Teamsters Hazardous Waste Worker Training

Hazardous Waste Worker Refresher Course

Electronic Version is Section 508 Compliant

International Brotherhood of Teamsters — IBT Worker Training Program

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Hazardous Waste Worker Refresher Course
Electronic version is 508 Compliant
2018 Edition

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Preface

This manual covers the topics that OSHA requires for annual refresher training of workers involved in the clean-up of uncontrolled hazardous waste sites.

[OSHA 29 CFR 1910.120(e)(8) and 29 CFR 1926.56 (e)(8)]

This manual was prepared by the Worker Training Program of the International Brotherhood of Teamsters - the Teamsters Union - with funds from the National Institute of Environmental Health Sciences.

About the Teamsters

Workers founded the International Brotherhood of Teamsters (IBT) in 1903. Today the Teamsters are a diverse union representing 1.4 million workers in transportation, construction, warehousing, and in almost every other type of employment. The IBT Safety and Health Department includes professionals in safety, industrial hygiene and adult education.

Teamster Training

The Teamsters offer safety and health training throughout the United States for:

- Construction Workers
- Hazardous Waste Workers
- Industrial Workers
- Hazardous Materials Transportation Workers
- Port Workers
- Emergency Responders
- Radiological Workers

Teamster Instructors

Teamster instructors use effective adult education techniques, real equipment, and realistic hands-on activities.

IBT instructors have experience doing the same types of jobs that trainees perform, including construction, remediation, warehousing and hazmat transportation. Instructors use participatory adult teaching techniques and hands-on activities. Instructors have completed the DOE Basic Instructor Training Program and the OSHA 500 Construction Trainer Course. The Teamsters certify each instructor after a period of supervised teaching and evaluation. To maintain certification, each instructor attends an annual Instructor Development Program that includes new regulations and work procedures, and practice teaching. Each instructor is certified in adult first aid and CPR.

Teamster Training Centers

Teamster Training Centers have classrooms and outdoor areas for realistic hands-on activities. Teamster Training Centers also have mobile units that can transport instructors and equipment to hold courses at hazardous waste sites, construction projects, company locations and union halls ... anywhere.

For More Information

For more information, or to schedule a course, contact:

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To email the Program Office, go to the website, and click on the “Contact Us” link.

Chapter

1

Rights, Responsibilities, and Lessons Learned

Learning objectives

This chapter reviews the legal standards that apply to worker safety and health at hazardous waste sites, and the rights and responsibilities of workers and employers with regard to occupational safety and health.

After completing this chapter you will be able to demonstrate your ability to:

1. IDENTIFY five federal government agencies responsible for safety and health.

2. UNDERSTAND recent changes to pertinent regulations including EPA, OSHA, and DOE Standards.

3. IDENTIFY the rights and responsibilities of workers and employers with regard to safety and health in the workplace.

4. DEFINE:

   a. HAZWOPER.

   b. Uncontrolled site.

5. IDENTIFY lessons that can be learned from incidents which occurred in the past year on the job site to demonstrate the use of good work practices.

Government Agencies that Regulate Safety & Health

OSHA: The Occupational Safety and Health Administration is the federal agency that enforces safety and health standards to protect workers on the job. In 26 states there are state safety and health agencies that do this job instead of federal OSHA.

DOT: The Department of Transportation is the federal agency that enforces regulations for safe transportation of hazardous materials. Most states have a state agency that also enforces transportation regulations.

EPA: The Environmental Protection Agency is the federal agency that enforces regulations to protect the environment. Most states have a state agency that also enforces environmental regulations.

NIOSH: The National Institute for Occupational Safety and Health is a federal agency that studies safety and health problems, recommends standards, and gives advice to workers and employers.

DOE: The Department of Energy is the federal agency that controls the facilities used to make nuclear weapons. Clean-up of hazardous and radioactive waste is a major project at these sites.

States that have their own Occupational Safety and Health Program

Alaska	**Michigan**	**South Carolina**
Arizona	**Minnesota**	**Tennessee**
California	**Nevada**	**Utah**
Connecticut*	**New Jersey***	**Vermont**
Hawaii	**New Mexico**	**Virgin Islands***
Indiana	**New York***	**Virginia**
Iowa	**North Carolina**	**Washington**
Kentucky	**Oregon**	**Wyoming**
Maryland	**Puerto Rico**	

*** The state programs in CT, NJ, NY, and the Virgin Islands only apply to public sector employees; in these states, private sector employees are covered by OSHA.**

The OSHA HAZWOPER Standard

The OSHA standard that has safety and health rules for hazardous waste workers is called **HAZWOPER: Hazardous Waste Operations and Emergency Response**.

OSHA calls hazardous waste clean-up sites **uncontrolled sites**.

Uncontrolled means that hazardous waste was put on the site without complying with current safety requirements. The hazardous waste creates a threat to the health and safety of people or the environment.

Some **examples of uncontrolled sites** include:

- A construction or demolition site where hazardous waste was left from previous activities.
- A landfill where chemicals were dumped without safeguards to prevent contaminating the water or the air. This may have been legal at the time, but does not comply with current requirements.
- A site where hazardous waste was illegally dumped without any regard for the environment.
- The scene of an emergency release of hazardous materials after the emergency has been resolved but where chemicals still remain to be cleaned up.

This manual is for workers who work at uncontrolled sites.

This is different from a treatment, storage and disposal site where hazardous waste is handled in a controlled manner.

If you work at a hazardous waste clean-up site, then you need to have eight (8) hours of refresher training each year. This is why you are taking this course.

You need eight (8) hours of refresher training each year.

Lessons Learned

29 CFR 1910.120 (e) (8)

Workers will critique hazmat or hazwaste incidents that occurred over the last year.

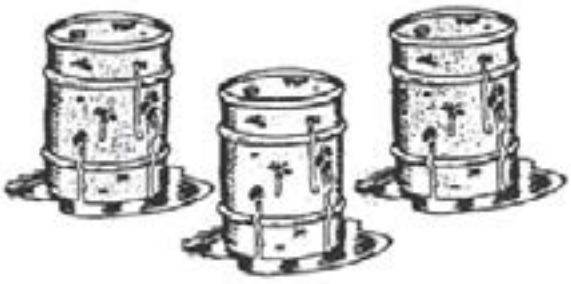
RCRA, Superfund, and SARA

RCRA ("Rick Rah") is the federal law regulating the proper handling of hazardous waste – in order to protect the environment and the community. RCRA requires:

- **Regulations**: The EPA makes regulations for those who generate hazardous waste, or store, ship, recycle, treat or dispose of hazardous waste.
- **Cradle to Grave Tracking**: Keeping records of what happens to hazardous waste from when it is created to when it is properly disposed of.
- **Uniform Hazardous Waste Manifest**: A special shipping paper for transporting hazardous waste.
- **Registration** for generators, **licenses** for transporters and **permits** for recyclers and disposal facilities.
- Requirements for **Underground Storage Tanks**.

Superfund is a federal program that provides money to clean up the worst hazardous waste sites, called **Superfund Sites**. The Superfund law is called **CERCLA**.

There is another federal law called **SARA**. One part of the SARA law tells OSHA to write a standard to protect hazardous waste and emergency response workers. This is why OSHA made the HAZWOPER Standard.



RCRA: Resource Conservation and Recovery Act of 1976.

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act of 1980.

SARA: Superfund Amendments and Reauthorization Act of 1986.

Discussion of Recent Changes to Pertinent Regulations

Your OSHA Rights

OSHA requires your employer to:

- **Provide a safe and healthy workplace**.
- **Comply with OSHA standards**.

As an employee you have legal rights, and you also have the responsibility to work in a safe manner that is in compliance with OSHA standards.

Your OSHA rights include:

1. **The right to a safe and healthy workplace**.
2. **The right to receive safety and health training**.
   A. Hazard communication training.
   B. HAZWOPER emergency response training.
   C. Respirator training (if applicable).
   D. Confined space training (if applicable).
3. **The right to information**.
   A. Material Safety Data Sheets (MSDSs).
   B. Your employer's Log of Work-Related Injuries and Illnesses (the "OSHA 300 Log").
   C. Results of workplace monitoring and surveys.
   D. Your own medical records.
   E. Your employer's written Site Safety and Health Plan.
   F. Copies of any OSHA citations.
4. **The right to take part in safety and health activities**.
   A. Point out hazards and suggest corrections.

B. Discuss safety and health concerns with your fellow workers and your union representative.

5. **The right to participate in OSHA inspections**.

   A. You or your union representative participate in the opening and closing conferences.

   B. You or your union representative accompany the OSHA inspector during the inspection.

   C. Respond to questions from the OSHA inspector.

6. **The right to file an OSHA complaint if a hazard exists**.

   A. Have your name kept confidential by OSHA.

   B. Be told by OSHA of actions on your complaint.

   C. Be notified if your employer contests a citation.

   D. Object to an abatement period proposed by OSHA.

7. **The right to refuse to do work that would expose you to imminent danger of death or serious injury**.

   (See the next page for more detail about this right.)

8. **Protection from retaliation or discrimination because of your safety and health activities**.

   File a discrimination complaint with OSHA if you have been discriminated against for discussing safety and health, pointing out hazards, filing an OSHA complaint, or refusing dangerous work.

9. **The right to necessary Personal Protective Equipment paid for by your employer**.

The Right to Refuse Dangerous Work

As an employee, you are expected to do your job the way your supervisor tells you. However, sometimes a situation may arise where you believe it is unsafe to do a task- for example, if the truck that you are assigned has faulty brakes. Usually you, or your union steward will be able to resolve the problem by discussing it with the supervisor.

If you can't resolve the situation, the union contract and the law give you certain rights in a situation where you feel that you must refuse to do dangerous work. In order to preserve your rights make sure that you:

1. **Don't act alone.** Talk with your fellow workers. If you are a union member, contact your shop steward or union representative.

2. **Point out the danger** to the supervisor and to your fellow workers.

3. **Make it clear that you are not insubordinate.** Explain that you are willing to do the job if it can be done safely.

4. **Offer to do other work**.

5. **Don't walk off the job**. Don't leave the site unless ordered to do so by the supervisor.

If you are disciplined, your union representative can help you file a grievance. You should also consider filing a complaint with OSHA and with the National Labor Relations Board.

The Right to Stop Work at DOE Sites
DOE Order 440.1A

DOE Order 440.1A says that workers at DOE facilities can "decline to perform an assigned task because of a reasonable belief that, under the circumstances, the task poses an imminent risk of death or serious bodily harm to that individual, coupled with a reasonable belief that there is insufficient time to seek effective redress through the normal hazard reporting and abatement procedures."

For Drivers, Mechanics and Freight Handlers: Section 405

Section 405 of the Surface Transportation Assistance Act protects drivers, mechanics, and freight handlers from discrimination or discharge for:

- Refusing to operate a vehicle if to do so would violate a safety regulation.
- Refusing to operate a vehicle if the employee has a reasonable apprehension of serious injury, or injury to the public, because of the unsafe condition of the equipment.
- Complaining or testifying about violations of vehicle safety requirements.

If you feel that you must refuse to operate the vehicle, make sure that you first ask your supervisor to correct the problem, or give you another, safe vehicle to use.

If you believe that you have been penalized for refusing to drive an unsafe vehicle, you can file a Section 405 complaint with OSHA. Any complaint must be filed within 180 days.

If you belong to a union, you should talk to your shop steward or union representative.

Chapter

2

Safety Hazards

Learning objectives

This chapter reviews safety hazards at work.

After completing this chapter you will be able to demonstrate your ability to:

1. IDENTIFY several safety hazards found in hazardous waste work.
2. DESCRIBE safe work practices and equipment that can protect you from the hazards that you have identified.

Safety, Health, and Other Hazards on the Site

29 CFR 1910.120 (e) (2) (ii)

Safety means preventing injuries like cuts, burns, broken bones, or even death caused by sharp objects, fires, falls, collisions or other unwanted events.

Health means preventing diseases and illness such as nerve damage, cancer, respiratory illness, heat stress or hearing loss caused by exposure to things like toxic chemicals, radiation, noise or hot environments.

Many things are both a safety hazard and a health hazard. For example, a solvent like benzene is a fire hazard. Breathing benzene vapors can cause leukemia and blood diseases, so benzene is also a health hazard.

Unsafe Working Surfaces

Workers walk, climb and work on many kinds of surfaces at hazardous waste sites, including ladders and scaffolds; gravel, sand and loose dirt; wet, slippery surfaces; areas cluttered with debris; and uneven, sloped or curved surfaces.

To prevent slips, trips and falls:

- Take time to prepare work areas.
- Don’t climb on barrels or other unstable objects.
- Use fall protection when at heights.
- Use only ladders and scaffolds that meet OSHA requirements.
- Use only established marked walkways, vehicle routes and controlled work zones.

Vehicles and Heavy Equipment

Vehicles and heavy equipment create hazards for drivers, and for workers on the ground. The Site Safety and Health Plan should include safe driving practices, as well as maintenance and testing of all safety features. There should also be a traffic control plan with marked vehicle routes and controlled work zones.

Here are some basic safety requirements:

- Inspect all equipment before use.
- Follow inspection and maintenance schedules.
- Stay on equipment until it stops.
- Use roll over protection (roll bars, etc.).
- Use cab shields or protective canopies on equipment loaded by crane, power shovel or loader.
- Use extreme caution on slopes or near excavations.
- Use a safety tire rack to work on tires with split or locking-ring rims.
- Block wheels and set brakes on parked vehicles.
- Beware of rotating equipment – watch for loose clothing.
- Listen for backup alarms.
- Be seen – wear a high visibility vest.

Overhead and Underground Utilities

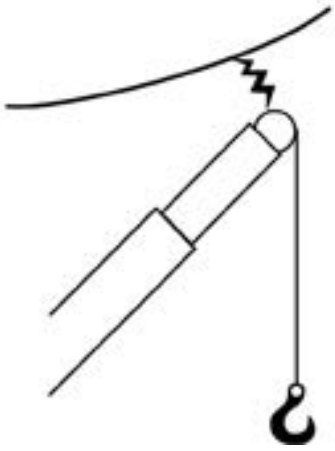
Cranes and other equipment must maintain a sufficient clearance from overhead power lines.

The minimum distance from any power line is 10 feet. A greater distance is required for lines carrying more than 50 kilovolts. [29 CFR 1926.1501(a)(15)(ii)]

Use a spotter when working near power lines. The spotter can make the difference between a safe job and a fatality.

Always assume that any overhead line is energized, unless the owner or the utility has certified that it is not energized – and you can see that it's grounded.

Before any digging or excavation takes place, the contractor must locate all underground power lines, gas lines, communications cables, pipe lines and sewers. Contact utility companies for information. All lines should be marked, and if possible disconnected.



The minimum clearance is 10 feet.

Electrical Hazards

Most people do not realize how little current it takes to kill – if the current passes through the heart.

50 milliamps (1/20 of an amp) can be fatal.

A typical circuit provides 20 amps. That's 400 times what it takes to kill. If only a small part of the available current reaches your heart, you might die.

As little as 50 milliamps (1/20 of an amp) can be fatal.

The heart uses tiny electrical signals to regulate its beat. A small current can disrupt these signals causing rapid, useless beating. This condition is called **ventricular fibrillation**. The heart no longer pumps blood efficiently. Death follows in minutes unless the fibrillation is stopped. (This is why emergency medical personnel use a device called a defibrillator.)

