes:

Information from the Capitol Region Council of Governments  
<http://www.crcog.org/>

- Cold Zone - Contains the command post and other support functions deemed necessary to control the incident.
- Hot Zone - The area immediately surrounding a hazardous materials incident, which extends far enough to prevent adverse effects from hazardous materials releases to personnel outside the zone.
- Warm Zone - The area where personnel, equipment decontamination, and hot zone support takes place.

### Setting up work zones will depend on:

- Type of delivery method used
- Agent deployed
- Population density
- Environmental factors: enclosed spaces, wind direction, day/night, etc...



## Work Zones

### Exclusion Zone (Hot Zone)

- Chemical hazard is present and only properly trained and authorized personnel may enter

### Contamination Reduction Zone (Warm Zone)

- Used to remove contamination from personnel and equipment and includes: Decontamination corridor; Equipment decontamination; Emergency decontamination

### Support Zone (Cold Zone)

- Incident command and other support functions stationed here



**HAZWOPER and other duty-specific training is required for entry into hot and warm zones on an incident site.**

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### Trainer's Notes:

- The Photo is from IL EPA of a response to a ruptured HCL cylinder.



## Downwind Hazard Predictions

The purpose of the downwind hazard analysis is to:

- Create work zones based on the best possible information
- Warn downwind personnel and prevent people from entering into the hazard area.
- Properly allocate critical resources to where they are needed most.

**When deployed, a chemical weapon may release a cloud of material, which will then move with the wind.**



Chemical explosion at plant, Photo courtesy of EPA

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### Trainer's Notes:

A plume is a gaseous or vaporous release that emanates from a chemical release source. A cloud, in contrast, has left its source and moves (floats) away. Both plumes and clouds are analyzed in the same manner for downwind predictions. Many factors affect the travel of a toxic plume or cloud. Precipitation can wash agent out of the air, but may cause a runoff problem. Some agents are destroyed by sunlight's UV radiation and may travel further downwind during darkness than during the day. Air stability is important. On hot, sunny days ground-level air tends to rise, taking the toxic cloud with it. During evenings and overcast days, the ground air and cloud tend to stay low.

•What is CAMEO? (<http://www.epa.gov/OEM/content/cameo/what.htm>)

•World Meteorological Organization Emergency Response Activity (ERA) ([http://www.wmo.int/pages/prog/www/DPFSERA/modelling\\_tools.htm](http://www.wmo.int/pages/prog/www/DPFSERA/modelling_tools.htm))

#### Dispersion Modeling Tools

In a conceptually similar framework to the meteorological modeling problem, dispersion models, either source code or executables, can be obtained to support a local response to an emergency. Such a system does not rely on communications with a remote centre.

#### **2.1** The NOAA HYSPLIT model - <http://www.arl.noaa.gov/ready/hysplit4.html>

A 3-d Lagrangian particle/puff model that uses meteorological model output fields as input for the dispersion calculation. It can be customized to support a variety of different simulations. Interface programs are available to process MM5, ETA, RAMS, or ECMWF model output fields.

#### **2.2** The NOAA Aloha/Cameo model - <http://response.restoration.noaa.gov/>

Provided by NOAA's Office of Response and Restoration, it consists of a chemical data base linked with a straight line Gaussian model for very short-range applications.

**2.3** EPA dispersion modeling resources - <http://www.epa.gov/scram001/aqmindex.htm> and for a more detailed discussion on dispersion modeling, access to models and related databases see <http://www.epa.gov/scram001/dispersionindex.htm>.

#### Other Modeling Resources

•CALPUFF - <http://www.src.com/calpuff/calpuff1.htm>

•HPAC - <http://www.dtra.mil/toolbox/directorates/td/programs/acec/hpac.cfm>

•SCIPUFF - <http://www.titan.com/products-services/336/?docID=336>

•FLEXPART - <http://www.forst.tumuenchen.de/EXT/LST/METEO/stohl/flexpart.html>





## Confined Spaces



### What is a Confined Space (CS)?

- Space with limited access and egress
- Large enough for bodily entry
- Not designed for occupancy
- Examples: boiler, pit, septic tank, utility vault, well, basement, trench, collapsed structure, and elevator shaft

### What hazards make it a permit required CS?

- Oxygen deficiency
- Entrapment
- Engulfment
- Hazardous atmosphere
- Any other recognized, serious health or safety hazard



**Your Safety Officer Must Approve Confined Space Entry!!!!**

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### Trainer's Notes:

**Confined Spaces may only be entered by Authorized Personnel approved by the Safety Officer**  
OSHA 29 CFR 1910.146

The task being performed in the picture is sumping the sewer system.  
Possible hazards: hydrogen sulfide, methane, entrapment, environmental hazards such as rodents, snakes, & insects.

Work involving confined space entry shall conform to 29 CFR 1910.146. Any agency or contractor that will be performing confined space entry shall develop a specific plan and conduct a Job Hazard Analysis (JHA) prior to commencing work. Plans shall include space evaluation and established acceptable entry conditions; a permit system; training for entrants, attendants, and supervisors; atmospheric monitoring; and rescue / emergency services.

Structural collapse may create confined spaces. Make sure workers understand that confined spaces, especially unstable ones, are deadly and may only be entered with proper training, equipment and planning.

**If caused by structural collapse, have space certified safe by a registered professional engineer or architect before you enter!!!**

Before you enter a confined space your supervisor must:

- Make sure you and the attendant are trained.
- Ventilate and monitor for hazardous atmosphere.
- Lock out or tag out all energy sources in the space.
- Issue appropriate PPE, possibly including self-contained breathing apparatus (SCBA).
- Establish barriers to external traffic such as vehicles and pedestrians.
- Provide ladders or similar equipment for safe entry and exit in the space.
- Provide good communications equipment and alarm systems.
- Have rescue equipment and trained rescue personnel nearby.



## Electrical Hazards

- Four main types of electrical injuries seen in disaster cleanups:
  - Electric shock
  - Burns
  - Falls caused by contact with electricity
  - Electrocutation
- Avoid working with electricity in wet environments. If this is not possible, use equipment approved for wet conditions.
- Use double insulated tools.
- Use Ground Fault Circuit Interrupters (GFCIs) on all power tools and cords as close to the panel as possible.
- Do not re-energize electrical systems or use electrical equipment that has been in a fire or wet until it has been evaluated by a qualified electrician.



Portable GFCI.

**Electrical cords and outlets must meet OSHA standards.**

WORKER EDUCATION & TRAINING PROGRAM

### Trainer's Notes:

Workers should check the Label to be sure the tool is double insulated.

If water is or has been near electrical circuits or equipment:

- **Stay away from the circuit or equipment**
- DO NOT handle a downed power line. **Lines may be re-activated by power company or the system automatically do not mess with power lines, down or not**
- Turn off power at the main breaker or fuse of the service panel.
- Do not turn power back on until electrical equipment is inspected and qualified.
- Do not use electrical equipment that has been exposed to heat from fire until checked by an electrician.
- Never enter flooded areas or touch electrical equipment if the ground is wet unless power is off.

Special precautions for using generators:

- If you are using gasoline and diesel generators for a building, **switch main power breaker or fuse to off** prior to starting generator. Turning power off protects utility line workers from electrocution and prevents damage from feedback electrical energy.
- For more information, visit the NIOSH Electrical Safety topic page (<http://www.cdc.gov/niosh/topics/electrical/>).



## Carbon Monoxide (CO) Exposure

### CO may be present with:

- Any activity using gasoline, diesel or propane-powered machinery
- Work near operating equipment
- Debris reduction sites
- Work near hot work (cutting, welding) especially in confined spaces

### To control CO exposures:

- Wear CO monitoring equipment
- Do not use gas/diesel powered equipment indoors or in enclosed areas
- Use forced air ventilation

**Carbon Monoxide has no warning properties; it is a colorless odorless gas!**

**Symptoms:** Headache, dizziness, drowsiness, or nausea progressing to vomiting, loss of consciousness. Prolonged or high exposure can lead to coma or death. If you experience any of these symptoms where CO may be present **LEAVE THE AREA IMMEDIATELY!**

WORKER EDUCATION & TRAINING PROGRAM

### Trainer's Notes:

#### Carbon Monoxide (CO) Exposure Symptoms:

•Headache, dizziness, drowsiness, or nausea progressing to vomiting, loss of consciousness. Prolonged or high exposure can lead to coma or death.

#### General Recommendations:

•Use CO warning sensors when using or working around combustion sources.

•Shut off engine immediately if symptoms of exposure appear.