The best way to prevent electrocution and death is to make sure that you never come in contact with wires or equipment that carry electricity.

GFCI

Electricity moves in a circle, down the black wire, through the tool you are using, and back on the white wire. The tool does not use up the current. Under normal conditions, the same current flows through each of the two wires. If there is damage, then some current might return via the green ground wire – or through your body.

A **Ground Fault Circuit Interrupter (GFCI)** senses flow in the black and white wires. If it's not the same, the GFCI shuts off the circuit. If some current is flowing through your body, the GFCI will sense less current in the white wire. The GFCI will trip before your heart does. A GFCI can sense a difference as small as 5 milliampere, and can shut off in a fraction of a second, before there's enough current to cause ventricular fibrillation.

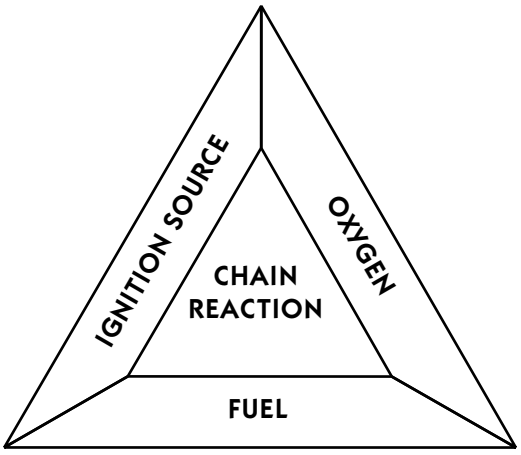
Fire and Explosion

A material that can act as a fuel (that can burn) is called a **combustible** or a **flammable** material. Later we will explain the difference between these two terms. A material that doesn't burn is called non-combustible.

Four things are necessary for fire:

1. **Fuel.**
2. **Oxygen.**
3. **Ignition source** (heat) to start the process.
4. **Chain reaction** to keep the fire going.

We call this the **fire pyramid**. If any component is missing, the fire can't happen. If a fire starts, we have to remove at least one component in order to put it out.



Combustion: the chemical reaction between fuel and oxygen which gives off heat and light.

To put out a fire, remove at least one component of the fire pyramid.

Flammable Vapor Explosions

The LEL is sometimes called the LFL or "lower flammable limit."

To have an explosion of flammable vapors in the air, there has to be the right mixture of vapor (fuel) and oxygen. If there is too little vapor, it won't burn. If there is too much vapor, it won't burn either.

The **Lower Explosive Limit (LEL)** is the smallest concentration of vapor in the air that will sustain a chain reaction and burn in the air, creating a vapor explosion.

The LEL is different for different chemicals. For gasoline it's 1.4%. At least 1.4% of the molecules in the air have to be gasoline in order to start a fire or explosion.

If there's a release of flammable vapor into the air, we want to be certain that the concentration is far below the LEL. This is because conditions could change. More fuel could evaporate, or the concentration could be greater as we move deeper into a confined space or closer to the source of the fuel. Also, the instrument we use to measure the concentration might not be accurate.

OSHA requires the concentration of a flammable gas, vapor, or mist to be less than 10% of the Lower Flammable Limit.

OSHA requires the concentration of a flammable gas, vapor, or mist to be less than 10% of the Lower Flammable Limit. [29 CFR 1910.146(b)]

Some Site Safety and Health Plans might establish an even lower action level (the point at which you have to leave the area). We can use ventilation to lower the concentration below the action level.

Flash Point

Liquids evaporate more easily as they get warmer, and they evaporate less if they are colder.

The **flash point** is the lowest temperature of a liquid at which it gives off enough vapor so that a spark will set off a fire or explosion.

A low flash point tells you a material is dangerous. Consider gasoline. It's flash point is minus 45°F. Anytime gasoline is warmer than minus 45°F, there will be enough vapor to have a fire or explosion. This means that in any situation (except maybe at the South Pole) liquid gasoline creates enough vapor to burn.

The flash point is the lowest temperature of a liquid at which it gives off enough vapor so that a spark will set off a fire or explosion.

Consider diesel fuel. It's flash point is around 130°F. Diesel fuel is not as easy to start burning as gasoline.

A **flammable liquid** is one that has a low flash point so that under normal conditions there's enough vapor that a spark will set off a fire or explosion.

Low flash point means high hazard.

A **combustible liquid** is one that has a flash point higher than the temperatures we consider normal. This means that under normal conditions there won't be enough vapor for a spark to set off a fire or explosion.

Flash Point

What's normal temperature? The NFPA (National Fire Protection Association) says that if the flash point is below 100°F, the material is considered flammable. If the flash point is 100°F or above, it's combustible. The idea is that most of the time the temperature doesn't get above 100°F, so it isn't hot enough for the liquid to give off enough vapor to burn or explode.

A DOT Flammable Liquid has a flash point of 140° or less.

The Department of Transportation (DOT) calls a liquid flammable if the flash point is 140°F or less.

[49 CFR 173.120(a)]

A DOT Combustible Liquid has a flash point of 141° or more.

DOT calls a liquid combustible if it has a flash point above 140°F. [49 CFR 173.120(b)]

DOT recognizes that sometimes liquids do get hotter than 100°F. This could happen in a tanker on a sunny day, in drums in a sealed trailer in the sun, or on a warm day in Tucson.

Low flash point means high hazard.

The idea behind both the NFPA and DOT systems is that we need to be more careful with flammable liquids because even a little spark could cause a fire.

Bonding and Grounding

Because a tiny spark can ignite the vapors, it is essential to **prevent all sparks when handling flammable liquids.**

Static electricity is produced when dissimilar materials rub together. Friction transfers electrons from one object to the other. If the extra electrons have no way to leave, they just sit there. That's what "static" means.

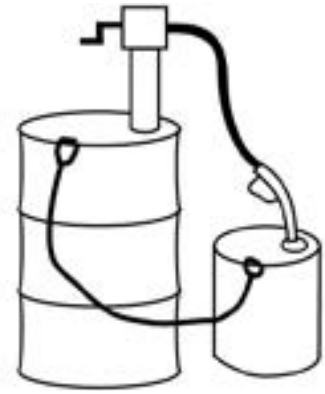
A **spark** occurs when the object with the extra electrons gets close to another object that can conduct electricity. The electrons jump through the air to the conductor. When you walk across a nylon carpet wearing rubber soles, electrons transfer from the carpet to your body. When you are about to touch a door knob, the electrons jump to the knob.

When liquid flows through a hose, or pours out of a container, friction causes electrons to transfer from the liquid to the container. When the spout touches another container, there could be a spark which ignites the vapors coming from the liquid.

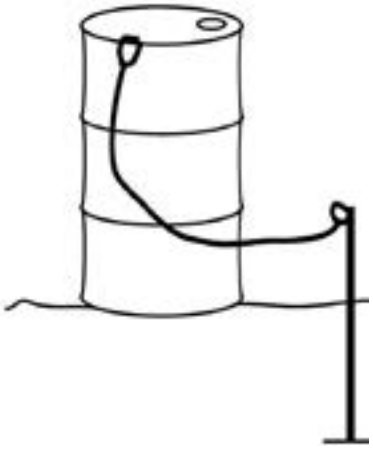
Bonding is connecting a good conductor (such as a copper wire) between two containers so that any extra electrons on one container can flow easily to the other container without causing a spark.

Grounding is connecting a good conductor (such as a copper wire) between a container and the earth. This prevents a spark from jumping between the container and a metal object that is in contact with the earth.

Not just any old wire will do. Use heavy gauge copper wire with special connectors that are designed for this purpose. These connectors are either clamps with sharp pointed screws, or special heavy duty clips. The connector has to make a good contact with the container, piercing through the rust or paint.



Bonding: connecting a good conductor between two containers to prevent a spark.



Grounding: connecting a good conductor between a container and the earth to prevent a spark.

Chemical Incompatibility

Incompatible chemicals are combinations of chemicals that undergo dangerous reactions if they mix with each other. The effects of these reactions can be:

- Production of heat and pressure;
- Fire and explosion;
- Formation of toxic gases and vapors; or
- Formation of flammable gases and vapors.

Incompatible chemicals are combinations of chemicals that undergo dangerous reactions if they mix with each other.

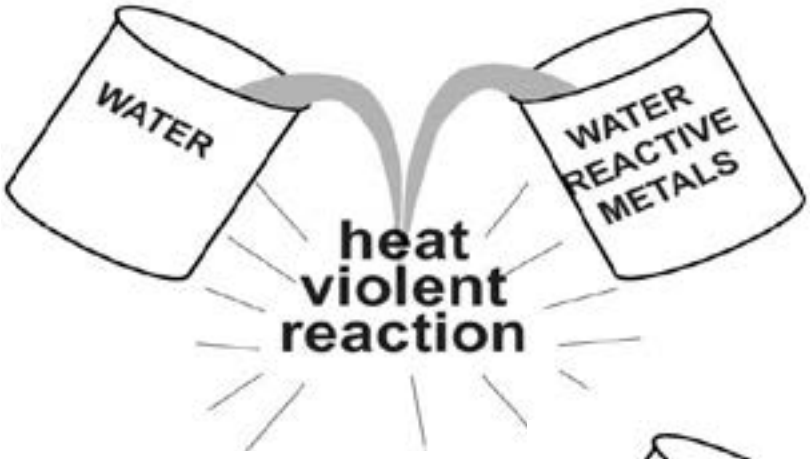
Some chemicals are dangerous if they come in contact with water, air, or common items like wood and paper.

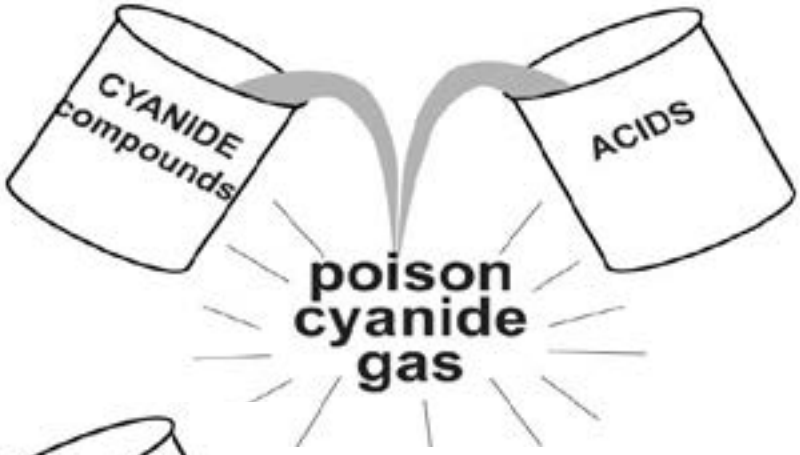
Because of the extreme danger that incompatible chemicals create, a great deal of effort must be put into analyzing hazardous substances and keeping them separate. This includes the creation of segregated staging areas for chemical storage. It is also why the DOT has special rules about chemical segregation during transportation.

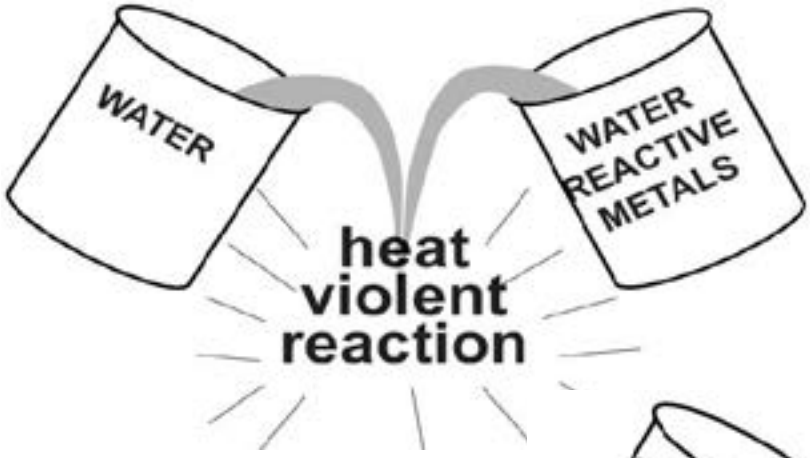
While you are not expected to be a chemist, there are some deadly combinations you can remember:

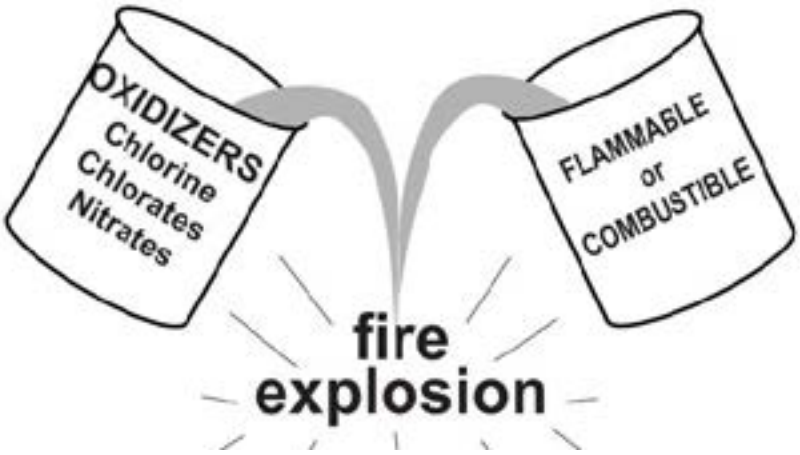
- Never mix acids and bases. They react violently and give off poisonous gases.
- Never mix cyanide compounds with acids. This creates deadly hydrogen cyanide gas.
- Never let strong oxidizers contact flammables or combustibles. Fire or explosion could follow.
- Never put water on materials like magnesium or sodium metal. They react violently, and can start a fire.

Chemical Incompatibility









Some examples of chemical combinations that are incompatible

Chapter

3

Health Hazards

Learning objectives

This chapter reviews the chemical, physical and biological health hazards that you might encounter at a hazardous waste site.

After completing this chapter you will be able to demonstrate your ability to:

1. IDENTIFY examples of adverse health effects from occupational exposure to chemicals.
2. IDENTIFY five routes of entry, into or on the body.
3. IDENTIFY six warning signs of possible chemical exposure.
4. IDENTIFY four forms of heat stress.
5. IDENTIFY four preventive measures to prevent heat stress.
6. IDENTIFY the health hazard presented by noise exposure.

Chemicals and Your Health

There are many ways hazardous chemicals can affect you. You might get a rash, feel sick or become dizzy. Your liver, lungs or other organs might be damaged. Your ability to have children might be affected. You might get cancer. The effect depends on the chemical, how much you absorb, and your own state of health.

A single chemical might cause more than one effect. For example, an acid might be corrosive (burn your skin) and be a poison (if it gets inside you).

Lack of Oxygen (Asphyxia)

Lack of oxygen – asphyxia. There are two ways that chemicals can cause a lack of oxygen:

- **Displacing the oxygen in the air**.
- **Interfering with how the body uses oxygen**.

The **normal amount of oxygen in the air is 21%**.

OSHA says that you may **not work in an area with less than 19½% oxygen**. [29 CFR 1910.146(b)]

Any gas or vapor can be a simple asphyxiant if enough is released to displace oxygen in the air.

Corrosives

Corrosives burn any tissue they contact: skin, eyes, mouth, nose, esophagus, stomach, and lungs. (Examples: **acids** like sulfuric acid or hydrofluoric acid; and **bases** like ammonia and lye.)