•**Warning!** Do not use gasoline generators or portable fuel driven tools in confined spaces or poorly ventilated areas.

•**Warning!** Do not work in areas near exhaust (CO poisoning occurs even outdoors if engines generate high concentrations of CO and worker is in the area of the exhaust gases). With symptoms of exposure, shut off the engine.

#### OSHA 1926.302(c)

•If using a fuel powered tool in an enclosed area such as a trench, be aware that carbon monoxide generated can displace or deplete oxygen. Mechanical ventilation and testing needs to be done.

•Note: CO poisoning can occur in small spaces, such as a crawl space or large areas, such as a big parking garage.

•For more information on CO, go to <http://emergency.cdc.gov/disasters/carbonmonoxide.asp>.



## Portable Generators



### Hazards include:

- Carbon monoxide poisoning
- Electrocutation from backfeed

If it is necessary to use a portable generator, follow manufacturer's recommendations and specifications

- Use a qualified electrician to install and start-up
- If using gasoline- and/or diesel-powered portable generators, switch the main breaker or fuse to "off" before starting
- Do not use on or in wet surfaces
- Do not use indoors, or in temporary or permanent shelter.
- Do not operate in rain unless the generator can be kept dry
- When refueling, turn off and wait for motor to cool or use appropriate funnel to prevent spills onto hot engine

WORKER EDUCATION & TRAINING PROGRAM

### Trainer's Notes:

#### Backfeed

Backfeed occurs when a generator is plugged into a household circuit without turning the main breaker to the "off" position or removing the main fuse and the electrical current reverses going back through the circuit to the outside power grid energizing power lines or electrical systems in other buildings.

#### To safeguard against backfeed:

- Use extreme caution when working on or in the vicinity of unverified de-energized power lines.
- Linemen should treat all power lines as energized unless you personally de-energized them.
- Verify that the power lines have been de-energized.
- Provide proper grounding for the lines.
- Wear appropriate PPE.

For more information, go to: <http://www.bt.cdc.gov/disasters/pdf/elecgenerators.pdf>.



## High Pressure Washers

### Hazards include:

- Chemical burns
- Lacerations
- Thermal burns
- Contusions
- Back and shoulder strains
- CO production
- Chemical Penetration
- Projectile Production
- Electric shock

### Safe use guidelines include:

- Inspection of washer
- Training and proper use
- PPE (including insulating rubber boots)
- Hazcom for cleaning agents
- Use with GFCI and proper electrical safety



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### Trainer's Notes:

#### Pressure Washer Safety

<http://www.bt.cdc.gov/disasters/pressurewashersafety.asp>

•A pressure washer is a power tool that sprays water at high pressures to clean large, sturdy surfaces such as buildings, farm equipment and roads. Pressure washers may be used more often during disaster clean-up when the risk of injury may be higher.

•When using a pressure washer, always follow the safety instructions included in the owner's manual.

#### If you are hurt by a pressure washer:

•Call 911 if emergency help is needed.

•Take care of any wounds:

•Before treating the wound, wash your hands with soap and clean water.

•Remove any object that is in the way of caring for the wound.

•Put pressure on the wound with a clean cloth to stop bleeding.

•After bleeding has stopped, pour bottled or clean running water over the wound.

•Gently clean around the wound with soap and clean water.

•Pat dry and use an adhesive bandage or dry clean cloth to cover the wound.

•Leave unclean wounds open.



## Hazardous Dusts

- Consider using the following engineering controls in addition to wearing a respirator:
  - Wet methods
  - Appropriate HEPA vacuum
- Minimize particulate matter (dust) production:
  - Do not aggressively dry sweep
  - Avoid walking in single file lines. Those behind the leader may become covered in particulate matter.



*Wetted debris during clean up of 2003  
Angora wildfire*

**Do not use a vacuum that is not approved  
for ash and that does not contain a HEPA filter.**

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### Trainer's Notes:

#### Jobs Affected:

- Debris removal and dumping
- Loading trucks
- Demolition
- Assessment personnel



## Prevent the Spread of Contamination to Your Family and Home

- Bringing home contaminated work clothes or equipment may contaminate your home and place your family at risk.
- Bring a clean change of clothes to the work site.
- Wash work clothes separately. Preferably in an employer provided location.