Irritants

Irritants cause redness, swelling, itching or burning of the eyes and skin. If inhaled, they cause coughing, or difficulty breathing. (Examples: solvents, weak solutions of ammonia, weak solutions of acids.)

Sensitizers

Sensitizers cause some people to become “sensitized”, and react to even a very small exposure. They suffer asthma-like symptoms or skin irritation. (Examples: formaldehyde, nickel, and toluene-di-isocyanide.)

Toxins (Poisons)

There are many kinds of **toxins (poisons)** – they are classified by what organs or parts of the body they damage.

Liver toxins (hepatotoxins) can cause hepatitis, cirrhosis, or liver failure. (Examples: ethyl alcohol, PCB’s, carbon tetra-chloride, vinyl chloride.)

Neurotoxins affect nerves. Some affect the brain (central nervous system) causing dizziness, nausea, headaches, poor coordination, or behavior changes. Other neurotoxins affect the nerves that go to other parts of the body (peripheral nervous system) causing numbness, tingling, weakness or tremors. (Examples: lead, mercury, organic solvents.)

Kidney toxins (nephrotoxins) damage the kidneys, and may cause kidney failure. (Examples: lead, cadmium, mercury, methyl alcohol, carbon tetrachloride.)

Respiratory toxins damage the lungs and airways. Ozone and phosgene gas cause fluid to collect in the lungs (edema). Asbestos and silica cause cancer and lung scarring. Asbestos and tobacco smoke can cause lung cancer.

Blood toxins (hematopoietic toxins) affect the blood, or the organs that make blood cells. (Example: benzene.)

Reproductive toxins affect your ability to conceive, or give birth to normal, healthy children. Possible effects include low sperm count, deformed sperm, impotence, menstrual irregularities, infertility, miscarriage, low birth weight and birth defects. (Example: ethyl alcohol.)

Cancer

Cancer is the uncontrolled growth of abnormal cells. Cancer is what happens when some cells begin to "misbehave", and enough of these cancer cells grow so that they cause a problem.

Cancer is the uncontrolled growth of abnormal cells that interfere with the way your body is supposed to work.

For example, the cells in your lungs form a structure which expands and contracts as you breathe. Some cells form the air passages, others let oxygen pass into your blood. If some cells grow into a mass that interferes with the passage of air or the normal expansion and contraction, then this mass of cells is called lung cancer.

Because there are different kinds of cells, there are different kinds of cancer: liver cancer, lung cancer, leukemia (blood cancer), skin cancer and so forth.

Chemicals that increase your risk of getting cancer are called carcinogens.

Chemicals that increase your risk of cancer are called **carcinogens**. Just because you are exposed to a carcinogen doesn't mean you'll get cancer.

To decrease your risk, keep your exposure as low as possible.

Not all chemicals cause cancer. We need to identify the ones that do, and keep our exposure as low as possible. Very few chemicals have actually been studied to see if they are carcinogens.

Some Examples of Chemical Carcinogens

Chemical	Type of Cancer	Chemical Uses
Asbestos	Lung cancer, mesothelioma	Insulation, brake linings
Arsenic	Lung cancer	Pesticides, pigments, smelter residue
Benzene	Leukemia	Chemical manufacturing, solvents
Benzidine	Bladder cancer	Manufacture of dyes, plastics, chemicals
Chromium	Lung cancer	Welding fumes, plating fumes and residues
Coal tar	Skin and scrotal cancer	Fly ash, roofing and sealing compounds
Naphthalene	Bladder cancer	Manufacture of dyes, rubber, chemicals
Vinyl chloride	Liver cancer	Manufacture of polyvinyl chloride (PVC)

Chemical Forms and Health Effects

The form of a chemical has a lot to do with how it affects our health, and with how we protect ourselves.

Very small particulates, like welding fumes, penetrate deep into the lungs when we inhale – and stay there. A larger particulate, like sawdust, might be caught in the nose, and we can blow it out. Fibers, like asbestos, because of their long, thin shape, also penetrate deep into the lungs.

Small particulates are also harder to trap in a respirator filter than larger particulates. For fumes, fibers and very small dusts we need a much better filter than we would need for sawdust.

Vapors and gases, because they are individual molecules, can penetrate deep into the lungs – where they can be absorbed into the blood.

Vapors and gases are difficult to capture in a respirator cartridge. For many gases and vapors no cartridge works – we have to use a respirator with its own air supply.

Air Contaminants

Air contaminants are hazardous chemicals in the air.

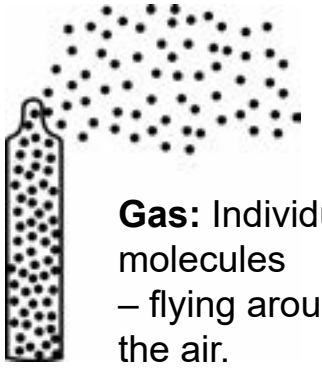
In order to be small enough to stay in the air and be inhaled, the chemical must either be in the form of a gas or a particulate. All air contaminants are either:

- **Gases and vapors**
- **Particulates**

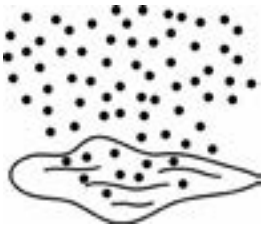
Gases and vapors are the same thing: individual molecules in the air. Particulates include dusts, fibers, fumes, mists and sprays.

Air Contaminants

Gases and Vapors



Gas: Individual molecules – flying around in the air.



Vapor: A gas that evaporates from a liquid or solid.

Particulates

Dust: Tiny solid particles – floating in the air.

Fibers: Tiny solid particles – much longer than wide – floating in the air.

Fume: Very tiny solid particles – from hot processes – floating in the air.

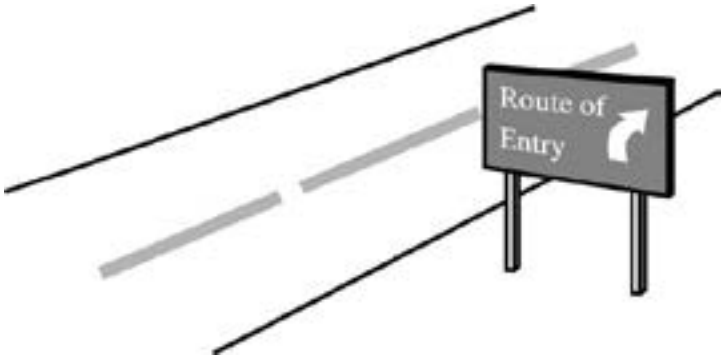
Mist and Spray: Tiny liquid pieces – floating in the air.

Routes of Entry

In order for a hazardous material to affect your health, it has to get into or on your body. The different ways that chemicals do this are called **routes of entry**.

1. **Inhalation** is breathing in a hazardous material. It may damage the lungs, and it may be absorbed in the blood and carried to other parts of your body.
2. **Skin or eye contact** is when a hazardous material gets on your skin or in your eye.
3. **Skin absorption** is when a hazardous material gets on your skin and soaks through the outer layers. It then enters the blood and is carried to other parts of your body.
4. **Ingestion** is when you accidentally swallow a hazardous material. This might happen if the material gets on your hands, and then on the sandwich you eat.
5. **Injection** is when a sharp object punctures the skin, allowing a chemical or infectious agent to enter.

Chemicals can use more than one route of entry. For example, if you handle a leaking container of solvent, you may get some on your hands. It can irritate your skin. It can also soak through, into your blood, and reach your liver or other organs. It can also evaporate and you will inhale it. The solvent affects you by skin contact, skin absorption, and inhalation.



Local and Systemic Effects

If a chemical causes damage where it comes in contact with your body, this is called a **local effect**. For example, if acid spills on your hand, the skin burn is a local effect. When you inhale ammonia, the irritation in your nose, throat and airways is a local effect.

If a chemical is absorbed — by whatever route of entry — and travels through your system to damage another organ, this is called a **systemic effect**. For example, suppose you inhale solvent vapors and start to feel dizzy. The solvent has been absorbed through the lungs, traveled in the bloodstream and caused an effect in your brain. Another example might be a chemical that soaks through your skin and then causes damage to your liver.

Local Effect: Occurs where the chemical contacts your body.

Many chemicals produce both local and systemic effects. For example, inhaling a solvent might irritate the nose and lungs. This is a local effect: it happens where the chemical comes in contact with your body. But the solvent will also be absorbed in the lungs and carried by the blood to the liver, kidneys and brain. Damage to these other organs is a systemic effect.

Systemic Effect: Occurs in some other organ after the chemical has circulated through your system.

In any case, the organs that a chemical affects are called target organs.

Local effect, systemic effect and target organ have to do with **where** the chemical affects you.

Acute effect, chronic effect and latency period have to do with **when** the chemical affects you.

Short Term and Long Term Effects

Acute = short term
Chronic = long term

Some chemicals cause effects that occur right away. If acid gets in your eye, it causes a painful burn immediately. If you inhale ammonia vapor, you cough and feel irritation in your nose and airways right away. This is called a **short-term effect** or **acute effect**.

If you breathe small amounts of asbestos fibers you won't even notice them. There are no acute effects. But if you inhale asbestos month after month, year after year, you greatly increase your chances of getting lung cancer. This is a **long-term effect** or **chronic effect**.

It may take many years between the time you were exposed and when symptoms begin to appear. This is called the **latency period**. For some diseases, like cancer, the latency period can be twenty, thirty or more years.

The same chemical can cause both kinds of effects. For example, toluene is a chemical used in paints and solvents, and in the cement for plastic models. Inhale toluene and you can get dizzy or "high", and feel respiratory irritation. Toluene can also dry and irritate the skin. These are acute effects. However, if you are exposed again and again, toluene will damage your liver and destroy brain cells. These are chronic effects.

We usually notice acute effects. For example, acid burns and we feel it almost immediately. Just one whiff of ammonia vapor can make you cough. These effects can warn us to take precautions.

Unfortunately, you usually won't notice chronic effects until it's too late, because they happen slowly and it takes a long time to develop symptoms. You have to learn the possible chronic effects of the chemicals you work with. Then you will know that you must be careful, and what precautions to take, even if the materials don't cause any immediate effects.

Latency Periods: Average Years After Exposure for Cancer to Appear

Asbestos:	**33 yrs**
Arsenic:	**25 yrs**
Benzene:	**10 yrs**
Benzidine:	**16 yrs**
Chromates:	**21 yrs**
Napthylamine:	**22 yrs**
Vinyl chloride:	**15 yrs**

Differences Between Acute and Chronic Health Effects

Acute Effect	Chronic Effect
Occurs immediately, or soon after exposure.	Develops slowly over a long time. (The time lag is called the latency period.)
Often involves a high exposure in a short time.	Often involves a low exposure over a long period of time.
Often reversible. You recover after exposure stops.	Many chronic effects are irreversible. (Permanent effects).
Often it's obvious what caused the effect.	Because of the delay, it's difficult to establish what exposure caused the effect.

Examples of Acute and Chronic Health Effects

Hazard	Acute Effect	Chronic Effect
Asbestos	None	Asbestosis (scarring of the lung). Lung cancer. Mesothelioma (cancer of the lining around the lung).
Acid mist	Irritation of the eyes, nose and throat. Cough. Sore throat. Chest pain.	Chronic bronchitis. Emphysema.
Tri-chloro-ethylene	Light headedness. Numbness. Nausea.	Liver damage. Kidney damage. Possibly liver cancer.
Carbon-monoxide	Drowsiness. Headache. Confusion. Unconsciousness. Death.	Heart attack. Stroke.

Are You Exposed?

How do you know what chemicals you are exposed to? How do you know how much you're exposed to? How do you know if your exposure is below the limit?

There are instruments for monitoring some chemicals in the air. For some chemicals there are tests to see how much is in your body.

There are also clues to indicate exposure even if you don't have special instruments. You may be able to smell a chemical or feel an acute effect like itching skin or watery eyes. There may also be clues in your work environment to indicate exposure.

Odor. If you can smell it, you are inhaling it.

However, many chemicals don't have a smell, or the amount needed for smell is higher than the exposure limit. Others have no smell, like carbon monoxide, or they numb your sense of smell, like hydrogen sulfide.

Taste. Never taste something that might be a hazardous chemical. However, if you inhale a chemical or accidentally get some in your mouth, it may have a particular taste that warns you you're being exposed.

Particles in your respiratory system. Your nose and airways have mucous that traps particulates and removes them when you cough or blow your nose. If your mucous is an unusual color or has visible particles in it, then you have inhaled particulates. What you see are particles that were large enough to be trapped. There may be smaller ones that made it deep into your lungs. Particulates this small are too small to see.

Spills or leaks. Leaking drums or pools of liquid indicate a hazard. Chemicals may be evaporating into the air. Don't walk through spilled material, or get it on your bare skin.

This is why for particulate contamination, like asbestos fibers, people say, "It's what you can't see that hurts you."

Are You Exposed?

Visible material in the air. If you see visible clouds of vapor or particulates, there is probably a serious exposure problem. Remember, however, that most gases and vapors are invisible, and that often the most dangerous particulates are too small to see.

Acute symptoms. Many chemicals cause irritation. One whiff of ammonia warns you it's there.

Settled dust. If there is dust on the ground or on other surfaces, it probably got there by settling out of the air. This means that there are particulates in the air that you could inhale. It is likely that if you walk through the area, or use equipment, you will send more of the settled dust back into the air, increasing the inhalation hazard. If dust settles on the ground, it can also settle on your clothes, on your hair, and on your food.

Dead vegetation or **dead animals**. If they're dead, think about what chemical might have killed them.

Acute symptoms like dizziness, nausea or headache may also warn you of exposure. But it's easy to ignore these, or assume that you're just getting a cold or the flu.

What If There Are No Signs or Symptoms of Exposure?

It's important to recognize the warning signs of chemical exposure, like odor, or acute symptoms. But what if there are no signs? Can you forget about exposures? Many chemicals have no smell, taste, or acute symptoms. Some people can't smell certain chemicals. Some chemicals numb your sense of smell. Many air contaminants are invisible. There may be contamination on the things you handle, without there being enough to see or feel.

Use the common sense clues we've discussed as warning signs. But never assume you're not exposed just because you don't see or feel any warning signs.

Biological Hazards

Biological hazards include acute and chronic infections, parasites, toxic shock and allergic reactions to plants and animals. This includes:

- Bacteria
- Viruses
- Fungi
- Pollens
- Insects
- Snakes
- Rodents

Biological hazards may be found at any hazardous waste site. These hazards may result from infectious agents that were disposed of (such as medical wastes), or they may be natural inhabitants of the area.

Infectious waste. The most common forms of waste that might contain biological hazards are infectious medical and laboratory waste. This can include syringes and other “sharps”, as well as bandages and materials contaminated with infected body fluids.

Bio-Hazard Warning Symbol

Infectious waste is required to be packed in red plastic bags. Needles, syringes, scalpels and other sharps are required to be packed in hard red plastic containers. These red bags and plastic containers must be printed with the biohazard warning symbol.

Infectious waste may only be legally disposed of at sites specifically authorized to accept infections waste. However, it has frequently been disposed of improperly, so you might encounter infectious waste at any waste site.

Biological Hazards

Hantavirus is transmitted to humans from the dried droppings, urine, or saliva of mice and rats.

Molds and fungi release millions of small spores into the air. Some cause allergic or asthma-like reactions as well as other respiratory symptoms.

Bloodborne pathogens include Human Immuno-deficiency Virus (HIV), hepatitis B, and hepatitis C.

These hazards might be found in waste from hospitals and clinics, especially if the waste contains used needles. Used needles abandoned by drug users are also a potential hazard.

You might also be exposed to bloodborne pathogens from a worker who is injured.

If you are stuck by a needle or other sharp object, or get blood in your eyes, nose, mouth, or on broken skin:

- Immediately flood the exposed area with water and clean any wound with soap and water or a skin disinfectant if available.
- Report this immediately to your supervisor.
- Seek immediate medical attention.

Heat Stress

Heat stress can be a serious, life-threatening hazard, especially for workers wearing impermeable protective clothing. Heat stress means that your body is having trouble keeping its temperature at the normal level – about 99°F. It means that your body is overheating.

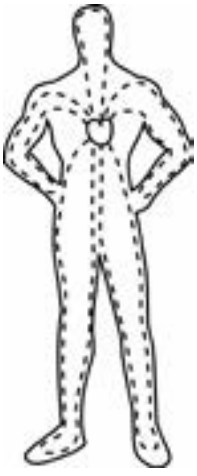
Heat in your body comes from two sources:

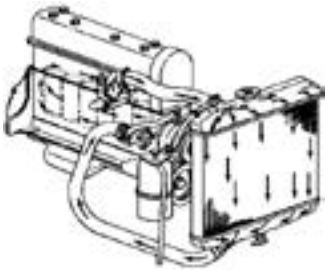
- Heat your muscles make as they work.
- Heat from the environment around you.

If your body gets too hot it means that:

- You are working too hard, and/or
- The environment is too hot, and/or
- Something is keeping your body's cooling system from working effectively.

Your body has a cooling system. As the body gets hotter, it sends more blood to the skin where heat in the blood dissipates into the air. This is like the way hot water from an engine goes to the radiator where it gives off heat. Your body also sweats. As the sweat evaporates, it takes even more heat with it.





Heat Stress

Heat stress is possible if you are working in a hot environment.

Heat stress is also possible if you are wearing protective clothing – even when it's not very hot out.

Protective clothing can keep chemicals out. But these garments also trap sweat inside, and keep it from evaporating. Sweating only cools if the sweat evaporates. **If sweat can't evaporate, it can't cool.**

If you wear heavier or more protective clothing than you need, you could create a new hazard: heat stress.

Even in moderate weather, it's possible to suffer heat stress if you're in protective clothing that interferes with your body's cooling.

Protective clothing can cause heat stress even if it's not very hot out.

Types of Heat Stress

There are four types of adverse health effects caused by heat stress:

Heat Rash. Itchy rash that occurs when the skin swells and plugs the sweat glands. (Not life-threatening, but indicates that heat stress conditions may be present.)

Heat Cramps. Painful muscle cramps caused when sweating diminishes water and electrolytes. (Not life threatening, but indicates heat stress conditions.)

Heat Exhaustion. You feel worn-out, nauseous, dizzy or faint. Heavy sweating. You may have rapid, shallow breathing. Stop work: rest in a cool place. Drink fluids. Get medical assistance: heat exhaustion can develop into deadly heat stroke.

Heat stress can kill-One half of all people who experience heat stroke die as a result!

Heat Stroke. This is a serious medical emergency. Call emergency medical help now! Symptoms: hot, red, dry skin; little or no sweating; very rapid pulse; dizziness; and nausea. Temperature above 105 °F. Delirium or possible coma.

Preventing Heat Stress

There are several ways to help prevent heat stress:

- **Recognize the signs of heat stress in yourself and in your fellow workers.** Often we don't notice what's happening to ourselves. If your buddy looks like they're having a hard time, getting too red, sweating too much, or acting dizzy and uncoordinated, don't be afraid to say something. You might be saving their life.
- **Adjust Schedules.** Take breaks. Heavy work in protective clothing or in a hot environment may require more time resting than working. Schedule heavy work in the coolest part of the day, or at night.
- **Provide Rest Shelters.** Have shaded rest shelters with chairs or benches. Air conditioning is even better.
- **Drink Fluids.** Sweating cools the body, but it also robs the body of fluid. Drink enough to replace what you lose. You may not feel thirsty until you've become dehydrated. Drink regularly throughout the day. Don't wait until you're thirsty. Your employer is required to provide clean running water, or sanitary, insulated water jugs.
- **Keep Fit.** The healthier you are, the more resistant your body is to conditions that cause heat stress. Your muscles work more efficiently and your body is better able to transfer heat to your skin surface where sweating can dissipate this heat.

You don't feel thirsty until you've started to dehydrate. Drink water or other fluids regularly throughout the day, before you get thirsty.

Noise Exposure

Long term (chronic) exposure to loud noise levels at work can destroy nerve cells in your inner ear. This kind of hearing damage is called **industrial hearing loss.**

This is a permanent condition. Because it develops slowly, over several years of noise exposure, you won't notice it until it's too late. You may be surprised one day when you realize that you can't understand your grandchildren, or that music just doesn't sound right anymore.

Industrial hearing loss is a permanent condition. There is no cure. That's why prevention is so important.

You need to protect yourself now in order to prevent hearing loss later.

OSHA Noise Standards

If your average daily exposure to noise is 90 decibels or above, OSHA requires hearing protection (plugs or muffs) to be worn. [29 CFR 1910.95 and 29 CFR 1926.52]

How loud is 90 decibels? A rule of thumb is that if you have to shout in order to talk to a person standing three feet away, then it's probably more than 90 decibels.

Decibels are different than ordinary numbers. According to OSHA, every time the sound level goes up 5 decibels, it's twice as loud! So, 95 is twice as loud as 90, and 100 is four times as loud as 90.

Hearing Conservation Programs

The general industry standard requires a **hearing conservation program** if average sound levels are 85 decibels or above. The program must include:

- Training and information about risks and how to control them;
- Measuring noise levels at work;
- Annual hearing exams;
- Engineering and administrative controls, where feasible;
- Protective equipment; and
- Keeping records.

The requirements listed above for general industry are more protective than the OSHA standard for the construction industry.

Even if your work site is a construction project, it's still a good idea to have a hearing conservation program, including noise measurements, controls, training and annual exams.

Ergonomic Hazards

Ergonomic hazards can cause injuries to muscles, tendons, ligaments, joints, cartilage, and nerves. There are many different names for ergonomic injuries:

- Musculoskeletal disorder (MSD).
- Repetitive stress injury.
- Cumulative trauma disorder.
- Carpal tunnel syndrome.
- Lower back pain.
- Disk injury.
- Tendonitis.
- Sciatica.

These are painful and often disabling conditions that often develop over a long period of time. **They are very difficult to cure, so prevention is always important.**

MSDs can cause pain, numbness, tingling, stiff joints, difficulty moving, muscle loss, and paralysis.

You might have a musculoskeletal disorder if you have any of these symptoms:

- Numbness in your fingers.
- Numbness in your thighs.
- Stiff joints.
- Back pain.

Ergonomics means designing jobs to fit the worker, rather than forcing the worker's body to fit the job.

Examples of ergonomic solutions include fully adjustable driver's seats, preventive maintenance to reduce vibration, and good job planning to minimize manual lifting.

Ergonomic Hazards

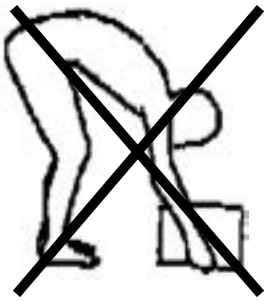
Proper Lifting Technique. To prevent painful, possibly permanent injury, use the proper technique.

- Don't overestimate your strength: if it's too bulky or too heavy, get assistance.
- Keep the back straight and lift with the legs.
- Lift slowly and carefully.
- Keep the load as close to your body as possible.
- Don't turn or twist while you are lifting.
- Be just as careful putting the load down.

Correct

Even proper lifting technique puts a tremendous strain on the muscles and discs in the lower back.

If the load is too heavy, or if the worker reaches out too far, or twists while lifting, the force can be many times greater, even if the weight of the object is not very great.



Wrong!

The job should be planned to minimize the amount of manual lifting. There should be enough workers to lift safely. Use drum grapplers, forklifts and boom trucks whenever possible.

Back belts. Do back supports work? NIOSH studied workers who do lifting. They found that workers wearing supports are just as likely to be injured as those who don't use them.

Makers of back supports, and also some scientists and workers, disagree with NIOSH. Many people believe supports help because they remind you to use proper technique. One thing is certain: a back support won't make you stronger. Don't assume that you can lift more just because you have one.

Chapter

4

Medical Surveillance

Learning objectives

This chapter reviews the medical examinations that you are required to have if you work at a hazardous waste site.

After completing this chapter you will be able to demonstrate your ability to:

1. EXPLAIN the purpose of medical surveillance.

2. IDENTIFY when medical exams are required.

3. DESCRIBE the four main parts of an occupational medical exam.

Medical Surveillance

29 CFR 1910.120 (e) (2) (vi)

Medical surveillance means keeping track of workers' health by providing occupational medical exams and maintaining medical records.

The OSHA HAZWOPER Standard requires your employer at a hazardous waste site to establish a medical surveillance program for workers who may be exposed to hazardous substances, or who wear respirators for thirty or more days during a year.

When Do You Need a Medical Exam?

OSHA requires occupational medical exams as follows: [29 CFR 1910.120(f)(3)(i) and 1926.65(f)(3)(i)]

- Prior to employment.
- Once a year after you start working.
- When you cease employment.
- As soon as possible after you develop signs or symptoms of overexposure to hazardous substances, or after you have been injured or exposed to a hazardous substance above the PEL in an emergency situation.

Who Pays for the Exam?

Your employer pays for medical exams required by HAZWOPER. They must be at a reasonable time and place without loss of pay. [29 CFR 1910.120(f)(5) and 1926.65(f)(5)]

The Purpose of Medical Surveillance

There are two main reasons for medical surveillance:

- To assess your health and fitness for work, including whether you can wear a respirator.
- To detect early warning signs and symptoms of occupational disease and overexposure.

What Doctor Do You See?

Most doctors have little or no specialized training in occupational medicine.

You want to see a doctor who is Board Certified in Occupational Medicine.

Ideally, you should see a physician who is Board Certified in Occupational Medicine. This is a doctor who has special training and experience in occupational medicine, and has passed a rigorous examination to verify his or her qualifications in occupational medicine. Unfortunately, most physicians receive only very limited training in occupational medicine.

You want a doctor who knows how exposure to chemicals or to physical agents at work can affect your health; who knows what signs and symptoms are work-related; who knows what questions to ask and what tests to perform; and who knows how to treat occupational diseases and injuries.

Who Sees the Results of the Exam?

You have a right to confidentiality.

Your exam results are confidential. The employer only gets an opinion as to your fitness to work, wear a respirator, or any other work limitations. The physician is not supposed to give your employer any information unrelated to your work unless you give permission.

[29 CFR 1910.120(f)(6) and 1926.65(f)(6)]

Keep a copy of the exam results. You may need it to show to another doctor, or for a compensation case.

Occupational Medical Exam

The medical exams required by HAZWOPER have four parts:

- **Work history**.
- **Medical history**.
- **Physical examination**.
- **Laboratory tests**.

Make it work for you

You and your union representatives can take steps to make sure that the medical surveillance program works for you.

- Read the specifics of the medical surveillance program in the Site Safety and Health Plan. See if it complies with the HAZWOPER requirements.
- Learn the meaning of the medical words that are used to describe the program.
- Use the Site Safety and Health Plan to find out what exposures are possible at the site.
- Ask about the qualifications of the physician who administers the occupational medical exams. What is the doctor's training? Is the doctor Board Certified in Occupational Medicine?
- Keep a personal written log of all exposures at work. What chemicals do you handle? Is there noise exposure, heat stress, ionizing radiation? What physical agents are present? What symptoms do you experience?

For help in understanding medical surveillance, contact the Teamsters Safety and Health Department

Chapter

5

Hazard Communication

Learning objectives

This chapter reviews the OSHA Hazard Communication Standard, which provides workers with information about hazardous chemicals.

After completing this chapter you will be able to demonstrate your ability to:

1. IDENTIFY the five major requirements of the OSHA HAZCOM Standard.
2. IDENTIFY the kinds of information about a chemical that you can find on its SDS.
3. LIST six types of information that must be on a chemical label.
4. DESCRIBE how to interpret an NFPA hazard diamond.

The OSHA HAZCOM Standard

[29 CFR 1910.1200 and 1926.59]

The **OSHA Hazard Communication Standard** (**HAZCOM)** requires employers to have:

1. **Written HAZCOM program** to inform workers of chemical hazards.

2. **Safety Data Sheet (SDS)** for each hazardous chemical in the workplace, and make these SDSs available to workers on all shifts.

3. **Labels** on all containers of hazardous chemicals.

4. L**ist of hazardous chemicals** in the workplace, and make this list available to workers.

5. **Training** for workers about:
   - The Hazard Communication Standard.
   - The employer's HAZCOM program.
   - The operations or locations in the workplace where hazardous chemicals are present.
   - What hazardous chemicals are present.
   - How to use SDSs.
   - How to interpret chemical labels.
   - How to detect the presence of chemicals.
   - The physical, health, simple asphyxiation, combustible dust and pyrophoric gas hazards as well as hazards not otherwise classified of the chemicals in the work area.
   - Safe work practices, protective equipment and emergency procedures for the chemicals.

The chemical inventory list should reference chemicals by using the name found on the container label and the name listed on the SDS

Training on HAZCOM must be provided at the beginning of each new assignment involving hazardous chemicals or whenever a new physical or health hazard is introduced.

Chemical Labels

Labels on chemical containers must include:

1. Product identifier
2. Signal word
3. Hazard statement
4. Pictograms
5. Precautionary statement
6. Name, address and telephone number of the chemical manufacturer, importer, distributor, or other responsible party.

See the next page for the OSHA Pictograms

The label may include a CAS number, which is a unique "social security" number for each chemical. This is helpful because most chemicals have more than one name. If you look in another information source you can be sure that you are getting information about the right chemical if you verify the CAS number.

A Chemical Abstract Service (CAS) Number is a unique number assigned to every chemical, regardless of its name. This is helpful because many chemicals have more than one name.

The label might also include a UN/NA identification number, which is the DOT number for the chemical, or for the group of chemicals it belongs to.

There is an exception: If the secondary container is only used by one worker for only one shift, then it doesn't have to be labeled.

If you transfer a chemical to a secondary container, HAZCOM requires the secondary container to be labeled also. For example, if you fill a one-quart can and take it to the repair shop, this secondary container also needs a label.

HAZCOM Pictograms

Health Hazard

- Carcinogen
- Respiratory Sensitizer
- Reproductive Toxicity
- Target Organ Toxicity
- Mutagenicity
- Aspiration Toxicity

Flame

- Flammables
- Self-Reactives
- Pyrophorics
- Self-Heating
- Emits Flammable Gas
- Organic Peroxides

Exclamation Mark

- Irritant
- Dermal Sensitizer
- Acute Toxicity (harmful)
- Narcotic Effects
- Respiratory Tract Irration
- Hazardous to Ozone Layer (Non-Mandatory)

Gas Cylinder

- Gases Under Pressure

Corrosion

- Skin Corrosion/Burns
- Eye Damage
- Corrosive to Metals

Exploding Bomb

- Explosives
- Self-Reactives
- Organic Peroxides

Flame Over Circle

- Oxidizers

Environment
(Non-Mandatory)

- Aquatic Toxicity

Skull and Crossbones

- Acute Toxicity (Fatal or Toxic)

Safety Data Sheet (SDS)

Your employer is required to have a **Safety Data Sheet (SDS)** for every hazardous chemical used in the workplace.