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Trainer's Notes:



## Bloodborne Hazards

- Use disposable nitrile or similar gloves when handling human remains or assisting those with injuries.
- Replace gloves if punctured or torn.
- Do not handle human remains or assist those with injuries if you have skin cuts or punctures.
- Use goggles or face shield and mask for handling human remains, recovering deceased. Make sure to wear a respirator.
- Transport human remains in closed, leak-proof, labeled containers.



**OSHA Blood Borne Pathogen  
Standard: 29 CFR 1910.1030**

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### Trainer's Notes:

In addition to the slides guidance, tell students that they should only be assisting decontaminated casualties. Response workers should not take on a burden of risk from contaminated casualties. Remember, WMD chemicals can be extremely harmful at low levels.





# Heat Stress

**Common signs and symptoms workers experience if they have any of these conditions:**



<u>Heat Stress</u>	<u>Heat Exhaustion</u>	<u>Heat Stroke</u>
<ul style="list-style-type: none"> <li>• Headache</li> <li>• Thirst</li> <li>• Profuse sweating</li> <li>• Muscle aches</li> </ul>	<ul style="list-style-type: none"> <li>• Headache</li> <li>• Dizziness</li> <li>• Confusion</li> <li>• Nausea</li> <li>• Sweating-pale, clammy skin</li> <li>• Cramps in legs &amp; abdomen</li> <li>• Rapid, weakening pulse &amp; breathing</li> </ul>	<ul style="list-style-type: none"> <li>• Headache</li> <li>• Dizziness</li> <li>• Restlessness</li> <li>• Confusion</li> <li>• Hot, flushed dry skin</li> <li>• Body temp above 104°F</li> <li>• Unresponsive/disoriented</li> </ul>

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**Trainer's Notes:**

CDC Heat Stress Resources

Workers who are exposed to extreme heat or work in hot environments may be at risk of heat stress. Exposure to extreme heat can result in occupational illnesses and injuries. Heat stress can result in heat stroke, heat exhaustion, heat cramps, or heat rashes. Heat can also increase the risk of injuries in workers as it may result in sweaty palms, fogged-up safety glasses, and dizziness. Burns may also occur as a result of accidental contact with hot surfaces or steam.

<http://www.cdc.gov/niosh/topics/heatstress/>

OSHA Heat Stress Resources

Operations involving high air temperatures, radiant heat sources, high humidity, direct physical contact with hot objects, or strenuous physical activities have a high potential for inducing heat stress. in employees engaged in such operations. Such places include: iron and steel foundries, nonferrous foundries, brick-firing and ceramic plants, glass products facilities, rubber products factories, electrical utilities (particularly boiler rooms), bakeries, confectioneries, commercial kitchens, laundries, food canneries, chemical plants, mining sites, smelters, and steam tunnels.

<http://www.osha.gov/SLTC/heatstress/index.html>



## Heat Stress (continued)

- **Know the signs of heat-related illnesses.**
- Drink when thirsty. Drink sports drinks, instead of water, if you can. Avoid alcohol, caffeinated drinks, or heavy meals.
- Monitor yourself and coworkers, use the buddy-system. Use monitoring such as aural temperature readings.
- Block out direct sun or other heat sources and shelter in shaded areas.
- Use cooling fans/air-conditioning and rest regularly.
- Wear lightweight, light-colored, loose-fitting clothes and a hat if available. Get medical help for symptoms such as altered vital signs, confusion, profuse sweating, excessive fatigue, or rapid heartbeat.
- Fire fighters should unbutton and remove bunker gear when resting.

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### Trainer's Notes:

It is possible to drink too much water (hyponatremia). It can especially be a problem when excessive sweating occurs and water dilutes the remaining electrolytes in the body.

The following excerpt is from Wikipedia:

The electrolyte disturbance **hyponatremia** exists in humans when the sodium (*Natrium* in [Latin](#)) concentration in the plasma falls below 135 mmol/L. At lower levels water intoxication may result, an urgently dangerous condition. Hyponatremia is an abnormality that can occur in isolation or, as most often is the case, as a complication of other medical illnesses.



Four factors contribute to cold stress:

- cold temperatures
- high or cold wind (wind chill factor)
- relative humidity
- cold water

## Cold Stress

**Common signs and symptoms workers experience if they have any of these conditions:**

<b><u>Mild Hypothermia (Body Temp: 98 - 90° F)</u></b>	<b><u>Moderate Hypothermia (Body Temp: 90 - 86° F)</u></b>	<b><u>Severe Hypothermia (Body Temp: 86 - 78° F)</u></b>
<ul style="list-style-type: none"> <li>• Shivering</li> <li>• Lack of coordination, stumbling, fumbling hands</li> <li>• Slurred speech</li> <li>• Memory loss</li> <li>• Pale, cold skin</li> </ul>	<ul style="list-style-type: none"> <li>• Shivering stops</li> <li>• Unable to walk or stand</li> <li>• Confused and irrational</li> </ul>	<ul style="list-style-type: none"> <li>• Severe muscle stiffness</li> <li>• Very sleepy or unconscious</li> <li>• Ice cold skin</li> <li>• Cardiac arrest</li> <li>• Death</li> </ul>

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### Trainer's Notes:

#### Hypothermia Resources

<http://web.princeton.edu/sites/ehs/coldstress/coldstress.htm>

Hypothermia occurs most often in the spring and fall, rather than winter. A cold environment forces the body to work harder to maintain its temperature. Cold air, water, and snow all draw heat from the body. Wind chill is the combination of air temperature and wind speed. Hypothermia means "low heat" and is a potentially serious health condition. This occurs when body heat is lost from being in a cold environment faster than it can be replaced. When the body temperature drops below the normal 98.6° F to around 95° F, the onset of symptoms normally begins. The person begins to shiver and stomp feet in order to generate heat. As the body temperature continues to fall, slurred speech, lack of coordination and memory loss develop and the person will stop shivering. Once the body temperature falls to around 85° F, the person may become unconscious, and at 78°, the person could die.

#### Who is at risk:

Anyone working in a cold environment may be at risk for cold stress. However, older people may be at more risk than younger adults, since older people are not able to generate heat as quickly. Certain medications may prevent the body from generating heat normally. These include *anti-depressants, sedatives, tranquilizers* and *some heart medications*.

#### What to do:

(Proper treatment depends on the severity of the hypothermia.)

- Mild hypothermia - move to warm area, stay active, remove wet clothes and replace with dry clothes or blankets, cover the head, and drink warm (not hot) sugary drink
- Moderate hypothermia - all of the above, plus: Call 911 for an ambulance, Cover all extremities completely, Place very warm objects, such as hot packs or water bottles on the victim's head, neck, chest and groin
- Severe hypothermia - Call 911 for an ambulance, Treat the victim very gently. Do not attempt to re-warm -- the victim should receive treatment in a hospital



## Cold Stress (continued)

- Know the signs of cold-related illnesses.
- **Drink when thirsty.** Avoid alcohol, caffeinated drinks, certain medications and smoking to minimize the risk.
- **Clothing:** Wear *at least three layers* of clothing
  - An outer layer to break the wind and allow some ventilation (like [Gortex®](#) or nylon)
  - A middle layer of down or wool to absorb sweat and provide insulation even when wet
  - An inner layer of cotton or synthetic weave to allow ventilation
- Wear a warm hat and insulated boots. Protect your extremities (i.e. head, feet, hands). If possible, schedule heavy work during the warmer parts of the day.
- **Buddy System:** Try to work in pairs to keep an eye on each other and watch for signs of cold stress. Take breaks out of the cold when possible.
- **Engineering Controls:** Use engineering controls when possible to reduce the risk of cold stress:
  - **Radiant heaters** may be used to warm workers
  - **Shield work areas** from drafts or wind
  - **Use insulating material** on equipment handles when temperatures drop below 30° F

**Do not wear tight clothing! Loose clothing allows air to be trapped and act as insulation to retain heat.**

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### Trainer's Notes:

#### Training:

- Employees and supervisors need to be trained to be able to detect early signs of cold stress.
- Supervisors should watch for signs of cold stress and allow workers to interrupt their work if they are extremely uncomfortable. Supervisors should also ensure that work schedules allow appropriate rest periods and ensure liquids are available. They should use appropriate engineering controls, personal protective equipment and work practices to reduce the risk of cold stress.

#### For more information:

- Contact Environmental Health and Safety at 258-5294 or Employee Health at McCosh Health Center at 258-5068 for more information.
- In an emergency, call Public Safety at 9-1-1.