The SDS must provide the following information in the order listed below:

1. Identification;
2. Hazard identification;
3. Composition/information on ingredients;
4. First-aid measures;
5. Fire-fighting measures;
6. Accidental release measures;
7. Handling and storage;
8. Exposure controls/personal protection;
9. Physical and chemical properties;
10. Stability and reactivity;
11. Toxicological information;
12. Ecological information;
13. Disposal considerations;
14. Transport information;
15. Regulatory information; and
16. Other information including date and preparation or last revision.

SDSs must be:

- **available to all workers**
- **available on all shifts**
- **available in each work area**
- **printed in English**

DOT Placards, Labels and Markings

The US Department of Transportation (DOT) has requirements for placards, labels and other markings on hazardous materials in transportation. These can help you identify the chemical hazards in your work place.

DOT Hazard Classes and Divisions

Class 1	**Division 1.1**	**Explosives (with a mass explosion hazard)**
	Division 1.2	**Explosives (with a projection hazard)**
	Division 1.3	**Explosives (with predominately a fire hazard)**
	Division 1.4	**Explosives (with no significant blast hazard)**
	Division 1.5	**Very insensitive explosives, blasting agents**
	Division 1.6	**Extremely insensitive detonating substances**
Class 2	**Division 2.1**	**Flammable gas**
	Division 2.2	**Nonflammable compressed gas and oxygen**
	Division 2.3	**Poisonous gas**
Class 3	**. . . . . .**	**Flammable and combustible liquids**
Class 4	**Division 4.1**	**Flammable solid**
	Division 4.2	**Spontaneously combustible material**
	Division 4.3	**Dangerous when wet**
Class 5	**Division 5.1**	**Oxidizer**
	Division 5.2	**Organic peroxide**
Class 6	**Division 6.1**	**Poisonous materials**
	Division 6.2	**Infectious substances (etiologic agent)**
Class 7	**. . . . . .**	**Radioactive material**
Class 8	**. . . . . .**	**Corrosive material**
Class 9	**. . . . . .**	**Miscellaneous hazardous material**
ORM-D	**. . . . . .**	**Other regulated material**

Emergency Response Guidebook

The DOT Emergency Response Guidebook (ERG) provides information to **identify hazardous materials** and **make decisions about response and evacuation during the initial response to a hazmat incident**.

The ERG contains **guides**, which are two-page descriptions of how to respond. Each guide is for a different set of circumstances. The guides are the “guts” of the book.

The ERG has six color-coded sections:

- **White: (front)** The white section at the front of the book has pictures of all the different placards, and pictures of different kinds of vehicles.

  The purpose of the white section is to help you find the right guide if you only know the placard or the type of vehicle.

- **Yellow:** The yellow section is a list of all of the UN/NA identification numbers. For each number it tells the name of the hazmat and also tells which guide to use.

  The purpose of the yellow section is to help you identify the hazmat and find the right guide to use – if you know the UN/NA identification number.

- **Blue:** The blue section is a list of the names of different hazmats. For each name it tells the UN/NA identification number and also tells which guide to use.

  The purpose of the blue section is to help you identify the hazmat and find the right guide to use – if you know the name.

The ERG is intended to assist emergency responders during the first half hour of their response. After that it is assumed that more complete information, such as expert consultation and computer databases will be available.

Emergency Response Guidebook

- **Orange:** The orange section contains the guides. Each guide gives information about:
  - Health hazards.
  - Fire hazards.
  - Protective clothing.
  - Evacuation.
  - Fire response.
  - Spill response.
  - First aid.

If the name and UN/NA number of the hazmat was highlighted in the yellow and blue sections, then there is more information about that hazmat in the green section.

- **Green:** The green section contains more detailed information about isolation and protective distances for certain hazmats.

  The green section also has a list of hazmats that produce toxic gases if they react with water. This is important information that fire fighters need before they use water to suppress a fire or to dilute a spill.

Both the front and back white sections contain a list of emergency phone numbers.

- **White: (back)** The white section at the back of the book contains a glossary of words used to describe hazmat and emergency response.

  This white section also has information about protective clothing, fire and spill control, and indications that the situation involves criminal or terrorist activity.

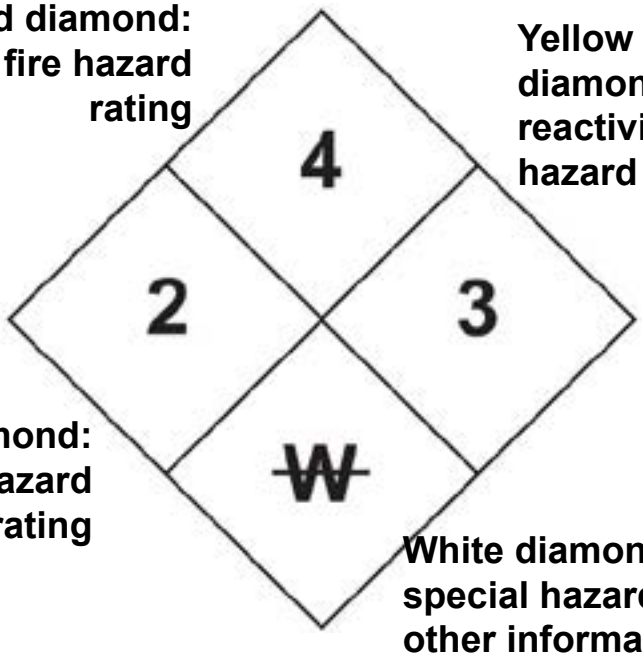
You should be familiar with the ERG – and practice using it – so that you can quickly get information if you are involved in a hazmat incident.

Keep the ERG with you when you transport hazmat.

NFPA Hazard Identification System

The NFPA Hazard Identification System provides information to fire fighters in an emergency. You will find the diamond shaped NFPA labels on containers, storage tanks, doors and walls.

"0" means no hazard. "4" means the most severe hazard. The bottom diamond is for special information, such as "radioactive", or "water reactive".



Red diamond: fire hazard rating

Yellow diamond: reactivity hazard rating

Blue diamond: health hazard rating

White diamond: special hazards or other information

The NFPA label does not identify the chemical. It does not give specific health effects. It also does not identify the manufacturer. These are all things which OSHA requires on product labels.

The NFPA Hazard Identification System is intended to provide information to fire fighters during an emergency.

The higher the number, the greater the hazard: "4" is the most extreme hazard.

The NFPA label does not identify the chemical, the specific health effects, or the manufacturer.

NIOSH Pocket Guide

The **NIOSH Pocket Guide to Chemical Hazards** describes more than 600 chemicals. These are all the chemicals for which OSHA has a Permissible Exposure Limit (PEL), plus some others for which NIOSH has recommended a standard.

In order to pack a lot of information into one book, the NIOSH Pocket Guide uses many abbreviations. These are all explained in the front part of the book.

The Guide gives an **Immediately Dangerous to Life or Health (IDLH)** level for many chemicals. This is the **airborne concentration** that "**is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such environment**."

If the chemical is a **carcinogen**, you will find "**Ca**" written in the IDLH column. NIOSH believes that any exposure to a carcinogen increases your risk of cancer, which is a permanent adverse effect. Therefore, no other IDLH value is listed for carcinogens.

If you can't find the chemical you're looking for, look in the "Synonym and Trade Name Index", the "CAS Number Index", or the "DOT ID Number Index" at the back of the book. These indexes give the page on which the chemical is listed.

- notes -

Chapter

6

Air Purifying Respirators

Learning objectives

This chapter reviews the respirators that workers use at hazardous waste sites, and focuses on one type: Air Purifying Respirators (APRs).

After completing this chapter you will be able to demonstrate your ability to:

1. DESCRIBE two basic types of respirators.

2. DESCRIBE the factors to consider before deciding to use an Air Purifying Respirator.

Air Contaminants

For something to be an air contaminant, it must be **small enough to stay in the air** and **small enough to be inhaled**. There are two ways that this can happen:

1. **Gases and Vapors**. These are individual molecules that become part of the air itself.

2. **Particulates**. These are tiny pieces that float in the air. Solid particulates: dust, fiber and fume. Liquid particulates: mist and spray.

Oxygen Deficiency

Oxygen and Health

Too Much		23½%	Oxygen Enriched. Fire Danger.
Just Right		21%	Normal Oxygen for People.
Too Little		19½%	OSHA Minimum for Safe Entry.
		16%	Dizzy and Confused.
		14%	Hard to Breathe.
		6%	Death in a Few Minutes.

19½% oxygen is the lowest level OSHA allows.

Below 19½ % you must have a respirator that supplies breathing air.

When Do You Need a Respirator?

There are three hazardous conditions in the air that require workers to use respirators:

1. **Gas and vapor contaminants**. These are individual molecules that become part of the air itself.

2. **Particulate contaminants**. These are tiny pieces that float in the air. Solid particulates: dust, fiber and fume. Liquid particulates: mist and spray.

3. **Oxygen deficiency**. The lowest level you are allowed to breathe is 19½%.

You may have all three conditions at the same time.

Respirators For Hazardous Waste Workers

Respirators are serious equipment. It is dangerous to wear a respirator without proper training. There are different kinds of respirators.

If you use the wrong respirator, it could be fatal!

NIOSH Approval

NIOSH has standards for approving respirators.

- Never use a respirator or cartridge unless it has the NIOSH Tested & Certified (TC) number and the NIOSH symbol.

- Never try to use filters, valves or parts from one make of respirator on another make.

TC means:
Tested & Certified.

Types of Respirators

There are two basic types of respirators:

1. **Air Purifying Respirators (APRs)**. You breath the dirty air around you. The respirator has filters or cartridges that try to clean the air before you inhale it. APRs do not supply oxygen.

2. **Atmosphere Supplying Respirators**. These have a separate, clean air supply from a cylinder on your back (SCBA), or an air line.

In an oxygen deficient atmosphere you must have an atmosphere supplying respirator.

Air Purifying Respirators (APRs)

With an **Air Purifying Respirator** or **APR**, the air you breathe is the air around you. It starts out contaminated, and you depend on the filters or cartridges to catch the contaminants before you breath them in.

There are many chemicals for which there is no filter or cartridge that works.

Air Purifying Respirators do not supply oxygen.

Fit Testing

If the respirator doesn't fit your face almost perfectly, dirty air will get in around the edge of the respirator.

Before wearing any respirator that requires a tight seal against your face, **you must have a fit test** to make sure that the respirator fits you correctly.

Filters and Cartridges for APRs

Air Purifying Respirators use filters, chemical cartridges, or both:

- **Filters are for particulates.**

  Particulates are small solid or liquid pieces floating in the air. A filter traps these particulates. **Filters do not trap gases and vapors.**

- **Chemical cartridges are for gases and vapors.**

  Gases and vapors are individual molecules in the air. Chemical cartridges catch some kinds of gases and vapors, but **there are many gases and vapors for which there is no cartridge that works. Chemical cartridges do not protect against particulates.**

One of the most common mistakes that people make is to not understand the difference between a filter and a chemical cartridge. If you are exposed to particulates, use a filter. If you are exposed to gases or vapors, use a chemical cartridge.

If you are exposed to particulates and gases/ vapors at the same time, then you need to use a combination filter-chemical cartridge.

How Long Do the Filters or Cartridges Last?

Filters. OSHA says that for filters, you can use them until you sense increased breathing resistance, which means that the filters are getting clogged.

Chemical cartridges. Breathing resistance does not increase when a chemical cartridge gets used up.

For chemical cartridges, OSHA requires the employer to use a **change-out schedule** that is based on the concentration of contaminant in the air and on how hard you are working. This has to be determined by a person with technical expertise.

OSHA also allows you to use a chemical cartridge that has an **End of Service Life Indicator (ESLI)**. This is something that changes color when the cartridge is full. However, there are very few of this kind of cartridge available.

IDLH

IDLH means **Immediately Dangerous to Life and Health**. If you are exposed to an IDLH concentration (or greater) for thirty minutes or more, you will likely:

- Suffer permanent damage to your health, or
- Become unconscious or otherwise unable to leave the area (after which you might die, or suffer permanent damage to your health), or
- Die

You must never use an APR in an IDLH situation. If the APR stops working, for example if the filter or cartridge gets used up, then you will risk death or permanent damage to your health.

Never use an APR in IDLH conditions.

The only type of respirator allowed in IDLH conditions is an atmosphere supplying respirator.

Assigned Protection Factors

The protection factor means how much cleaner the air is supposed to be in the respirator, compared to the contaminated air outside the respirator.

The **Protection Factor (PF)** means how much cleaner the air in the respirator is assumed to be if you pass a qualitative fit test. In the qualitative test we don't actually measure the air – that's why we use the assigned protection factor to assume how much cleaner it is inside the mask.

For example, a PF of 10 means the air in the respirator is supposed to be ten times cleaner than the outside air. If the contaminated air has 1000 ppm, then the air in the respirator – what you breathe – ought to be 100 ppm.

If you pass a qualitative fit test, you assume that the respirator has at least the protection indicated by the PF.

Most employers must now use PFs assigned by OSHA.

OSHA Assigned Protection Factors (PF)
[29 CFR 1910.134(d)(3)(i)(A)]

Quarter-face APR: 5

Half-face APR: 10

Full-face APR: 50

Full-face PAPR: 1,000

SCBA: 10,000

Air line with escape cylinder: 1,000

Air line without escape cylinder: 1,000

OSHA and ANSI Protection Factors

Most employers had been using the NIOSH assigned protection factors. However, in November, 2006 OSHA added a list of PFs to its respiratory protection standard. These are now the protection factors that all employers covered by OSHA must use.

The American National Standards Institute (ANSI) is a private organization that recommends standards for occupational safety and health.

Some employers, including **contractors at DOE facilities**, use ANSI assigned protection factors, some of which are different than the NIOSH or OSHA assigned PFs.

Comparing NIOSH, ANSI and OSHA Assigned Protection Factors			
	NIOSH	**ANSI**	**OSHA (new)**
Quarter Face APR	**5**	**10**	**5**
Half Face APR	**10**	**10**	**10**
Full Face APR	**50**	**100**	**50**
Full Face PAPR	**50**	**1,000**	**1,000**
Full Face SCBA	**10,000**	**> 1,000**	**10,000**
Full Face Air Line with escape cylinder	**10,000**	**> 1,000**	**1,000**
Full Face Air Line without escape cylinder	**2,000**	**1,000**	**1,000**

Choosing the Right Respirator

Unless you can say "yes" to <u>all</u> of these conditions, then it is unsafe to enter the area with an APR.

It is important that you understand when you can – and cannot – use an Air Purifying Respirator.

APRs can only be used when:

- There is at least 19½% oxygen.
- There will be no confined space entry (unless it is established by air monitoring before and during entry that contaminant levels cannot rise above the range of the available APR filters or cartridges).
- You know the identity of the contaminants – so you can pick the right cartridge or filter.
- You know the concentration of the contaminants – so you can know if the respirator is rated for this concentration.
- There are no IDLH concentrations.
- There is a correct APR filter or cartridge available.

If there is a possibility that the situation might change for the worse – a leak might occur or a fire might start – then you won't know what the contaminants or concentrations are. Don't rely on an APR.