## Excavation Hazards

- Excavations can create many hazards which must be controlled to safely work around and in them.
- An excavation is any man-made cut, hole, trench, or depression in the earth formed by earth removal.
- A trench is defined as a narrow below-ground excavation that is deeper than it is wide, and is no wider than 15 feet.
- Potential excavation hazards:
  - Cave-ins
  - Falls, falling loads
  - Hazardous atmosphere
  - Incidents involving mobile equipment



**Search and rescue, structural repair and cleanup operations may require excavation.**

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### Trainer's Notes:

#### General Trenching and Excavation Rules:

- Keep heavy equipment away from trench edges.
- Keep surcharge loads at least 2 feet (0.6 meters) from trench edges.
- Know where underground utilities are located.
- Test for low oxygen, hazardous fumes and toxic gases.
- Inspect trenches at the start of each shift.
- Inspect trenches following a rainstorm.
- Do not work under raised loads.

A competent person must evaluate soil for excavation safety. All excavations/trenches should have safe means for entering and exiting (ladders, safe design, etc.). DO NOT enter an unsafe excavation!

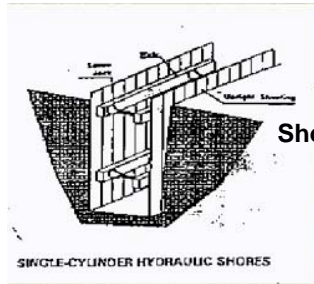
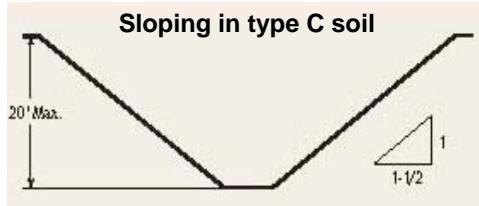
If an excavation is over 4 feet deep, an emergency exit route/device (i.e.ladder) must be provided which may not be the sides of the excavation. Distance to egress must be 25 feet or less.

If an excavation is five feet deep or more, one of the following engineering controls must be used:

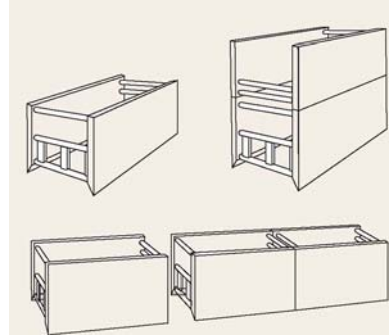
- Shoring
- Shielding
- Sloping



## Controlling Excavation Hazards



Shoring



Shielding

See [OSHA's Trenching and Excavation Factsheet](#)

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Trainer's Notes:



## Traumatic Stress

- A traumatic event is a shocking and emotionally overwhelming situation in which an individual perceives actual or threatened death or serious injury.
- Workers responding to a chemical release or terrorism incident may experience traumatic stress.
- Reactions to traumatic events will vary, ranging from relatively mild to severe.
- It is very common for people to experience anxiety, terror, shock, and become upset, as well as emotional numbness and personal or social disconnection.<sup>1</sup>



**Pay attention to co-workers and how they are being affected by traumatic stress**

<sup>1</sup> **International Society For Traumatic Stress Studies**

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### Trainer's Notes:

Mental health effects, the final type of "injury" are not only determined by exposure to the chemical, fire or explosion but also by "exposure to the event" itself. Severe incidents have the potential to disrupt the lives of victims through injury, loss of relatives, property or employment and societal disruption. A substantial proportion of victims of major incidents have been shown to experience long-lasting mental health problems.

Health Council of the Netherlands. *The medium and long-term health impact of disasters*. The Hague, Gezondheidsraad, 2007 (Report 2006/18E) (<http://www.gr.nl/pdf.php?ID=1487&p=1>).



## Traumatic Stress (continued)

### Symptoms and negative effects of traumatic stress include:

- Physical illness (headaches, fatigue)
- Unable to function normally on the job
- Depression
- Anxiety
- Making efforts to avoid reminders of a traumatic event
- Marital and family conflict
- Hostility and aggression
- Death through suicide as a reaction to overwhelming stress

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#### Trainer's Notes:

Critical Stress Management (<http://www1.mosby.com/periodicals/>)

- A variety of stress-management techniques can be utilized, including muscle relaxation, meditation, biofeedback, cognitive-behavioral skills, and combinations of these techniques.
- The most common techniques used are muscle relaxation, cognitive-behavioral skills, and combinations of two or more techniques.