Under certain conditions it is unsafe to use an Air Purifying Respirator. Then you have to use one of the atmosphere supplying respirators that we discuss in Chapter 7.

Look at the NIOSH Pocket Guide and at the manufacturer's selection chart to see what type of respirator you need to use.

Inspecting and Checking Your Respirator

Every time before you use a respirator you should inspect it. When you put it on you should perform a couple of quick seal checks.

User inspection.

- Make sure that you have the correct respirator and the correct filters or cartridges.
- Inspect the face piece, straps and visor.
- Inspect the inhalation and exhalation valves.

Negative pressure check.

- With your hands, cover the inlets to the filters or cartridges.
- Inhale. If the respirator is working properly, then you should be able to feel the face piece being sucked toward your face.
- Hold your breath for 10 seconds. The face piece should remain sucked in.

Positive pressure check.

- Cover the exhalation valve with your hand.
- Exhale. You should be able to feel the respirator expanding away from your face.
- Again, hold it for 10 seconds.

Chapter

7

Atmosphere Supplying Respirators

Learning objectives

This chapter reviews respirators that have their own clean air supply so that you don't have to rely on trying to filter the air around you.

After completing this chapter you will be able to demonstrate your ability to:

1. DESCRIBE the two basic types of atmosphere supplying respirators.

2. LIST the conditions under which it is required that you wear an atmosphere supplying respirator.

Two Types of Atmosphere Supplying Respirators

Atmosphere supplying respirators provide you with a clean source of air. You're not breathing the dirty air around you. There are two types:

1. **Self Contained Breathing Apparatus (SCBA).**

2. **Air Line Respirator (Supplied Air Respirator or SAR)**.

No respirator provides absolute protection. However, a SCBA, or an air line respirator with an escape cylinder, provide the maximum respiratory protection available.

Because atmosphere supplying respirators have their own air supply, they are the only respirators that you can use when there is **oxygen deficiency**.

When to Use an Atmosphere Supplying Respirator

You must use an atmosphere supplying respirator – either a SCBA or an air line respirator with an escape cylinder – in any of these conditions:

- Confined space entry (unless you have proven that no respiratory hazard can occur).
- Oxygen level less than 19½%.
- Unknown contaminants.
- IDLH concentrations of contaminants.
- Unknown concentrations of contaminants.
- Contaminants or concentrations for which no APR filter or cartridge is available.

Use a SCBA or an air line respirator with an escape cylinder when <u>any</u> of these conditions is present.

Using an Atmosphere Supplying Respirator

To safely use an atmosphere supplying respirator, all of the following must be true:

- You are trained to use it.
- You are medically approved to use it.
- You have been fit tested for the same make and model.
- You use only a Grade D or better air supply.

And, if you use an air line respirator:

- You have no more than 300 feet of air hose.
- You have an escape cylinder.

OSHA requires fit-testing and a clean shave for all tight-fitting respirators – including a SCBA and a SAR.

Protection Factors

The protection factors for supplied air line respirators are much higher than the protection factors for APRs. This is because atmosphere supplying respirators have their own clean air supply.

Air line respirators use the same face pieces and the same quality of air as Self Contained Breathing Apparatus (SCBAs). However, there is an important difference: the hose.

You may be dragging as much as three hundred feet of hose connected to your SAR. It is possible for that hose to get cut, or to be squashed by a vehicle tire. When that happens you have no air. You have to take off the face piece and hope that the air around you won't harm you while you escape from the area.

In order to avoid this problem, you should wear a small **escape cylinder** whenever you use a SAR. If something goes wrong with the SAR, you can switch on the escape cylinder and breathe clean air while you leave the area.

Because the protection factor with an SAR might drop to nothing in the situation we've just described, NIOSH gives SARs a lower factor than SCBAs.

The OSHA assigned protection factors rate the SAR at 1,000 - whether or not you have an escape cylinder. This doesn't change the fact that if your hose is damaged or blocked, an escape cylinder could save your life.

OSHA Assigned Protection Factors

Quarter-face APR: 5

Half-face APR: 10

Full-face APR: 50

PAPR: 1,000

SCBA: 10,000

Air line: 1,000

NIOSH Assigned Protection Factors

Air line with escape cylinder: 10,000

Air line without escape cylinder: 2,000

Chapter

8

Personal Protective Clothing and Equipment

Learning objectives

This chapter reviews clothing that protects against chemicals, and how protective clothing and respirators are used together.

After completing this chapter you will be able to demonstrate your ability to:

1. DESCRIBE the limitations of chemical protective clothing.

2. IDENTIFY the type of protective clothing and respiratory protection used in Levels A, B and C.

Limitations of Chemical Protective Clothing

Chemical Protective Clothing, or **CPC**, can be uncomfortable and even dangerous to wear. It has important problems and limitations:

- **CPC wears out**. Is it in good condition? Is it worn out? Does the zipper work?
- **CPC gets contaminated**. If your CPC was worn before, was it properly decontaminated? If not, you may be exposed to chemical residues.
- **CPC is uncomfortable**. It's hot and sweaty inside CPC. Your dexterity, agility and sense of balance may be affected. CPC may also affect your ability to see and to communicate.
- **CPC is not fire proof**. There are special heat resistant suits that offer limited protection from heat and flame. However, most CPC provides no protection, and may in fact burn easily.
- **CPC can be deadly**. Wearing CPC is not just uncomfortable, it can be life threatening if you experience heat stress.
- **Choose the right CPC**. Your protective clothing has to match the chemicals and conditions in which you wear it. You need to know what you'll be exposed to, and whether your CPC has sufficient resistance. Picking the wrong suit gives a false sense of security.

The OSHA Regulations on Protective Clothing and Equipment can be found in 29 CFR 1910.120 (e) (2) (iii).

Inspection, Decon and Storage

Do not use CPC that is damaged or contaminated.

Contaminated CPC is a hazardous waste.

Inspect your CPC before you put it on. Check for:

- Tears, holes and cuts.
- Contamination.
- Damaged zippers, seals or valves.

After CPC is used, it must be either:

- Thoroughly decontaminated; or
- Disposed of properly – because contaminated CPC is considered a hazardous waste.

Some Things to Remember about CPC

Your health and safety – perhaps your life – may depend on your CPC.

Pick the right CPC. Inspect it. Use it correctly.

- CPC must match the chemicals to which you are exposed. Use the manufacturer's selection charts to choose the best CPC for the job.
- No CPC provides protection against all hazards.
- Inspect CPC before you use it.
- Do not use CPC that is damaged or contaminated.
- Heat stress is a real danger when wearing CPC. Learn to recognize the signs of heat stress in yourself, and in your co-workers.
- CPC can make it harder to see and communicate; more difficult to walk; and harder to use tools or to pick things up.
- **Use the buddy system**. If the job requires CPC, then it's hazardous enough to require you and your co-workers to look out for each other.

Levels of Protection

There are two main categories of respirators: **Air Purifying Respirators** and **Atmosphere Supplying Respirators.**

There are two main categories of chemical resistant suits: **liquid-protective** and **vapor-protective**.

It is standard practice to talk of four basic combinations of suit and respirator. These are called the **four levels of protection**: **Level A, Level B, Level C and Level D**.

Level A and Level B use the same category of respiratory protection.

Level B and Level C use the same category of chemical protective suit.

Level D is simply regular work clothes with no respirator and no chemical resistant suit.

Liquid-protective means that the suit protects against contact with liquids and solids.

Vapor-protective means that the suit protects against contact with liquids, solids and vapors.

	Respirator	Protective Clothing
Level A	**SCBA - or - SAR with escape cylinder**	**Fully encapsulating vapor-protective suit**
Level B	**SCBA - or - SAR with escape cylinder**	**Liquid-protective suit**
Level C	**Air Purifying Respirator (APR)**	**Liquid-protective suit**
Level D	**None**	**Normal work clothes**

Level D

Level D means **ordinary work clothes**.

- Hard hat.
- Work boots.
- No respirator.
- No chemical resistant suit.

Level D is what workers wear when there is no air contamination hazard, and when there is very little chance of skin contact with hazardous chemicals.

Depending on the job that the worker is doing, he or she might also wear gloves, goggles or face shield, and an apron.

Level C

Level C provides **moderate respiratory protection** and **good skin** protection:

- Air Purifying Respirator (APR).
- Chemical resistant suit that protects against skin contact with splashes of liquid or solid chemicals.
- Chemical resistant gloves.
- Chemical resistant boots.
- Hard hat

Level C is what workers wear when there are **low levels of air contamination** and possible **skin contact with splashes** of solid or liquid chemicals.

Level B

Level B provieds the maximum respiratory protection and good skin protection:

- **Atmosphere Supplying Respirator- SCBA or air-line with escape cylinder.**
- **Chemical resistant suit that protects against skin contact with splashes of liquid or solid chemicals.**
- Chemical resistant gloves.
- Chemical resistant boots.
- Hard hat.

Level B is what workers wear when there are high levels of air contamination and possible skin contact with splashes of solid or liquid chemicals.

Level A

Level A provides the **maximum respiratory protection** and the **maximum skin protection**:

- Atmosphere supplying respirator- SCBA or air-line with escape cylinder (inside the suit).
- Fully-encapsulated suit that keeps out hazardous solids, liquids and vapors.
- Chemical resistant gloves.
- Chemical resistant boots.
- Hard hat (inside of suit).

Workers wear Level A when there are **high levels of air contamination,** and possible **skin contact with splashes of solid or liquid chemicals**, and **skin contact with vapors, gases or particulates is hazardous**.

Chapter

9

Decontamination

Learning objectives

This chapter reviews how to remove contamination from people, clothing, tools and vehicles in order to limit exposures and keep contamination from spreading.

After completing this chapter you will be able to demonstrate your ability to:

1. IDENTIFY several ways to prevent or minimize contamination.

2. DESCRIBE the layout of a decontamination line.

3. DESCRIBE the general procedures for decontaminating vehicles.

Preventing Contamination

An important part of decontamination is to **prevent contamination in the first place**. This means less chance of exposure, less chance of fire or chemical reaction, less mess to clean, and less waste to dispose of.

Use good work practices to limit chemical contact:

- Don’t walk through contaminated areas.
- Don’t step or kneel in puddles or spills.
- Never touch, sniff or taste a chemical.
- Where possible, cover tools and equipment with disposable plastic or tape.

Use protective clothing properly:

- Make sure you have the right protective clothing for the chemicals you may be handling.
- Wear outer boots and gloves.
- Avoid broken pallets, metal or glass that could tear or puncture your boots or clothing.
- Use the buddy system. Point out exposure hazards. Let your co-workers know if you see them getting contaminated.

Types of Contamination

There are two types of contamination:

1. **Chemicals on the surface** of clothing, tools, and equipment.

2. **Chemicals soaked in**, or imbedded in clothing, tools and equipment.

Chemicals that soaked in to clothing, tools, or equipment (permeate) are the most difficult to remove. Often it is easier and less expensive to use disposable protective clothing.

Types of Decon

29 CFR 1910.120 (b) (4) (ii) (G)

There are four general methods of decontamination:

1. **Physical removal.** This includes scrubbing, scraping, washing and rinsing.

2. **Chemical removal.** This uses other chemicals to neutralize or inactivate contamination.

3. **Evaporation.** This means allowing time for chemicals to evaporate out. The process is sometimes aided by careful heating.

4. **Disposable clothing and equipment.** This can eliminate the need for decontamination, but it creates an additional disposal problem.

Decon Lines and Stations

Decontamination is carried out in an orderly, well planned process in a designated decontamination area or decon line. Only persons who are directly involved in decontamination should be at the decon line.

The decon line moves from the contaminated area towards the clean area – never in the opposite direction.

Contaminated workers and equipment move through the line getting cleaner, and doffing clothing at stations along the way. Decon workers are assigned to help at the stations.

The decon line always moves from the most contaminated area toward the clean area.

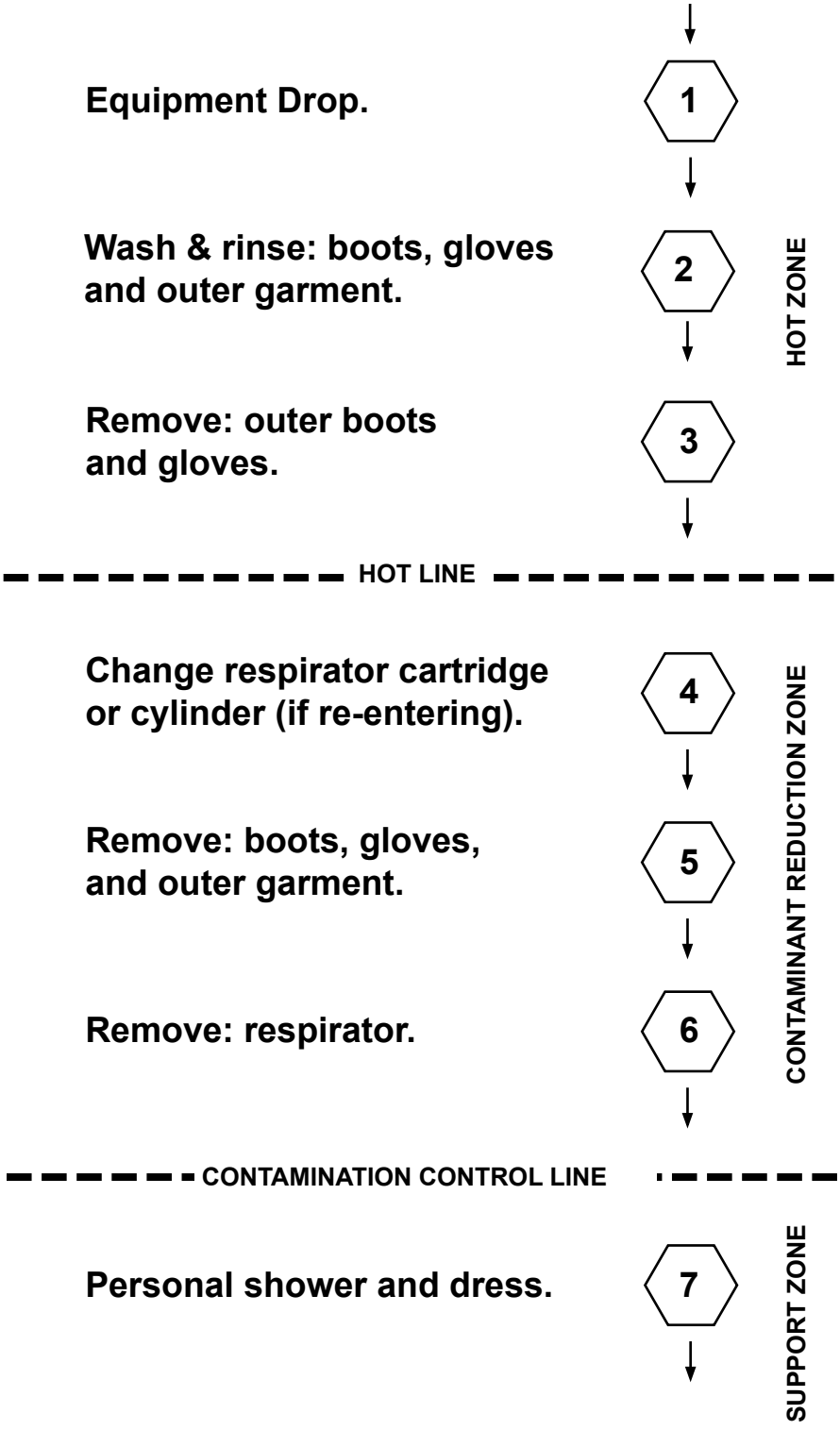
When other workers and equipment have been decontaminated, then the decon workers themselves go through the line, starting at their own station.

The decon line includes these kinds of activities, in order, and often at different stations:

- Equipment drop.
- Initial rinse.
- Decon shower, wash and rinse.
- Outer boot and glove removal.
- Protective clothing removal.
- Respirator removal or exchange.
- Personal shower and a change of clothes.

There are many ways to arrange the decon line. Some lines have only a few stations. Others have as many as nineteen stations.

Example Decon Line



This example is only one of many possible arrangements. The exact decon line should be planned in advance based on the kinds of contamination that are likely, and the types of equipment to be used.

Vehicle Decon

There are some special considerations for the decontamination of vehicles and heavy equipment:

- Keep vehicles and heavy equipment from getting contaminated in the first place. Don't drive through spills or contaminated areas.
- If vehicles must be used near contaminated areas, consider covering the wheels, and other exposed parts with tape and plastic sheeting.
- Have sturdy platforms to safely get at all parts without having to climb on the vehicle.
- Workers must have the right protective clothing, respirator and eye protection during decon.
- Be careful when using pressurized sprayers.
- Use decon solutions that are compatible with the chemicals involved, and with the vehicle's paint.
- Provide a means to collect runoff water.
- Start at the top and work down.
- Pay attention to the under-carriage and other areas where contamination might not be noticed.

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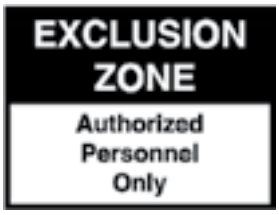
10



Site Control:

Key Personnel, Engineering Controls, and Emergency Response

Learning objectives

This chapter discusses the Site Safety and Health Plan, Key Personnel on a hazardous waste site, the methods to control hazards at hazardous waste sites, and emergency response procedures.

After completing this chapter you will be able to demonstrate your ability to:

1. IDENTIFY the requirements for a written Site Safety and Health Plan.

2. IDENTIFY the Key Personnel on a hazardous waste site.

3. IDENTIFY the types of emergencies that could occur at a hazardous waste site, and identify appropriate emergency response procedures.

4. IDENTIFY these areas and control lines at a hazardous waste site:
   a. Exclusion Zone.
   b. Contamination Reduction Zone.
   c. Support Zone.
   d. Hot Line.
   e. Contamination Reduction Corridor.
   f. Access Control Points.

5. LIST in order of effectiveness four categories of control methods.

6. EXPLAIN the purpose of the buddy system.

Written Site Safety and Health Plan

The employer or contractor at a hazardous waste site must have a written **Site Safety and Health Plan**.

The purpose of the plan is to make sure that the employer has identified all hazards, put qualified people in charge, trained the workers, provided medical surveillance, provided appropriate Personal Protective Equipment and supplies and prepared an emergency response plan.

You have a right to see the Site Safety and Health Plan, and you should receive training about the plan.

Hierarchy of Controls

The best control method is to **eliminate the hazard**, often by substituting a less hazardous product.

There are **engineering controls**, such as local exhaust ventilation systems, enclosures that surround the hazard, or cabins that isolate workers from the hazard.

There are also **administrative controls**, such as limiting hours of work, or scheduling work at less hazardous times.

For example, using a citrus based cleaning solution to eliminate the hazard of organic solvent exposure.

Finally, there is **Personal Protective Equipment (PPE)** including respirators and protective clothing.

The order in which control methods are described above is called the **hierarchy of controls**. The control methods at the top of the list are generally more effective than the methods further down.

PPE is at the bottom of the list. PPE is the least effective means of controlling safety and health hazards.

PPE is the least effective means of controlling safety and health hazards.

No matter what form of hazard control is used, we always need proper training and safe standard operating procedures.

Engineering Controls and Other Methods at Hazardous Waste Sites

29 CFR 1910.120 (e) (2) (v)

We use PPE at hazardous waste sites because other, better control methods are often not possible.

It is always possible to have good training and good standard operating procedures. Insist on these.

There are many examples of engineering controls such as enclosed cabins on vehicles, and remote sampling and drum handling equipment.

Because there is no product substitution with regard to hazardous waste, and because local exhaust ventilation is not practical, hazardous waste workers must often rely on PPE. It's the least effective method to protect workers, but it's often the only control method. We have to make sure we use it correctly.

Key Personnel

29 CFR 1910.120 (e) (2) (i)

Your employer is required to provide site-specific training – in addition to this course – on the safety and health plan for your site. This should include the names of all Key Personnel, their responsibility, and their contact information.

The Buddy System

It is not safe to work alone when handling hazardous waste. If you are injured or overcome, you need someone there to help and to call for assistance.

Your co-worker can also tell you if you're showing signs of heat stress, or warn you of other hazards that you might not have noticed.

When you work in the hot zone, and at other times as specified in the Site Safety and Health Plan, you must work with one or more other workers. This is called the **buddy system**.

Buddies stick together and look out for one another. If one person has to leave the area, for example to refill his or her air supply, then all "buddies" leave together.

Communication Systems and Alarms

There must be **good communication among the personnel on the site**. This is especially important in case of an emergency. Often there are radios, and/or a system of hand signals that everyone understands.

In case of an emergency there must be signals to warn workers and announce an evacuation. This could be a bell, horn or other device. The important thing is that the signals are easy to understand and workers are trained to know what they mean.

Spill Containment

29 CFR 1910.120 (b) (4) (ii) (J)

Leaks and spills. If you discover that hazmat is leaking from your vehicle, or leaking from a container:

- Do not continue to load or handle materials.
- Do not continue to drive any further than safety requires. Park safely as soon as possible.
- Call your supervisor or the authorities.
- Keep others away from the area.
- Use the shipping papers, placards, labels and markings to identify the hazmat that is leaking.
- Do not touch, sniff or taste the leaking materials.
- Keep a safe distance away, but do not leave the scene until emergency responders arrive.

Remember your job:

- **Protect yourself**
- **Alert the proper authorities**
- **Help to keep others away**

Provide Information. Lives depend on the information you provide to other responders, such as the fire department. You need to know what hazmat you are carrying, and have the shipping papers accessible.

Controlling the hazard. Stopping a leak or fighting a fire are jobs for operations-level responders.

Do not do the following unless you have operations-level response training and have the proper equipment:

- Do not try to contain the material unless you can do it without exposing yourself to the material.
- Do not try to stop a leak unless you can do it without exposing yourself to hazardous material.
- Do not try to put out a fire around hazmat.

This training does not prepare you to stop a spill in a hazmat emergency. It does not prepare you to fight a fire.

Three Zone Plan

A hazardous waste site is divided into **three zones**.

The specific way the zones are set up will be specified in the Site Safety and Health Plan.

Exclusion Zone or **Hot Zone**. This is the zone where contact with the hazardous substance is possible. It is where clean-up takes place. Often protective clothing and respirators will be required in this zone. Only personnel with the proper training and equipment are permitted in the hot zone.

Contamination Reduction Zone (CRZ) or **Warm Zone**. This zone surrounds the hot zone. It is a transition area between the contaminated area of the hot zone and the clean area of the support zone. It's purpose is to reduce the possibility of contaminants reaching clean areas.

Support Zone or **Cold Zone**. This is the clean area where support activities take place such as storage of supplies and equipment. The command post is located here.

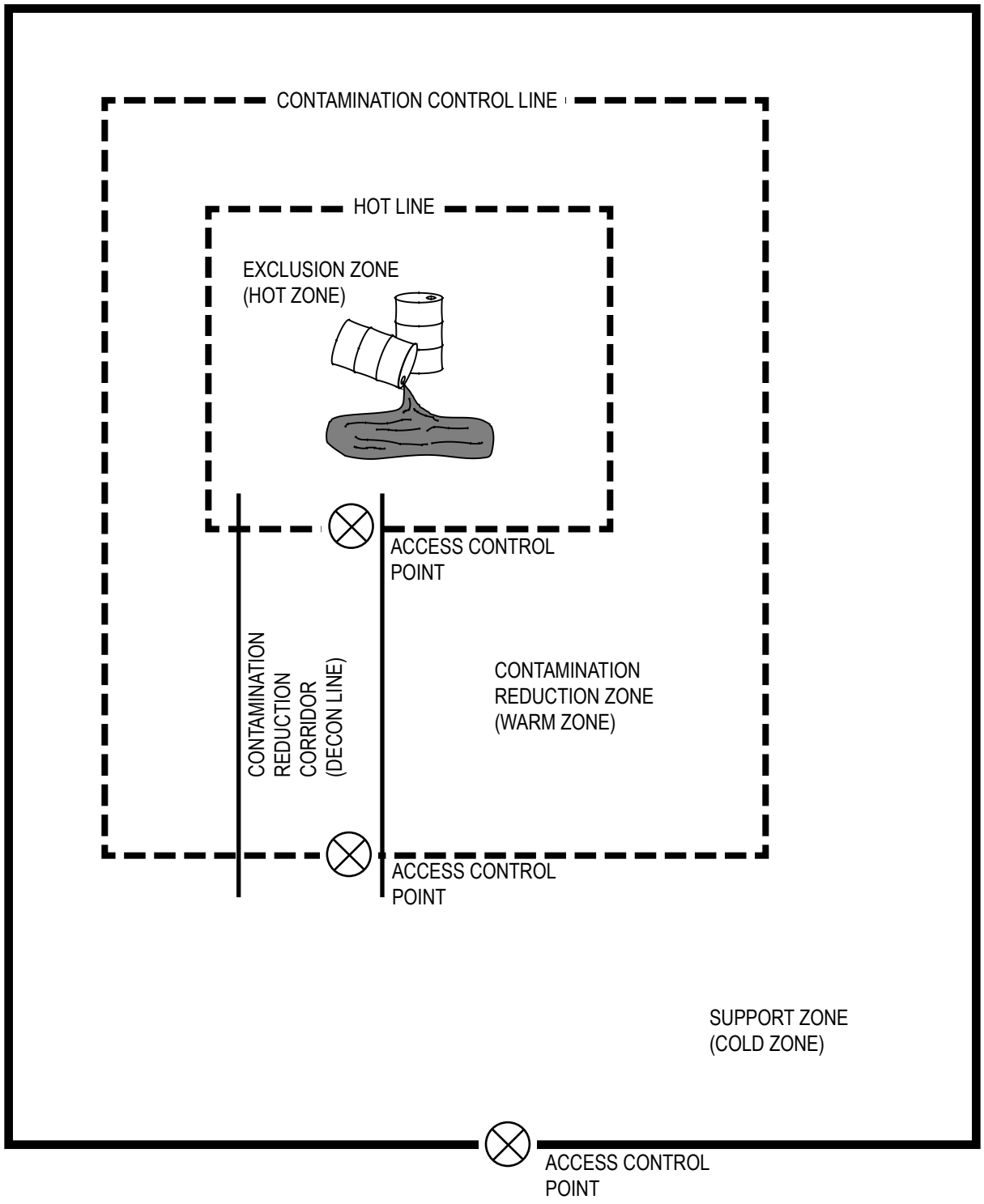
Hot Line. This is the border around the hot zone.

Contamination Control Line. This is the border around the contamination reduction zone.

Contamination Reduction Corridor (CRC). This is the passage connecting the support zone to the hot zone, passing through the CRZ. The decon line is located here.

Access Control Point. These are the only places where access to the different zones is allowed.

Three Zone Plan



Standard Operating Procedures (SOPs)

You don't "wing it" when you work with hazardous substances.

There must be **Standard Operating Procedures (SOPs)** for each activity on the site that poses a safety or health risk. Advance planning makes sure that risks are known and workers are prepared. An effective SOP is:

- Written in advance.
- Based on the best available information – taking into account prior experience and lessons learned.
- Field tested and practiced in "dry runs."
- Used in site specific training.

Emergencies at Hazardous Waste Sites

When an emergency happens, it's too late to figure out what to do. Advance planning is crucial, and it's the law.

Three types of emergencies that might occur are:

- **Waste related emergencies**.
  - Fire or explosion.
  - Reaction of incompatible chemicals.
  - Leaks and spills.
  - Release of toxic vapors and gases.
- **Worker-related emergencies**.
  - Injury.
  - Medical emergency such as a heart attack.
  - PPE failure.
  - Overexposure.
  - Heat stress.
  - Vehicle accident.
- **Natural disasters.**
  - Flood.
  - Lightning.
  - Earthquake.

Emergency Response Plan

29 CFR 1910.120 (b) (4) (ii) (H)

If an emergency occurs, properly trained personnel have to act fast. It's too late to decide who's in charge, or what equipment is needed.

These decisions have to be made in advance, so that when the need arises, the response can start immediately. This is why the site must have an **Emergency Response Plan**.

Emergency First Aid

There must be personnel on site at all times who are certified in industrial first aid and CPR. The first aid station should be located near the clean end of the decontamination area. All first aid personnel should be trained to recognize heat stress and how to deal with it. Drills should be held on a regular basis.

Emergency Decon

A worker might be injured and also contaminated. The first priority is always to save human life.

There may be cases where medical attention cannot wait for decontamination. Examples might include severe bleeding, cardiac arrest or heat stroke.

In other cases, it may be life threatening if the person is not decontaminated immediately. For example, if a person is lying in a pool of acid or caustic material.

An injured or unconscious person wearing protective clothing might also be suffering the effects of heat stress. Rapid medical attention is essential if there is the possibility of heat stroke.

If necessary, protective clothing might be cut away, rather than washed.

Chapter

11

Air Monitoring Instruments

Learning objectives

This chapter reviews the air monitoring instruments that we use to take measurements when hazardous waste and hazardous materials are present.

After completing this chapter you will be able to demonstrate your ability to:

1. LIST the four types of measurements required at hazardous waste sites.
2. EXPLAIN what “action level” means.
3. LIST three limitations of direct reading instruments.
4. EXPLAIN the importance of:
   a. Periodic calibration of instruments.
   b. Proper maintenance and storage of instruments.

Monitoring at Hazardous Waste Clean-Up Sites

OSHA requires that we measure for each of these unless we know for sure that it's not present:

1. **Oxygen level**. This must always be monitored in confined space entries, and in any other situation where fire, chemical reaction or purging may have depleted the oxygen level.

2. **Lower Explosive Limit (LEL)**. Check whether an explosion hazard exists, unless you know for certain that no flammable or combustible material is present.

3. **Toxics**. This is difficult, since there are thousands of toxic contaminants. The more information you have about what chemicals were used at the site, the easier it will be to pick what to measure for.

4. **Ionizing radiation**. It's not necessary to survey for ionizing radiation if you know for certain that radioactive materials were never used on the site.

Action Levels

The Site Safety and Health Plan must set **action levels** for each of the four conditions listed above. The action level is the point at which you take action. What action? This is simple: get out. If you're not already in, then stay out.

Action Levels

Oxygen:
No less than 19½%
No more than 23½%

Toxics:
No more than 50% PEL

Flammables:
No more than 10% LEL

Ionizing radiation:
No more than 2.5 millirem/hour

Action levels must be at least as protective as those in this box.

Direct Reading Instruments

There are direct reading instruments that can measure:

- **Oxygen**
- **Combustible and flammable gases and vapors**
- **Certain (but not all) toxic contaminants**
- **Ionizing radiation**

Some instruments can measure more than one thing. For example the oxygen meter is usually part of an instrument that measures flammable gases and vapors.