#### Critical Stress Management Resources

•International Critical Incident Stress Foundation, Inc.  
<http://www.icisf.org/articles>

•**Psychological Trauma and Posttraumatic Stress Disorder: A Review**  
<http://www.icisf.org/articles/Acrobat%20Documents/TerrorismIncident/PsyTrauPTSD.pdf>

•**Bringing Your Crisis Team Home After a Disaster: Post Action Staff Support (PASS)**  
[http://www.icisf.org/articles/Acrobat%20Documents/PASS\\_for\\_Disaster.08.pdf](http://www.icisf.org/articles/Acrobat%20Documents/PASS_for_Disaster.08.pdf)

•**Coordination of Mental Health and Community Agencies in Disaster Response**  
<http://www.icisf.org/articles/Acrobat%20Documents/TerrorismIncident/AgcyCoord.pdf>

•**Critical Incident Stress Information Sheet**  
<http://www.icisf.org/articles/Acrobat%20Documents/TerrorismIncident/CISInfoSheet.pdf>





## How to Cope With Traumatic Stress

**Some useful techniques to reduce stress when participating in a response are:**

- Take a break from the news.
- Pace yourself and take frequent rest breaks. Drink plenty of fluids such as water and juices. Try to eat a variety of foods and increase your intake of complex carbohydrates (breads, muffins made with whole grains).
- Watch out for each other.
- Be conscious of those around you. Responders who are exhausted, feeling stressed, or even temporarily distracted may place themselves and others at risk.
- Maintain as normal a schedule as possible.
- Avoid overuse of drugs or alcohol.

**Individuals with prolonged traumatic stress (anxiety, depression, etc.) that disrupt their daily functioning should consult with a trained and experienced mental health professional.**

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### Trainer's Notes:

•See **American Psychological Association** help center at [apahelpcenter.org](http://apahelpcenter.org) and the **Center for Disease Control** at [CDC.gov](http://CDC.gov) for further assistance on dealing with post traumatic stress disorder.



## Summary

- Proper training is a key component of a safe response.
- The chemicals and contaminated dusts can be hazardous to human health.
- The hazards and issues covered in this training tool are dynamic and require vigilance and flexibility.
- The key to a safe response is attention to the safety issues of your work environment.
- In addition to the similar physical hazards of a construction or demolition site, there is the added factor of an intentional or unintentional release of hazardous chemicals.

WORKER EDUCATION & TRAINING PROGRAM

Trainer's Notes:



## Information Sources

**This training tool is based on recommendations from:**

- National Institute of Environmental Health Sciences (NIEHS)
- National Institute for Occupational Safety and Health (NIOSH)
- Occupational Safety and Health Administration (OSHA)
- Centers for Disease Control and Prevention (CDC)
- Environmental Protection Agency (EPA)
- Department of Defense (DOD)
- Department of Justice (DOJ)
- Department of Homeland Security (DHS)
- World Health Organization (WHO)

Factsheets from these agencies and other chemical response resources are available on the NIEHS National Clearinghouse for Worker Safety and Health Training website, <http://tools.niehs.nih.gov/wetp/>.

WORKER EDUCATION & TRAINING PROGRAM

**Trainer's Notes:**

This training tool is based on recommendations from:

- National Institute of Environmental Health Sciences (NIEHS) [www.niehs.nih.gov/](http://www.niehs.nih.gov/)
- National Institute for Occupational Safety and Health (NIOSH) [www.cdc.gov/NIOSH/](http://www.cdc.gov/NIOSH/)
- Occupational Safety and Health Administration (OSHA) [www.osha.gov/](http://www.osha.gov/)
- Centers for Disease Control and Prevention (CDC) [www.cdc.gov/](http://www.cdc.gov/)
- Environmental Protection Agency (EPA) [www.epa.gov/](http://www.epa.gov/)
- Department of Defense (DOD) [www.defenselink.mil/](http://www.defenselink.mil/)
- Department of Justice (DOJ) [www.usdoj.gov/](http://www.usdoj.gov/)
- Department of Homeland Security (DHS) [www.dhs.gov/](http://www.dhs.gov/)
- World Health Organization (WHO) [www.who.int/](http://www.who.int/)