“Direct reading” means that the instrument gives you information right away. You don’t have to send a sample to the laboratory and wait for the results.

There are many brands and models of direct reading instruments. Be sure to read and understand the instructions that come with the meter.

Direct Reading Instruments
(not drawn to scale)

Multi-gas Meter

Colorimetric Indicator Tube

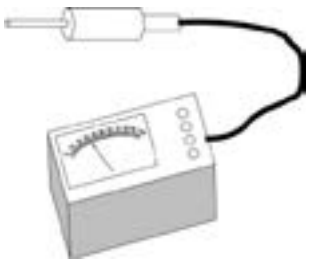


Photo Ionization Detector (for gases and vapors)

Radiation Survey Meter

Sound Level Meter

What the Data Means

No results are 100% accurate. You need to know how much faith you can put in monitoring results: what they mean – and what they don't mean.

- Conditions change. Monitoring only tells you what's happening at a specific time and place. It doesn't tell you what the situation will be later, or what it will be somewhere else.

- There may be other contaminants. Because you measure for one thing, and don't find it, doesn't mean that there aren't other contaminants that may be even more harmful.

- Monitoring equipment may be inaccurate. The batteries can wear down. The sensors may become less accurate over time.

- If an instrument is not calibrated to the same contaminants that are being measured, then its reading will probably be inaccurate.

Calibration and Maintenance

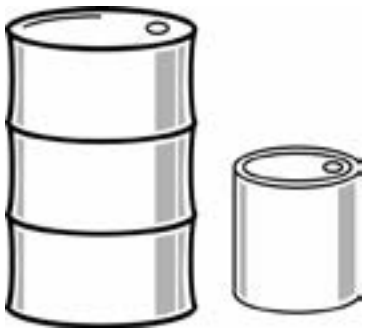
Instruments are worthless unless you know that they are functioning properly.

There should be a designated person trained to inspect and calibrate the equipment regularly, and to assure that it is stored properly.

At a minimum, calibrate each instrument when it arrives new, after servicing, after batteries are changed, after dropping or other mishandling, and if a long time has passed since the last use.

Chapter

12



Safe Work Practices:
Drum and Container Handling

Learning objectives

This chapter discusses how to safely handle drums and other containers of hazardous waste and hazardous materials.

After completing this chapter you will be able to demonstrate your ability to:

1. IDENTIFY the proper method to inspect a drum before handling.

2. IDENTIFY the proper method to open a drum.

3. IDENTIFY the purpose of staging drums.

4. IDENTIFY safe work practices to minimize risks presented by handling materials on a hazardous waste site.

Safe Work Practices: Materials Handling

29 CFR 1910.120 (e) (2) (iv)

Hazardous waste comes in various containers including bottles, bags, cylinders, tanks, cans and drums. The most common container at hazardous waste sites is the 55 gallon metal drum.

Cleaning up a hazardous waste site often involves finding drums, assessing their condition, identifying their contents and organizing (staging) them for shipment and disposal.

Accidents can occur when handling drums and other containers. These include fire, explosion, chemical reaction and the release of hazardous substances.

There is also the risk of physical injury from lifting and moving heavy containers by hand, and the danger that improperly stacked or hoisted containers might fall.

Proper safe work practices are essential to prevent accidents when handling drums and other containers.

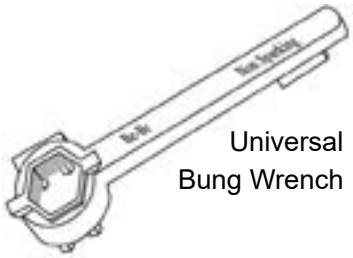
Visual Inspection

Before sampling, moving or otherwise handling a drum or other container, perform a visual inspection:

- Look for labels that might identify the contents.
- Look for deterioration, corrosion, or leaks.
- Look for signs that the container is under pressure. Is it swelled or bulging? Attempting to open or move a pressurized drum could cause serious exposure – and possibly an explosion.
- How does it open? Note what type of head and bungs a drum has.

If a hazardous substance was disposed of in its original container, then the label may be accurate. However, it might have been disposed of in a used container with a different label.

Opening Drums



Universal
Bung Wrench

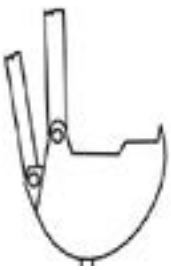
It can be very dangerous to open a drum, especially if you don't know for certain what it contains.

- Use a face shield, protective clothing and a respirator – if required by the Site Safety and Health Plan.
- Use the buddy system.
- Do a visual inspection.
- Remove any water from the top the drum.

If you have to unscrew a bung by hand:

- Use a non-sparking bung wrench to reduce the possibility of a static spark which could ignite flammable vapors.
- Turn the bung slowly. Even a non-sparking tool cannot prevent friction between the threads on the drum and on the bung.
- If you hear hissing, wait for the pressure to release before continuing to turn the bung.

Remote Drum Opening Equipment



There are several types of remote drum opening equipment:

- A metal spike welded to the bucket of a backhoe. The backhoe itself can have steel plates to protect the operator in the event of an explosion.
- Remote hydraulic or pneumatic puncture device, drum deheader or impact bung wrench.

Handling Drums

There are two main hazards with handling drums and other containers:

- Exposure to hazardous chemicals.
- Strains and other injuries from heavy lifting.

To avoid injury, whenever possible, use mechanical handling equipment. There are special drum grappler attachments available for forklifts and backhoes. There are also drum loading attachments for boom trucks.

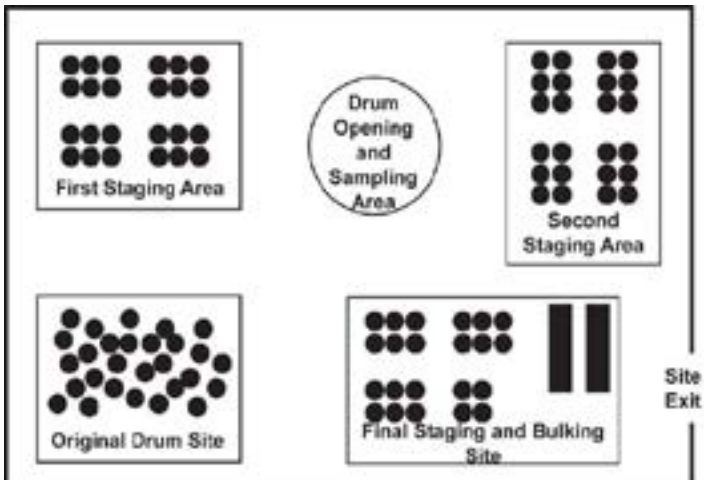
If drums are on pallets, tie them down with straps before moving the pallet.

Use the buddy system and follow the standard operating procedures in the Site Safety and Health Plan.

Drum Staging

Drum Staging is the process of organizing drums:

- In an orderly manner that allows easy and safe access for personnel and equipment.
- In categories by chemical compatibility.



Chapter

13

Confined Spaces

Learning objectives

This chapter reviews **awareness training** about the hazards of **confined spaces** so that you will be able to **recognize** and **avoid** them.

If your job requires that you enter a confined space, then you must first receive more detailed training including site specific information about your employer's confined space entry and rescue procedures.

After completing this chapter you will be able to demonstrate your ability to:

1. IDENTIFY five characteristics that make a confined space hazardous.

2. IDENTIFY three hazardous atmospheres found in confined spaces.

3. IDENTIFY two reasons why a confined space permit is important.

What Is A Confined Space?

Many confined spaces are easy to recognize: tanks, tank trucks, tank cars, boilers, pipelines, septic tanks, manholes, utility vaults, sewers and ventilation ducts.

In some cases, it might be less obvious that a work area is a confined space. For example, sumps and pits can be confined spaces even though they are open to the air.

Any type of health or safety hazard might be present in a confined space. However, if an accident or hazardous exposure occurs, the consequences are often worse because they occur in a confined space.

Any health or safety hazard might exist in a confined space.

For example, using a chipping hammer to remove slag or corrosion is a noisy operation. Inside a steel tank the noise is even louder. When using a solvent to remove grease, toxic vapors may be released. In a sump pit the concentration of vapors will be greater because there is less air to dilute them. Also, if an accident occurs, it is more difficult to escape or to be rescued from a confined space.

If anything bad occurs, it will be worse, because it's in a confined space.

What Makes Confined Spaces Dangerous?

Several characteristics make confined spaces dangerous:

- **Restricted entry and exit**
  It's hard to get in or out, and difficult for rescue personnel to respond quickly.

- **Not designed for continuous work**
  The space was made for some other purpose, not for people to work there.

- **Poor ventilation**
  It's hard for fresh air to get in or for contaminants to get out.

Three types of air hazards:

1. Oxygen deficiency
2. Flammable vapors
3. Toxic contaminants

- **May contain a hazardous atmosphere**
  - **Oxygen deficiency**
  - **Toxic air contaminants**
  - **Flammable vapors**

- **May contain other hazards**
  - **Electrical hazards**
  - **Sparks**
  - **Moving machinery**
  - **Process liquids**
  - **Engulfment hazards**
  - **Extreme temperatures**
  - **Noise**
  - **Falling objects**

Safety With Hazardous Atmospheres

Never enter a confined space unless proper monitoring is being done. **Stay out, or get out, if there is:**

- **Less than 19½% oxygen.**
  Unless you are wearing an SCBA or an air line respirator with escape bottle.

- **More than 10% of the LEL of a flammable material**.

- **More than 50% of the PEL of an air contaminant.**
  Unless you are wearing the proper respirator.

- **More than the IDLH of a toxic air contaminant**.
  Unless you are wearing an SCBA or an air line respirator with escape bottle.

Do not enter to do the initial testing. Use equipment with a hose or remote capability.

Continue monitoring while workers are inside. Conditions may change!

All monitoring must be done by a properly trained person using the appropriate, calibrated equipment.

To know it's safe, air monitoring must be done:

1. Before anyone enters.

2. During the time that workers are inside.

Confined Space Program

The OSHA Standard for confined spaces in general industry is:
29 CFR 1910.146

OSHA requires a Confined Space Program include:

- Identifying and labelling confined spaces.
- A Confined Space Permit System.
- Evaluation of the hazards before anyone enters.
- Air monitoring before and during the entry.
- Specific safe work practices.
- All necessary safety equipment.
- Standby personnel to monitor workers inside and summon the rescue team if an accident occurs.
- Training for all workers and supervisors involved.
- Close-out procedures to make sure that all workers have left safely and it is OK to return the space to its intended purpose.
- A rescue plan.
- Procedures for sharing information about confined spaces if there are multiple contractors.

Confined Space Entry Procedures

29 CFR 1910.120 (b) (4) (ii) (I)

OSHA requires your employer to determine if there are any permit required confined spaces in the workplace. Each confined space must be posted with a sign. This is an example:

DANGER

PERMIT REQUIRED CONFINED SPACE

DO NOT ENTER WITHOUT PERMIT

THIS SPACE CONTAINS MOVING PARTS AND POTENTIAL OXYGEN DEFICIENCY

In many cases it is appropriate to lock the confined space to prevent unauthorized entry.

Labeling and Posting

Although not specifically required by OSHA, a confined space sign might also include specific work practices such as what type of respirator to wear. The sign might also include an emergency phone number.

What Does "Entry" Mean?

Entry means putting any part of your body into the confined space. If you stick your head through the opening to get a quick look or to sniff the air inside, you have just entered the confined space. These are unsafe work practices unless all safe entry procedures have been followed, including, if necessary, wearing the proper respirator.

Never stick you head inside to get a quick look or sniff the air. One breath could be fatal.

Confined Space Permits

The Confined Space Permit authorizes the work to be done and certifies that all necessary safety procedures are in place. The Permit must include:

- The location of the confined space.
- The purpose of the entry.
- The date and duration of the entry.
- Names of all workers who will enter.
- Names of standby personnel.
- Supervisor's name and signature.
- Identification of all present or potential hazards.
- Specific procedures such as lock-out, ventilation and purging.
- Air testing to be done before and during entry.
- How to summon the Rescue Team.
- Communication procedures.
- List of all required PPE, including respirators.
- If "hot work" such as welding is to be done, an additional Hot Work Permit must be issued.

A Confined Space Permit takes time to fill out properly.

Don't cut corners. Failure to carefully complete the permit could cost lives.

If the work will be continued by a different crew, or by the same crew on a different shift, then a new permit should be issued.

Why Is The Permit So Important?

The permit is not just a piece of paper. It serves two very important purposes:

- **Assures that time is taken to identify all hazards and to take all necessary precautions** to protect the lives of workers. It's like the checklist that a pilot goes through before taking off.

- **Requires the supervisor to take responsibility**, in writing, for assuring that safe work practices are followed. It holds the supervisor accountable.

Ventilation and Purging

If monitoring reveals oxygen deficiency, toxic contaminants, or flammables then the space must be ventilated and tested again before workers enter.

Ventilation works best if clean air flows into the space at one end and exits at the other end. If the space has only one opening, blow or suck air through a hose located as far into the space as possible. Fresh air will travel through the space on its way out.

Use clean air. Make certain the blower's intake is not near a source of contaminants such as vehicle exhaust.

Lock-Out Tag-Out

It is essential to isolate a confined space from sources of hazardous energy. The best method is lock-out:

- Lock-out electrical circuits by removing circuit breakers and putting locks on the switches.
- Lock-out pipes by removing a section of pipe and sealing both exposed ends with solid plates. This is called “double blank and block.”
- Lock-out mechanical equipment by removing gears, drive shafts or chain drives.

Each worker should have their own lock. Equipment can only be turned on after each worker has removed their own lock.

Also tag-out the equipment with a sign to alert others that the equipment must remain out of service. Remember that tag-out by itself – without lock-out – does not prevent an accidental start-up.

Standby Attendant

A trained attendant (standby person) must be assigned to remain outside the confined space while workers are inside. The attendant should not have any other duties that prevent giving his or her full attention to the workers inside the confined space.

More than 50% of all the workers who die in confined space accidents are would-be rescuers who enter without the proper equipment and training.

The attendant is responsible for starting the rescue procedure as described in the employer’s Site Safety and Health Plan. Usually this means calling the rescue team.

The attendant should only enter the confined space if he or she is part of the rescue team and is properly trained and equipped.

Rescue

More than one half of all the workers who die in confined space accidents are would-be rescuers.

They die because they do not have the training or equipment to perform a safe rescue. It is normal to want to help your co-worker. However, you are not helping if you only add to the list of fatalities.

The only effective way to protect confined space workers is to have a Rescue Plan and specially trained and equipped rescue personnel.

In many cases it is best to provide for non-entry rescue. This means that the workers entering the confined space are equipped with harnesses that allow them to be extracted without anyone else actually entering.

OSHA allows the employer to rely on an off-site rescue team such as a fire department. However, these rescuers might arrive too late.

Many confined space accidents result in multiple deaths when would-be rescuers enter without the right training and equipment.

You have the best protection if your employer maintains a properly trained and equipped on-site rescue team.

Confined Space Training

If your job requires you to work in a permit-required confined space, then OSHA requires you to have site-specific confined space training.

The training that you receive in this course is not enough to qualify you to work in a permit-required confined space. This is awareness training. We discuss confined space hazards so that you know enough to recognize them and to keep out of them - unless you have additional, site specific confined space training.

- notes -